Presented at the International Society for Pharmacoeconomics and Outcomes Research, May 7-10, 2023, Boston, MA

PCR230

Estimating Utility Values Using the Duchenne Muscular Dystrophy-Quality of Life Measure (DMD-QoL): A New Preference-Based Measure for DMD

Andrea Bever,[1] Ivana F. Audhya,[2] Shelagh M. Szabo,[1] Pramoda Jayasinghe,[1] David Feeny,[3] Peter Neumann,[4] Daniel C. Malone,[5] Susan T. Iannaccone,[6] Katherine L. Gooch[1]

[1]Broadstreet HEOR, Vancouver, BC; [2]Sarepta Therapeutics, Inc., Cambridge, MA; [3]McMaster University, Hamilton, ON; [4]Tufts Medical Center, Boston, MA; [5]The University of Utah, Salt Lake City, UT; [6]The University of Texas Southwestern, Dallas TX.

Please scan QR code to download poster

Key Findings

- HUI2 utility values declined with increasing DMD functional severity
- DMD-QoL values were relatively stable until loss of upper limb function precipitated a decline in scores
- The HUI2 appears more sensitive to changes in functional status, but values estimated using the DMD-QoL may reflect a broader conceptualization of HRQoL

BACKGROUND

- Progression of DMD is characterized by loss of ambulation and upper limb function, respiratory insufficiency, cardiomyopathy, and premature mortality[1]
- The DMD-QoL is the first **condition-specific** health-related quality-of-life (HRQoL) measure that can be used to estimate utility values for DMD-specific health states. It was developed based on patient feedback with a preference-based subscale [2-4]
  - Prior research indicated that descriptive systems of generic preference-based measures (PBMs) are limited in their coverage of attributes important to those with DMD[2,5,6]
  - How utility values estimated using the DMD-QoL compare to those based on generic PBMs is unclear
- The **study objective** was to understand how DMD-QoL utilities compare to those measured using a generic PBM, the Health Utilities Index (HUI)[7]

STUDY DESIGN

- Patients living with DMD were recruited through Parent Project Muscular Dystrophy, a patient advocacy organization in the United States (US)
- Inclusion criteria were 1) age 12-40 years; 2) self-report a confirmed diagnosis of DMD; 3) living in the US; and 4) able to respond to survey questions in English and provide informed consent
- Participants completed the DMD-QoL, HUI, and a questionnaire to assess health status online
  - DMD-QoL attributes include mobility, hand function, difficulty breathing, pain, tiredness, worry, participation, and feeling good about oneself[6]
  - The HUI categorizes health status using two complementary systems; the HUI2 is presented here and considers sensation, mobility, emotion, cognition, self-care, pain, and fertility (optional attribute)[7]
  - Responses to clinical questions were used to classify participants into functional health states based on lower and upper limb function, need for ventilation, and presence of symptomatic cardiomyopathy
- Scores reflecting levels for DMD-QoL and HUI2 attributes were transformed to overall utility values using the developers' algorithms for each measure
  - DMD-QoL: Preference weights from the UK were applied, as no US value sets are available[6]
  - HUI: The original Canadian preference weights were applied, as recommended[8]
- Median (Q1, Q3) DMD-QoL and HUI2 utility values were stratified by self-reported health state
  - To understand which attributes were most affected by DMD, median (Q1, Q3) attribute levels contributing to the DMD-QoL and HUI2 utility values were estimated for each health state

RESULTS

- Of the 63 participants, the mean (SD) age was 19.8 (6.1) years and 44 (69.8%) were non-ambulatory
- Median (Q1, Q3) DMD-QoL and HUI2 utility values for the complete range of DMD health states are displayed in **Figure 1**
- To illustrate trends, median (Q1, Q3) DMD-QoL utility values were 0.77 (0.73, 0.86) for the *ambulatory with preserved upper limb function* health state (n=10), 0.69 (0.58, 0.82) for the *non-ambulatory with mildly impaired upper limb function without daytime ventilation or symptomatic cardiomyopathy* (CM) state (n=16), and 0.20 (-0.02, 0.41) for the *non-ambulatory with loss of upper limb function, symptomatic CM and night and daytime ventilation* state (n=2)
  - Median (Q1, Q3) HUI2 utilities for the same health states were 0.96 (0.86, 0.99); 0.51 (0.44, 0.55); and 0.32 (0.23, 0.42)
- For the attribute-specific analyses (**Tables 2 and 3**),
  - DMD-QoL attribute scores demonstrated decline in mobility and hand function with disease progression, with participants reporting difficulty with mobility only once they also experienced a loss of upper limb function
  - Mobility and self-care were the HUI2 attributes showing the greatest impact; unlike in the DMD-QoL these impacts were observed throughout non-ambulatory health states with varying levels of upper limb impaired

