The prevalence and severity of disease-related disabilities and their impact on quality of life in neuromuscular diseases

Isaac Bos, Klaske Wynia, Josué Almansa, Gea Drost, Berry Kremer & Jan Kuks

To cite this article: Isaac Bos, Klaske Wynia, Josué Almansa, Gea Drost, Berry Kremer & Jan Kuks (2018): The prevalence and severity of disease-related disabilities and their impact on quality of life in neuromuscular diseases, Disability and Rehabilitation, DOI: 10.1080/09638288.2018.1446188

To link to this article: https://doi.org/10.1080/09638288.2018.1446188

© 2018 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

Published online: 08 Mar 2018.

Article views: 36

View supplementary material
Submit your article to this journal
View related articles
View Crossmark data
The prevalence and severity of disease-related disabilities and their impact on quality of life in neuromuscular diseases

Isaac Bos\textsuperscript{a}, Klaske Wynia\textsuperscript{a, b}, Josué Almansa\textsuperscript{b}, Gea Drost\textsuperscript{a}, Berry Kremer\textsuperscript{a} and Jan Kuks\textsuperscript{a}

\textsuperscript{a}Department of Neurology, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands; \textsuperscript{b}Department of Community and Occupational Health, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands

ABSTRACT

Purpose: People with neuromuscular disease experience lower quality of life levels than people from the general population. We examined the prevalence and severity of a broad range of neuromuscular disease-related disabilities and their impact on health-related quality of life.

Materials and methods: A cross-sectional postal survey study was conducted among patients diagnosed with neuromuscular disease. Patients completed the Neuromuscular Disease Impact Profile, a disease-related disability impact questionnaire, and two generic health-related quality of life questionnaires: the medical outcome study Short Form Questionnaire and the World Health Organization Quality of Life-brief. The impact of disabilities on quality of life was estimated using multiple regression analyses.

Results: Six hundred sixty two patients (68\% response rate) completed the questionnaires. There were no differences in quality of life between diagnosis-based subgroups. ‘Impairments in muscle functions’ had the highest prevalence and severity scores in the total sample and diagnosis-based subgroups. Neuromuscular disease-related disabilities showed strong and independent associations with all aspects of health-related quality of life. ‘Impairments in mental functions and pain’ was the most important predictor of health-related quality of life followed by ‘restrictions in participation in life situations’.

Conclusions: Although ‘impairment in muscle functions’ is the most prevalent and severe disability, the ‘impairments in mental functions and pain’ have a strong association with health-related quality of life in patients with a neuromuscular disease.

IMPLICATIONS FOR REHABILITATION

\begin{itemize}
  \item Disease-related disabilities have a strong and independent associations with all aspects of health-related quality of life.
  \item Although health-related domains of quality of life are affected by the neuromuscular disease, the general quality of life is quite good.
  \item The most prevalent and severe disability in total group and diagnosis-based subgroups is ‘impairments in muscle functions’.
  \item The most significant predictor in health-related quality of life is ‘impairments in mental functions and pain’.
\end{itemize}

Introduction

Neuromuscular diseases (NMDs) can be caused by dysfunction of the anterior horn cell or sensory ganglion cell (neuronopathy), peripheral nerve (neuropathy), neuromuscular junction (myasthenia), or muscle (myopathy) \cite{1}. Common impairments in functioning as a consequence of neuromuscular diseases include muscle weakness, impairment in muscle endurance, involuntary muscle activity (stiffness, myotonia, cramp and fasciculation), sensory loss, autonomic dysfunction and impairment in the control of voluntary movements \cite{1}. These impairments cause fatigue and pain in most people, which has a profound impact on their daily activities and participation in life situations \cite{1–5}.

