

# EQUIVALENCE OF THE ELECTRONIC VERSUS PAPER-BASED SHORT VERSION OF THE MSQOL-54 (MSQOL-29)



UNIVERSITÀ  
DEGLI STUDI  
DI TORINO

This study was supported by the Italian MS Society (AISM) through its foundation, FISM (Grant No. 2013/R/20)



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**Background.** We recently developed a short version of Multiple Sclerosis Quality Of Life-54 (MSQOL-54) using factor analysis and item response theory [1]. The short version, named MSQOL-29 (25 items grouped in 7 subscales, plus 4 single items) is also available in electronic, self-administered form, with automatic scoring (eMSQOL-29).

**Objective.** To assess the acceptability of the eMSQOL-29 and its equivalence to the paper-based version.

**Methods.** Equivalence of the eMSQOL-29 was assessed on 223 adult patients with a confirmed MS diagnosis [2]. Patients with exacerbations in the previous month, overt cognitive impairment, or any physical compromise precluding participation were excluded. We adopted a crossover design with random test order, by which patients completed both MSQOL-29 versions, in an interval of 2-4 weeks. After the second administration, they completed a short, ad hoc questionnaire assessing the acceptability and usability of the eMSQOL-29. For each of the 11 MSQOL-29 subscale scores equivalence was assessed by (a) the intraclass correlation coefficient (ICC, with 95% confidence interval); and (b) mixed effect model. The latter included the following independent variables: version (paper vs. electronic), order (first vs. second administration), sequence (order per version), centre (Milan vs. Orbassano), sex, age, Expanded Disability Status Scale score ( $\leq 2.5$  vs.  $> 2.5$ ) [3], and disease course (relapsing-remitting vs. primary or secondary progressive). We also tested for the first-order interaction term sequence per age

**Results.** Of the 233 MS patients enrolled, 220 (94%) completed the questionnaire in both modes (13 did not return the paper MSQOL-29). The between-mode difference in mean subscale scores, effect size (95% CI), and intraclass coefficient correlations (95% CI) are shown in table 1

**Table 1. Distribution of eMSQOL-29 subscale scores, and measures to assess equivalence. CI is confidence interval; ICC is intraclass correlation coefficient; SD is standard deviation.**

	N	Mean (SD) eMSQOL-29	Mean (95% CI) difference paper - eMSQOL-29	Effect size (95% CI) paper - eMSQOL-29	ICC (95% CI)
<b>Multi-item subscales:</b>					
Physical Function	220	74.4 (30.1)	-0.08 (-1.77 - 1.62)	-0.006 (-0.063 - 0.051)	0.95 (0.94 - 0.96)
Bodily Pain	220	75.7 (24.3)	0.29 (-1.90 - 2.48)	0.018 (-0.072 - 0.107)	0.87 (0.83 - 0.90)
Emotional Wellbeing	219	64.1 (19.3)	0.96 (-0.85 - 2.77)	0.071 (-0.024 - 0.165)	0.85 (0.81 - 0.89)
Energy	219	51.5 (21.0)	-0.04 (-1.79 - 1.72)	-0.003 (-0.087 - 0.081)	0.89 (0.85 - 0.91)
Cognitive Function	220	68.0 (22.4)	1.23 (-0.71 - 3.18)	0.084 (-0.001 - 0.170)	0.88 (0.85 - 0.91)
Health Distress	219	74.5 (21.2)	0.84 (-1.32 - 3.00)	0.052 (-0.044 - 0.148)	0.85 (0.80 - 0.88)
Sexual Function	219	78.2 (30.0)	1.58 (-1.48 - 4.65)	0.069 (-0.031 - 0.169)	0.84 (0.79 - 0.87)
<b>Single-item subscales:</b>					
Health Perceptions	219	47.9 (28.0)	1.52 (-1.79 - 4.84)	0.061 (-0.055 - 0.177)	0.62 (0.54 - 0.70)
Social Function	219	65.3 (27.1)	1.94 (-1.62 - 5.50)	0.073 (-0.057 - 0.202)	0.52 (0.42 - 0.61)
Overall Quality of Life	208	68.9 (17.0)	1.35 (-0.25 - 2.94)	0.115 (0.022 - 0.208)	0.77 (0.71 - 0.82)
Change in Health	215	54.8 (23.8)	0.58 (-2.20 - 3.37)	0.028 (-0.086 - 0.142)	0.63 (0.55 - 0.71)