DISCUSSION

- HUI2 utilities were higher than DMD-QoL values for less severe health states. They declined with worsening ambulation, while DMD-QoL utilities were relatively stable throughout the course of DMD
  - The relatively low DMD-QoL utility for the ambulatory stage may reflect the impact of distal aspects of HRQoL, unlike the HUI2 where HRQoL impact is largely driven by physical functioning
  - While mobility is considered in both descriptive systems, differences in scores may be attributed to the DMD-QoL's broader conceptualization of mobility as one's ability to get around as opposed to walking ability in the HUI
- The large sample size and values derived directly from patient feedback were key strengths of this study; limitations include that clinical status was self-reported

Figure 1: Median (Q1, Q3) DMD-QoL and HUI2 utility values per health state

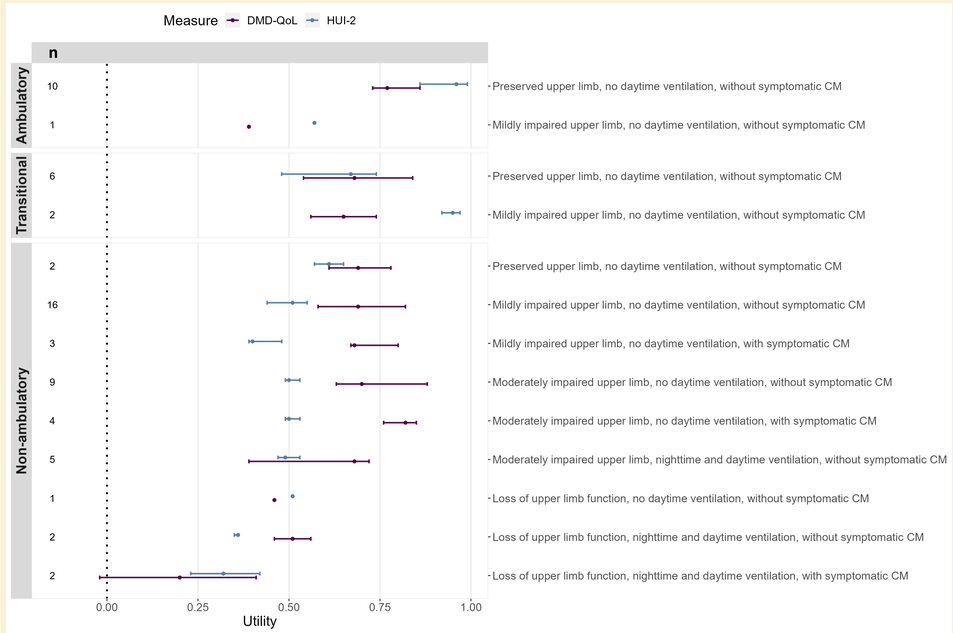

Table 1: Median (Q1, Q3) DMD-QoL attribute levels per health state

	n	Mobility	Difficulty using hands	Difficulty breathing	Pain	Tiredness	Worry	Participation	Feeling good about yourself
Ambulatory									
Preserved upper limb, no daytime ventilation, without symptomatic CM	10	2.0 (1.3, 2.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	2.0 (1.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.5 (1.0, 3.0)
Mildly impaired upper limb, no daytime ventilation, without symptomatic CM	1	3.0 (3.0, 3.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	2.0 (2.0, 2.0)	3.0 (3.0, 3.0)	2.0 (2.0, 2.0)	4.0 (4.0, 4.0)	3.0 (3.0, 3.0)
Transitional									
Preserved upper limb, no daytime ventilation, without symptomatic CM	6	2.0 (1.3, 2.8)	1.0 (1.0, 1.0)	1.5 (1.0, 2.8)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.5 (1.3, 3.0)	1.5 (1.0, 2.0)
Mildly impaired upper limb, no daytime ventilation, without symptomatic CM	2	1.5 (1.3, 1.8)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.5 (1.3, 1.8)	1.5 (1.3, 1.8)	1.5 (1.3, 1.8)	2.5 (1.8, 3.3)	3.5 (3.3, 3.8)