Quality of Life (QoL) has become increasingly important in evaluating healthcare outcomes in recent decades. Commonly, general quality of life is the perceived quality of an individual’s daily life, including physical, psychological, social and environmental aspects of the individual’s life \cite{6,7}. In healthcare, health-related quality of life (HRQoL) is the perceived quality of life when affected by a disease or disabilities \cite{8}. Several studies found that all QoL domains were worse in NMD-groups compared to healthy people in the general population \cite{5}, which can be explained by NMD-related health problems such as poorer physical \cite{5,9} and social functioning \cite{10,11}, pain \cite{12–14}, fatigue \cite{15}, cognitive impairments and impaired emotional functioning \cite{16}.

Although these studies have generated clinically important information, they are limited by their typical focus on the impact of individual disabilities on HRQoL. Little is known of the relative impact of aggregated NMD-related disabilities on HRQoL. Insight
into this could facilitate our understanding of the impact of
disease-related disabilities in NMDs on HRQoL.

The aim of this study is therefore to examine the prevalence
and severity of a large number of disease-related disabilities and
their impact on HRQoL in a sample of patients diagnosed with a
wide range of NMDs.

Methods

Sample and procedure

A cross-sectional postal survey was conducted among patients
diagnosed with an NMD and registered at the Department of
Neurology, University Medical Center Groningen, The Netherlands.
The inclusion criteria in addition to an NMD diagnosis were: being
aged 18 or older, and being able to read and write in Dutch.

A total of 980 eligible patients diagnosed with a neuromuscu-
lar disease were selected from the hospital patient record system.
To avoid inappropriately sending questionnaires, we crosschecked
for deceased patients using the national population register.

Patients received information about the study and were invited
to participate. Respondents completed the Neuromuscular Disease
Impact Profile (NMDIP), two generic health-related QoL question-
naires and some demographic and disease-specific questions.
Reminders were sent after two weeks if there was no response.

Measurement instruments

Disease-related disabilities were assessed using the NMDIP [1].
This measurement instrument is based on the International
Classification of Functioning, Disability and Health (ICF) [17] and
consists of 36 items covering four ICF components. Its items are
grouped into eight scales with four additional items. For the body
functions and participation component items, scoring options
ranged from 0 (no disability) to 4 (complete disability); for the
activities component items, scoring options ranged from 0 (no dis-
ability) to 3 (complete disability); and for the environmental fac-
tors component items, scoring options ranged from 0 (no support)
to 2 (full support). Scores are summed for each scale.

To make the scores for each scale and the individual items com-
parable, the summed and individual scores were divided by the
highest possible score and multiplied by 100 to obtain a result
between 0 and 100. We established in previous work that the
NMDIP shows satisfactory levels of internal consistency:
Cronbach’s alphas ranged from 0.63 to 0.92, while mean inter-
item correlations ranged from 0.38 to 0.77 [1]. Test-retest reliabil-
ity was good: intraclass correlations ranged from 0.79 to 0.97 [18].

HRQoL was assessed using two generic HRQoL measurement
instruments, the Medical Outcome Study 36-item Short Form
Health Survey (SF-36) [19] and the World Health Organization
Quality of Life (abbreviated version) (WHOQoL-bref) [20]. The SF-
36 consists of eight scales and two separate questions covering
physical, psychological, and social aspects of health. Item scores
were coded, summed, and transformed to a scale ranging from 0
(worst QoL) to 100 (best QoL) for each dimension. The Cronbach’s
alpha for a recent NMD study ranged from 0.77 to 0.94 [1]. The
WHOQoL-bref consists of 26 items divided into four domains cov-
ering physical, psychological, social and environmental aspects
and has two single-item questions. For each scale, item scores
were coded, summed, and transformed to a scale ranging from 0
(worst QoL) to 100 (best QoL). The Cronbach’s alpha for a recent
study of NMD patients ranged from 0.6 to 0.84 [1]. Contextual
variables were assessed using three questions with a visual ana-
logue scale: General health status was assessed using the
EuroQol-visual analogue scale for the single question ‘How good
or bad is your health today?’ [21], with the endpoints ‘Best
imaginable health state’ scoring 100, and ‘Worst imaginable health
state’ scoring 0. The extent of limitations was assessed using the
single question ‘To what extent are you limited due to your
NMD?’ Response options are on a 10-point scale ranging from 1
(not limited at all) to 10 (completely limited). And general QoL
was assessed using the single question ‘How do you rate your
QoL?’, with the endpoints ‘Best imaginable QoL’ scoring 10, and
‘Worst imaginable QoL’ scoring 0.