**Table 2. Distribution of eMSQOL-29 item scores, mean differences with paper format, effect sizes, and intraclass coefficient correlations (ICCs). Single-item subscales are in bold. CI is confidence interval, SD is standard deviation.**

	N	Mean (SD) eMSQOL-29	Mean (95% CI) difference paper - eMSQOL-29	Effect size (CI 95%)	ICC (CI 95%)
<b>Item 1 (Change in Health)</b>	<b>215</b>	<b>53.43 (24.7)</b>	<b>0.58 (-2.20 - 3.37)</b>	<b>0.03 (-0.09 - 0.14)</b>	<b>0.63 (0.55 - 0.71)</b>
Item 2	219	69.96 (35.6)	0.68 (-2.34 - 3.71)	0.03 (-0.05 - 0.11)	0.80 (0.75 - 0.84)
Item 3	219	69.10 (36.1)	0.68 (-2.20 - 3.57)	0.03 (-0.05 - 0.11)	0.82 (0.77 - 0.86)
Item 4	219	67.81 (35.9)	0.23 (-2.80 - 3.25)	0.01 (-0.07 - 0.09)	0.80 (0.75 - 0.84)
Item 5	219	78.66 (32.4)	0.00 (-2.87 - 2.87)	0.00 (-0.09 - 0.09)	0.77 (0.72 - 0.82)
Item 6	217	69.18 (37.3)	-0.69 (-3.83 - 2.44)	-0.03 (-0.11 - 0.05)	0.81 (0.76 - 0.85)
Item 7	217	84.98 (29.2)	-2.07 (-4.75 - 0.60)	-0.10 (-0.20 - -0.01)	0.77 (0.71 - 0.82)
Item 8	219	71.76 (27.4)	-0.46 (-3.06 - 2.15)	-0.02 (-0.12 - 0.07)	0.75 (0.68 - 0.80)
Item 9	219	75.54 (27.7)	0.69 (-2.12 - 3.50)	0.03 (-0.07 - 0.14)	0.70 (0.62 - 0.76)
Item 10	219	72.84 (23.7)	1.28 (-1.26 - 3.83)	0.07 (-0.04 - 0.17)	0.68 (0.60 - 0.74)
Item 11	218	59.74 (20.1)	0.35 (-2.38 - 3.07)	0.02 (-0.11 - 0.14)	0.54 (0.44 - 0.63)
Item 12	219	50.86 (22.9)	-2.64 (-4.98 - -0.30)	-0.15 (-0.25 - -0.05)	0.70 (0.63 - 0.77)
Item 13	218	58.66 (22.4)	0.00 (-2.53 - 2.53)	0.00 (-0.11 - 0.11)	0.66 (0.58 - 0.73)
Item 14	219	57.22 (22.2)	1.49 (-0.71 - 3.69)	0.09 (-0.01 - 0.19)	0.73 (0.66 - 0.79)
Item 15	219	44.72 (24.0)	2.17 (-0.49 - 4.83)	0.11 (0.00 - 0.22)	0.67 (0.59 - 0.74)
<b>Item 16 (Social Function)</b>	<b>219</b>	<b>63.25 (27.3)</b>	<b>1.94 (-1.62 - 5.50)</b>	<b>0.07 (-0.06 - 0.20)</b>	<b>0.52 (0.42 - 0.61)</b>
<b>Item 17 (Health Perceptions)</b>	<b>219</b>	<b>45.98 (29.3)</b>	<b>1.52 (-1.79 - 4.84)</b>	<b>0.06 (-0.05 - 0.18)</b>	<b>0.62 (0.54 - 0.70)</b>
Item 18	219	72.50 (23.2)	0.09 (-2.55 - 2.74)	0.01 (-0.11 - 0.12)	0.63 (0.55 - 0.71)
Item 19	219	74.57 (25.2)	0.64 (-1.89 - 3.17)	0.03 (-0.07 - 0.14)	0.70 (0.63 - 0.76)
Item 20	218	74.57 (25.4)	1.72 (-1.16 - 4.60)	0.08 (-0.04 - 0.19)	0.62 (0.54 - 0.70)
Item 21	219	64.66 (26.1)	2.40 (-0.02 - 4.82)	0.13 (0.04 - 0.23)	0.75 (0.69 - 0.81)
Item 22	219	68.58 (26.1)	0.91 (-1.84 - 3.67)	0.04 (-0.06 - 0.15)	0.67 (0.60 - 0.74)
Item 23	219	66.09 (25.1)	0.46 (-2.09 - 3.01)	0.02 (-0.08 - 0.13)	0.71 (0.64 - 0.77)
Item 24	218	76.97 (32.9)	0.76 (-2.69 - 4.22)	0.03 (-0.08 - 0.14)	0.68 (0.61 - 0.75)
Item 25	119	82.94 (26.5)	-0.30 (-3.74 - 3.13)	-0.02 (-0.14 - 0.11)	0.78 (0.71 - 0.85)
Item 26	119	82.94 (26.2)	3.33 (-0.57 - 7.24)	0.16 (0.01 - 0.31)	0.66 (0.55 - 0.76)
Item 27	119	91.60 (20.1)	0.00 (-3.19 - 3.19)	0.00 (-0.17 - 0.17)	0.64 (0.51 - 0.75)
Item 28	219	77.37 (26.0)	0.80 (-2.09 to 3.69)	0.04 (-0.08 - 0.15)	0.64 (0.56 - 0.72)
<b>Item 29 (Overall Quality of Life)</b>	<b>208</b>	<b>66.83 (17.2)</b>	<b>1.35 (-0.25 to 2.94)</b>	<b>0.11 (0.02 - 0.21)</b>	<b>0.77 (0.71 - 0.82)</b>