Non-ambulatory									
Preserved upper limb, no daytime ventilation, without symptomatic CM	2	1.5 (1.3, 1.8)	1.5 (1.3, 1.8)	1.0 (1.0, 1.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	3.0 (2.5, 3.5)	2.0 (1.5, 2.5)	2.5 (2.3, 2.8)
Mildly impaired upper limb, no daytime ventilation, without symptomatic CM	16	2.0 (1.8, 3.3)	2.0 (1.0, 2.0)	1.0 (1.0, 1.0)	2.0 (1.8, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 3.0)	2.0 (1.0, 2.3)	2.0 (1.0, 2.0)
Mildly impaired upper limb, no daytime ventilation, with symptomatic CM	3	2.0 (2.0, 3.0)	1.0 (1.0, 1.5)	1.0 (1.0, 1.5)	2.0 (1.5, 2.0)	2.0 (2.0, 2.5)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (1.5, 2.5)
Moderately impaired upper limb, no daytime ventilation, without symptomatic CM	9	2.0 (1.0, 2.0)	2.0 (2.0, 2.0)	1.0 (1.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (1.0, 3.0)	2.0 (1.0, 2.0)
Moderately impaired upper limb, no daytime ventilation, with symptomatic CM	4	1.0 (1.0, 1.5)	2.0 (2.0, 2.3)	1.0 (1.0, 1.3)	2.0 (1.8, 2.0)	2.0 (1.8, 2.0)	2.0 (1.8, 2.0)	2.0 (1.8, 2.0)	2.0 (1.8, 2.0)
Moderately impaired upper limb, nighttime and daytime ventilation, without symptomatic CM	5	4.0 (3.0, 4.0)	3.0 (2.0, 4.0)	2.0 (1.0, 2.0)	1.0 (1.0, 1.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 3.0)	2.0 (1.0, 2.0)
Loss of upper limb function, no daytime ventilation, without symptomatic CM	1	4.0 (4.0, 4.0)	4.0 (4.0, 4.0)	1.0 (1.0, 1.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)
Loss of upper limb function, nighttime and daytime ventilation, without symptomatic CM	2	2.5 (2.3, 2.8)	3.5 (3.3, 3.8)	3.0 (2.5, 3.5)	2.0 (2.0, 2.0)	2.0 (2.0, 2.0)	1.5 (1.3, 1.8)	1.5 (1.3, 1.8)	1.5 (1.3, 1.8)
Loss of upper limb function, nighttime and daytime ventilation, with symptomatic CM	2	3.0 (2.5, 3.5)	4.0 (4.0, 4.0)	2.5 (1.8, 3.3)	2.0 (2.0, 2.0)	3.0 (2.5, 3.5)	2.5 (1.8, 3.3)	2.0 (1.5, 2.5)	2.5 (1.8, 3.3)