Diagnosis-based subgroups

To examine the differences in the prevalence and severity of dis-
abilities between the relevant NMD subgroup we used the cat-
egorisation according to Rowland [22]: motor-neuron disorders,
muscle disorders, junction disorders, and peripheral nerve disor-
ders. Furthermore, the peripheral nerve disorders group was split
into primary motor and primary sensor subgroups because of the
differences in onset and expected differences in prevalence and
disability severity.

Data analyses

Descriptive statistics were used to examine the patient characteris-
tics. The prevalence of disabilities was calculated as the percent-
age of the patients who experience a disability (score >0). Severity
scores were calculated as the mean score of the disability scores of all patients. To assess differences between diagnosis-
based subgroups, analysis of variance and T-tests were performed
for normally distributed continuous variables, a Chi-square test
for categorical variables, and a Mann–Whitney U-test and
Kruskal–Wallis test for not normally distributed variables.

The impact of the disease-related disabilities on HRQoL was
assessed using a series of multiple regression analyses with each of
the HRQoL variables as dependent variable. We first analysed
the impact of patient characteristics (age, gender, years since
diagnosis, employment status, and educational level) on HRQoL in
Model 1 to control for patient characteristics. We then analysed
the impact of the disease-related disabilities overall in Model 2.
Before being entered into the regression analysis, the ordinal and
categorical variables – gender, educational level and employment
status – were dichotomized. The expected direction of standard-
dized sz weights is negative, meaning that less disability equates
to better HRQoL. Special attention was given to examining the
multicollinearity between variables [23].

Statistical analyses were performed using the SPSS 23.0 soft-
ware package, SPSS Inc. Chicago, IL 60606-6307.

Results

Patient characteristics

Of the 980 eligible patients, 662 participants completed the ques-
tionnaires (68% response rate). The distribution of NMD diagnoses
across the various NMD subgroups is described in Supplementary
Table S1. Non-respondents did not differ from respondents in
terms of gender, but were younger than respondents (mean
age =53, SD = 19.4).

The mean age of respondents was 59 years and their mean dis-
 ease duration was 11 years (Table 1). Most respondents were mar-
ried or in a relationship, were of low education level and were
retired. All NMD-subgroups had similar levels of general QoL.
**Table 1. Sample characteristics for the total sample (n = 662) and subgroups.**