**Results II.** All the effect sizes were  $< 0.20$  (range 0.003–0.12). Eight of the 11 ICCs were  $\geq 0.70$ , with higher values for multi-item subscales (median ICC 0.87, range 0.84–0.95) compared to single-item subscales (median ICC 0.63, range 0.52–0.76). Effect sizes and ICCs for the individual 29 items are reported in table 2. MSQOL-29 version, order and sequence of administration did not affect the subscale scores in the linear mixed model regression analyses (table 3).

**Table 3. Results of linear regression model for repeated measures design**

Subscale	Version		Order of administration		Sequence	
	$\beta$ (SE)	P value	$\beta$ (SE)	P value	$\beta$ (SE)	P value
Physical Function	-0.01 (0.9)	0.99	0.08(0.9)	0.92	12.50 (10.6)	0.24
Bodily Pain	0.21 (1.1)	0.85	1.47 (1.1)	0.19	5.23 ( 2.9)	0.07
Emotional Wellbeing	0.98 (0.9)	0.29	-1.05 (0.9)	0.25	1.26 ( 2.4)	0.60
Energy	0.08 (0.9)	0.92	-1.69 (0.9)	0.06	1.87 ( 2.5)	0.46
Cognitive Function	1.34 (1.0)	0.17	-1.57 (1.0)	0.11	4.37 ( 2.8)	0.12
Health Distress	0.66 (1.1)	0.55	0.19 (1.1)	0.86	3.43 ( 2.6)	0.19
Sexual Function	1.70 (1.5)	0.27	-2.77 (1.5)	0.07	-0.55 ( 3.5)	0.88
Health Perceptions	1.43 (1.7)	0.39	1.73 (1.7)	0.30	-0.56 ( 3.3)	0.86
Social Function	1.81 (1.8)	0.32	0.66 (1. 8)	0.71	3.59 ( 3.1)	0.24
Overall Quality of Life	1.47 (0.8)	0.07	0.13 (0.8)	0.87	1.66 ( 2.0)	0.41
Change in Health	0.65 (1.4)	0.65	0.48 (1.4)	0.73	1.65 ( 2.7)	0.54

All estimates are adjusted for centre (Milan, Orbassano), sex, age, EDSS, and diagnosis. SE, standard error.

## Conclusions

Equivalence of the eMSQOL-29 was supported by our findings, with slightly lower (but above threshold) ICC values for the single-item subscales. Acceptability of the tool was also good

## REFERENCES

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