Table 2: Median (Q1, Q3) HUI2 attribute levels per health state

	n	Sensation	Mobility	Emotion	Cognitive	Self-care	Pain
Ambulatory							
Preserved upper limb, no daytime ventilation, without symptomatic CM	10	1.0 (1.0 - 1.0)	1.0 (1.0 - 2.0)	1.0 (1.0 - 1.0)	1.0 (1.0 - 1.8)	1.0 (1.0 - 1.0)	1.0 (1.0 - 1.8)
Mildly impaired upper limb, no daytime ventilation, without symptomatic CM	1	2.0 (2.0 - 2.0)	2.0 (2.0 - 2.0)	4.0 (4.0 - 4.0)	2.0 (2.0 - 2.0)	1.0 (1.0 - 1.0)	2.0 (2.0 - 2.0)
Transitional							
Preserved upper limb, no daytime ventilation, without symptomatic CM	6	2.0 (1.3 - 2.8)	2.5 (1.3 - 3.0)	2.0 (1.3 - 2.8)	1.5 (1.0 - 2.0)	1.5 (1.0 - 2.0)	2.0 (2.0 - 2.8)
Mildly impaired upper limb, no daytime ventilation, without symptomatic CM	2	1.0 (1.0 - 1.0)	1.0 (1.0 - 1.0)	1.5 (1.3 - 1.8)	1.0 (1.0 - 1.0)	1.0 (1.0 - 1.0)	1.5 (1.3 - 1.8)
Non-ambulatory							
Preserved upper limb, no daytime ventilation, without symptomatic CM	2	1.0 (1.0 - 1.0)	4.0 (4.0 - 4.0)	2.0 (1.5 - 2.5)	1.5 (1.3 - 1.8)	1.0 (1.0 - 1.0)	1.5 (1.3 - 1.8)
Mildly impaired upper limb, no daytime ventilation, without symptomatic CM	16	1.5 (1.0 - 2.0)	4.0 (4.0 - 4.0)	2.0 (1.0 - 3.0)	1.0 (1.0 - 2.0)	4.0 (3.0 - 4.0)	2.0 (1.0 - 2.0)
Mildly impaired upper limb, no daytime ventilation, with symptomatic CM	3	2.0 (1.5 - 2.5)	4.0 (4.0 - 4.0)	2.0 (1.5 - 2.5)	2.0 (1.5 - 2.0)	4.0 (4.0 - 4.0)	1.0 (1.0 - 1.5)
Moderately impaired upper limb, no daytime ventilation, without symptomatic CM	9	2.0 (1.0 - 2.0)	4.0 (4.0 - 4.0)	2.0 (1.0 - 2.0)	1.0 (1.0 - 1.0)	4.0 (4.0 - 4.0)	2.0 (1.0 - 2.0)
Moderately impaired upper limb, no daytime ventilation, with symptomatic CM	4	2.0 (1.8 - 2.0)	4.0 (4.0 - 4.0)	1.5 (1.0 - 2.0)	1.0 (1.0 - 1.3)	4.0 (3.5 - 4.0)	2.0 (1.8 - 2.0)
Moderately impaired upper limb, nighttime and daytime ventilation, without symptomatic CM	5	2.0 (2.0 - 2.0)	4.0 (4.0 - 4.0)	1.0 (1.0 - 2.0)	1.0 (1.0 - 1.0)	4.0 (4.0 - 4.0)	1.0 (1.0 - 1.0)
Loss of upper limb function, no daytime ventilation, without symptomatic CM	1	2.0 (2.0 - 2.0)	4.0 (4.0 - 4.0)	1.0 (1.0 - 1.0)	1.0 (1.0 - 1.0)	4.0 (4.0 - 4.0)	2.0 (2.0 - 2.0)
Loss of upper limb function, nighttime and daytime ventilation, without symptomatic CM	2	2.0 (1.5 - 2.5)	5.0 (5.0 - 5.0)	1.5 (1.3 - 1.8)	1.5 (1.3 - 1.8)	4.0 (4.0 - 4.0)	2.0 (2.0 - 2.0)
Loss of upper limb function, nighttime and daytime ventilation, with symptomatic CM	2	2.0 (1.5 - 2.5)	4.5 (4.3 - 4.8)	3.0 (2.0 - 4.0)	2.5 (2.3 - 2.8)	4.0 (4.0 - 4.0)	2.0 (2.0 - 2.0)

CM= cardiomyopathy; n=number. Note: A higher attribute level indicates greater impairment and increasing intensity of shading in each cell indicated increasing severity of impacts. DMD-QoL attribute levels range from 1 to 4; for HUI2, sensation, cognition and self-care range from 1 to 4 and all other attributes range from 1 to 5.

REFERENCES

1. Szabo SM, et al. *Orphanet J Rare Dis*. 2021;16(1):237. 2. Powell PA, et al. *BMJ Open*. 2019;9:e023685. 3. Powell PA, et al. *Neurology*. 2021 May 11;96(19):e2438-e2450.
4. Rowen D, et al. *Value Health*. 2021 Oct;24(10):1499-1510. 5. Crossnohere, NL et al. *Med Decis Making*. 2021;41(2):209-221. 6. Powell, PA et al. *Health Qual Life Outcomes*. 2020 Aug 3;18(1):263.
7. Torrance GW, et al. *Medical Care*. 1996;34(7):702-722. 8. Horsman J, et al. *Health Qual Life Outcomes*. 2003;1:54-54.

ACKNOWLEDGMENTS & DISCLOSURES

The authors would like to gratefully acknowledge the support of Parent Project Muscular Dystrophy (PPMD)'s Duchenne Registry, that facilitated recruitment for this study.
This study was funded by Sarepta Therapeutics, Inc. IFA and KLG are employees of Sarepta Therapeutics, Inc. SMS, AB and PJ are employees of Broadstreet HEOR, which received funds from Sarepta to conduct this study. DF, PN, and DCM received consulting fees related to this work. DF has a proprietary interest in Health Utilities Incorporated, Dundas, Ontario, Canada. HUInc. distributes copyrighted Health Utilities Index (HUI) materials and provides methodological advice on the use of HUI. STI has received research funding or consulting fees from Avexis, Biogen, FibroGen, Sarepta, Scholar Rock, PTC Therapeutics, MDA, CureSMA, NIH, DoD, Capricor, Genentech-Roche.