<table>
<thead>
<tr>
<th></th>
<th>Total sample (n = 662)</th>
<th>Motor-neuron disorders (n = 62)</th>
<th>Muscle disorders (n = 155)</th>
<th>Junction disorders (n = 177)</th>
<th>Peripheral nerve disorders primary motor (n = 71)</th>
<th>Peripheral nerve disorders primary sensor (n = 197)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>335 (51)</td>
<td>31 (50)</td>
<td>77 (50)</td>
<td>115 (65)</td>
<td>32 (45)</td>
<td>80 (41)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>59 (15.4)</td>
<td>60.8 (12.7)</td>
<td>51.6 (16.8)</td>
<td>58.7 (15.7)</td>
<td>55.7 (14.4)</td>
<td>65.3 (12.3)</td>
</tr>
<tr>
<td>Employment status n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/partnership</td>
<td>468 (71)</td>
<td>51 (82)</td>
<td>95 (61)</td>
<td>128 (72)</td>
<td>52 (73)</td>
<td>142 (72)</td>
</tr>
<tr>
<td>Unmarried/widowed/divorced</td>
<td>193 (29)</td>
<td>11 (18)</td>
<td>60 (39)</td>
<td>48 (27)</td>
<td>19 (27)</td>
<td>55 (28)</td>
</tr>
<tr>
<td>Educational level n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower level</td>
<td>480 (73)</td>
<td>41 (66)</td>
<td>114 (75)</td>
<td>131 (74)</td>
<td>51 (73)</td>
<td>143 (73)</td>
</tr>
<tr>
<td>Higher level</td>
<td>177 (27)</td>
<td>21 (34)</td>
<td>37 (25)</td>
<td>46 (26)</td>
<td>19 (27)</td>
<td>54 (27)</td>
</tr>
<tr>
<td>Employment status n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>187 (28)</td>
<td>18 (29)</td>
<td>46 (30)</td>
<td>60 (34)</td>
<td>21 (30)</td>
<td>42 (21)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>475 (72)</td>
<td>44 (71)</td>
<td>109 (70)</td>
<td>117 (66)</td>
<td>50 (70)</td>
<td>155 (79)</td>
</tr>
<tr>
<td>Range</td>
<td>0–65</td>
<td>1–64</td>
<td>1–62</td>
<td>0–65</td>
<td>0–55</td>
<td>0–61</td>
</tr>
<tr>
<td>Health-state</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ-VAS, median (IQR)</td>
<td>67 (30)</td>
<td>65 (23)</td>
<td>65 (25)</td>
<td>70 (25)</td>
<td>70 (30)</td>
<td>65 (30)</td>
</tr>
<tr>
<td>Extent of limitations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>5 (4)</td>
<td>7 (3)</td>
<td>6 (5)</td>
<td>5 (3)</td>
<td>6 (4)</td>
<td>6 (5)</td>
</tr>
<tr>
<td>Quality of Life</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QoL-rate, median (IQR)</td>
<td>7 (2)</td>
<td>7 (2)</td>
<td>7 (2)</td>
<td>7 (2)</td>
<td>7 (1)</td>
<td>7 (2)</td>
</tr>
</tbody>
</table>

IQR: Inter quartile range.

**Prevalence and severity of disease-related disabilities**

The most prevalent disability reported in the total sample (Table 2) was ‘impairments in muscle functions’, followed by ‘limitations in activities of moving around’ and ‘impairments in mental functions and pain’. The peripheral nerve disorders subgroup, primary sensor group, had the highest prevalence for ‘impairments in mental functions and pain’ and for ‘impairments in excretion and reproductive functions’ compared to the other disorders. The most severe disability in the total sample was ‘impairments in muscle functions’ followed by lack of support from social security services and ‘health services’, and ‘limitations in activities of moving around’. Disability severity differed statistically significantly for most disabilities between NMD subgroups.

**Impact of disease-related disabilities on QoL**

We obtained satisfactory results, and there was no multicollinearity: the variance inflation factor (VIF) for ‘activities of moving around’ was 5.6 and the average VIF was 2.0. The mean tolerance was 0.59 and the range was from 0.20 to 0.85 and was never below the critical value of 0.2.

Disease-related disability variables contributed significantly and considerably to an important segment of the variance for all SF-36 and WHOQoL-bref domains. The significant standardized β weights were in the expected direction, meaning that patients who reported more disability experienced less QoL. The low significant positive direction of the β weight for the variable ‘seeing functions’ in relation to the SF-36 variable bodily pain was somewhat unexpected.

The disabilities which were strong predictors for QoL evaluated using the SF-36 (Table 3) were:

- ‘Impairments in mental functions and pain’ (impairments in sleep functions, fatigue, emotional functions, thought functions, and sensation of pain) was a significant predictor for six out of eight QoL variables.
- ‘Impairments in muscle functions’ (impairments in muscle power functions and muscle endurance functions) and ‘limitations in activities of moving around’ (limitations in changing body position, maintaining body position, transferring oneself, walking, using transportation, and recreation and leisure) were important predictors in the ‘physical functioning’ QoL domain.
- ‘Restrictions in participation in life situations’ (restrictions in mobility, relationships and recreation and leisure) was an important predictor in the ‘role physical’ and ‘social functioning’ QoL domains.
- ‘Restrictions in self-care and domestic activities’ (limitations in fine hand use, hand and arm use, washing oneself, caring for body parts, going to the toilet, dressing, preparing meals, and doing housework) and ‘restrictions in mental functions and pain’ were important predictors in the ‘role emotional’ QoL domain.

The disabilities which were strong predictors for QoL evaluated using the WHOQoL-bref (Table 4) were:

- ‘Restrictions in participation in life situations’ was a significant predictor for three out of four QoL variables.
- ‘Impairments in mental functions and pain’ was an important predictor in the ‘physical health’ and ‘psychological health’ QoL domains.
- ‘Impairments in excretion and reproductive functions’ (impairments in defecation functions, urination functions, and sexual functions) was an important predictor in the ‘social relations’ QoL domain.
- ‘Lack of support from immediate family’ and ‘lack of support from social security services’ showed significant contributions in the ‘social relationships’ QoL domain.
- ‘Lack of support from immediate family’ showed a significant contribution in the ‘environment’ QoL domain.

**Discussion**

This study examined the prevalence, severity and impact of a broad range of disease-related disabilities on HRQoL in a large sample of NMD patients. The study’s most important finding is that disease-related disabilities have a strong and independent association with all aspects of HRQoL. Although ‘impairments in muscle functions’ was the most severe disability with the highest prevalence in all diagnosis-based subgroups, the ‘impairments in
Table 2. Prevalence and severity of disease-related disabilities in the total sample and in disease subgroups.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Total sample</th>
<th>Muscle disorders</th>
<th>Junction disorders</th>
<th>Peripheral nerve disorders primary</th>
<th>Peripheral nerve disorders primary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n = 155$</td>
<td>$n = 177$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$n = 62$</td>
<td>$n = 62$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% mean (CI)</th>
<th>% mean (CI)</th>
<th>% mean (CI)</th>
<th>% mean (CI)</th>
<th>% mean (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impairments in ...</td>
<td>Impairments in ...</td>
<td>Impairments in ...</td>
<td>Impairments in ...</td>
<td>Impairments in ...</td>
</tr>
<tr>
<td>Motor functions</td>
<td>Motor functions</td>
<td>Motor functions</td>
<td>Motor functions</td>
<td>Motor functions</td>
</tr>
<tr>
<td>Movement functions</td>
<td>Movement functions</td>
<td>Movement functions</td>
<td>Movement functions</td>
<td>Movement functions</td>
</tr>
<tr>
<td>Excretion and reproductive functions</td>
<td>Excretion and reproductive functions</td>
<td>Excretion and reproductive functions</td>
<td>Excretion and reproductive functions</td>
<td>Excretion and reproductive functions</td>
</tr>
<tr>
<td>Limitations in Activities of Moving Around</td>
<td>Limitations in Activities of Moving Around</td>
<td>Limitations in Activities of Moving Around</td>
<td>Limitations in Activities of Moving Around</td>
<td>Limitations in Activities of Moving Around</td>
</tr>
<tr>
<td>Restrictions in Participation in Life Situations</td>
<td>Restrictions in Participation in Life Situations</td>
<td>Restrictions in Participation in Life Situations</td>
<td>Restrictions in Participation in Life Situations</td>
<td>Restrictions in Participation in Life Situations</td>
</tr>
<tr>
<td>Lack of support from ...</td>
<td>Lack of support from ...</td>
<td>Lack of support from ...</td>
<td>Lack of support from ...</td>
<td>Lack of support from ...</td>
</tr>
<tr>
<td>Social security services</td>
<td>Social security services</td>
<td>Social security services</td>
<td>Social security services</td>
<td>Social security services</td>
</tr>
</tbody>
</table>

The positive association of increased ‘impairments in seeing functions’ with perceived QoL in the ‘bodily pain’ domain (SF-36), which means that worsening sight has a relatively small but a positive association with a patient’s experienced pain, was an unexpected finding. Given the number of relationships under investigation, this could be a chance finding, but on the other hand, worsening sight could cause a decrease in activity and thereby a decrease in experienced activity-related muscle pain. A comparable unexpected finding is the relatively small positive association of increased ‘impairments in movement functions’ with quality of environmental aspects (WHOQoL-bref). This can probably be explained by the beneficial effects of adaptations in the environment and the use of assist devices such as mobility scooters.

We also found that the association of disabilities with HRQoL was dependent on the HRQoL measurement instrument used. For example, when using the WHOQoL-bref, we found that limitations in activities did not affect one of the four domains of QoL. However, when using the SF-36, these limitations did affect QoL in the ‘physical functioning’ and ‘role emotional’ domains. Conversely, we found that environmental aspects had no association with HRQoL when using the SF-36, while ‘lack of support from immediate family or social security services’ affected one or two of the four WHOQoL-bref domains. This finding indicates that HRQoL continues to be an evolving concept, which should be borne in mind when choosing a QoL measurement instrument and interpreting results.

We examined our expectation of differences in disability prevalence and severity between the peripheral nerve disorders subgroups. We found significant differences between ‘impairments in mental functions and pain’ and ‘impairments in excretion and reproductive functions’. The prevalence and severity of ‘impairments in mental functioning and pain’, and ‘impairments in reproductive functions’ were higher in the primary sensor group, probably because the autonomous nervous system is more involved compared to the motor sensory group.

We did not expect a prevalence of more than 50% for ‘impairments of swallowing and speech functions’ in our muscle group, but it should be realized that swallowing is a complex process not only comprising pharyngeal sphincters but also facial, lingual, and chewing muscles. Self-evidently swallowing is an important factor for patients’ prognosis and QoL [27,28].
Our study has some important strengths. First is the fact that we examined the impact on HRQoL of a broad range of disease-related disabilities, separately and in relation to each other, while most studies examined only one or some disabilities in one or some NMDs. As a result, this study offers a unique insight into the consequences of NMD. Second, this study examined the consequences of a large sample of NMDs representing all acknowledged diagnosis-based subgroups and not just one disease or a few diseases as is usually the case. Combined with our finding that it is the disease-related disabilities rather than the medical diagnosis, which are relevant to predicting HRQoL, our findings are relevant to a broad population and could have important implications for the treatment of patients with chronic diseases such as NMD. Insight into the prevalence, severity and relative impact of a large number of disease-related disabilities could contribute to medical and non-medical support of NMD patients. Furthermore, if the focus of support is shifted from medical diagnoses to disabilities, the professionals who support patients with a
chronic disease might exchange knowledge and experiences, or could integrate their activities. This ‘joining forces’ could contribute to the QoL of the chronically ill.

Conclusions

Although impairment of muscle function is the most prevalent and severe disability, impairment of mental function and pain have a strong association with HRQoL of NMD patients.

Ethical approval

Ethical approval was obtained from the local ethics committee, the Medical Ethical Committee of the University Medical Center Groningen. Reference: METc 2009.310. Informed consent was obtained from all participants.

Acknowledgements

We wish to thank the patients who participated in this study and shared their personal information about the consequences of their disease by taking the time to complete our questionnaires. We thank the students who assisted in data collection: Ronald Brans, Kyra van der Beek, Hanna Bosman, Annelies Verschure, Carolien Verschure and Marieke Verschure. This study was supported by the Neurology department of the University Medical Center Groningen.

Disclosure statement

The authors report no declarations of interest.

Reference


