EQ Health and Wellbeing (EQ-HWB): Assessing the Distinctiveness of Frequency and Severity Response Scales in Measuring Pain and Discomfort

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INTRODUCTION

Pain and discomfort are important dimensions of Health-Related Quality of Life (HRQoL), and often co-occur.

The exact nature of their interrelationship and how individuals differentiate between them remains an area of active investigation.

The EQ-HWB presents a unique opportunity to examine the relative merits of frequency and severity scales in HRQoL assessment. (1)

This research may contribute to our understanding of how different aspects of pain and discomfort are captured in HRQoL instruments.

OBJECTIVES

- To examine the psychometric performance of items assessing frequency and severity of pain and discomfort to reveal the concepts and inform measure design.

- To explore how these items perform across various health conditions.

Pain — Frequency / Severity — Discomfort
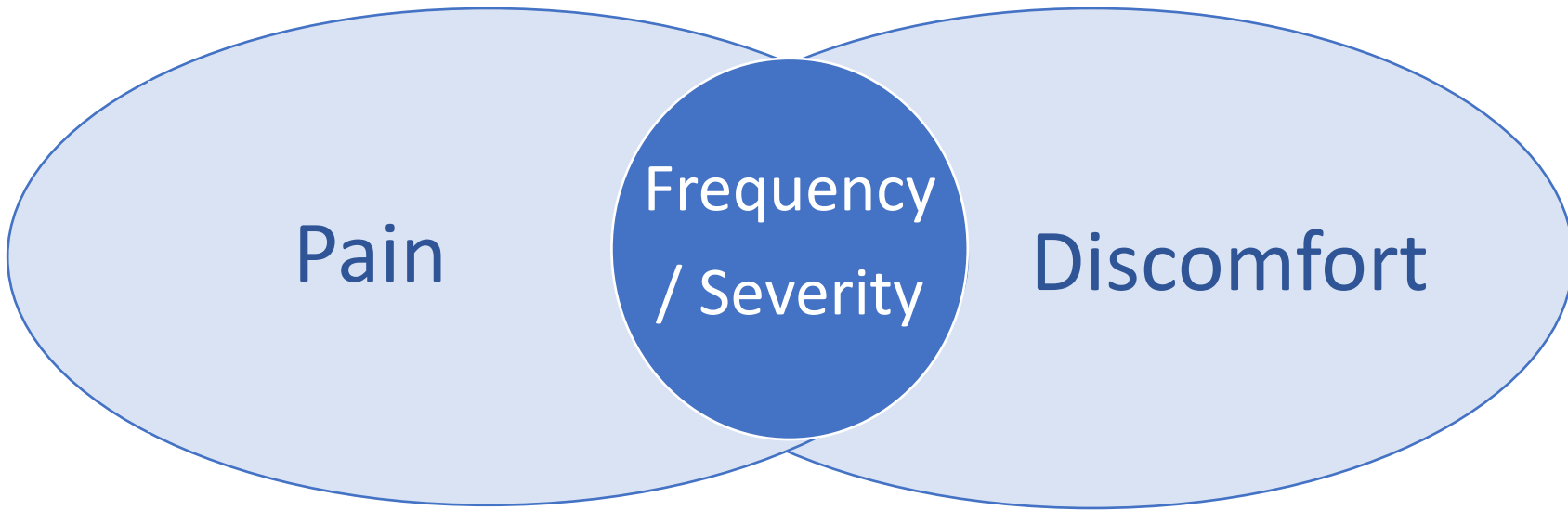
METHOD

A secondary analysis was conducted using EQ-HWB data from a cross-sectional survey of 1,008 participants administered in the US via Qualtrics between August 2022 and February 2023.

The performance of the frequency and severity response scales was assessed using
- Correlation analysis
- Shannon's indices
- Item Response Theory (IRT)
- Differential Item Functioning (DIF)
- Ordinal Logistic Regression (OLR)

RESULTS

- Among 1,008 participants, the majority were female (55%, n=557), and the largest age group was 65 years and older (39.9%, n=402).

- Strong correlations were observed among all EQ-HWB pain and discomfort items ($r_s \geq$ 0.5, $p<0.001$), with the strongest correlation between pain frequency and severity (r_s= 0.81, $p<0.001$). (table 1)

- **Shannon's indices** demonstrated higher informativity for frequency scales compared to severity scales for both pain and discomfort. (table 2)

- **IRT analysis** indicated that severity items were more discriminating (a=6.23 for pain severity), while frequency items were more suitable for differentiating at lower levels of pain or discomfort. (table 3)

- **DIF analysis** revealed a significant difference in responses between pain severity and frequency scales ($\Delta R2=0.24$, large DIF), but not for discomfort ($\Delta R2=0.001$).

- **OLR analysis:** the highest odds of reporting pain frequency was observed among individuals with immunological (OR 3.21, 95% CI: 1.97-5.24) or musculoskeletal conditions (OR 2.65, 95% CI: 1.95-3.61).

  -Neurological conditions were significantly associated with pain severity (OR 1.47, 95% CI:1.01-2.13), but not with pain frequency or discomfort severity/frequency

Table 2- Shannon's Indices - Frequency and Severity of Pain and Discomfort by Health Conditions

	Pain Frequency		Pain Severity			Discomfort Frequency		Discomfort Severity		
	H' (f)	J' (f)	H' (s)	J' (s)	f/s % difference	H' (f)	J' (f)	H' (s)	J' (s)	f/s % difference
Entire sample	**2.28**	**0.98**	**2.06**	**0.89**	**10.14%**	**2.18**	**0.94**	**2.00**	**0.86**	**8.61%**
Heart	2.19	0.94	2.04	0.88	7.09%	2.18	0.94	2.02	0.87	7.62%
Hypertension	2.23	0.96	2.03	0.88	9.39%	2.22	0.96	2.04	0.88	8.45%
Cholesterol	2.27	0.98	2.11	0.91	7.31%	2.24	0.96	2.07	0.89	7.89%
Lung	2.02	0.87	2.04	0.88	-0.99%	2.27	0.98	2.01	0.87	12.15%
Diabetes	2.23	0.96	2.06	0.89	7.93%	2.23	0.96	2.02	0.87	9.88%
Cancer	2.13	0.92	2.15	0.93	-0.93%	2.27	0.98	2.15	0.93	5.43%
Depression	2.21	0.95	2.07	0.89	6.54%	2.24	0.97	2.03	0.87	9.84%
Anxiety	2.21	0.95	2.06	0.89	7.03%	2.24	0.97	2.04	0.88	9.35%
Gastrointestinal	2.12	0.91	1.93	0.83	9.38%	2.25	0.97	1.89	0.82	17.39%
Musculoskeletal	2.08	0.89	1.89	0.81	9.57%	2.26	0.97	1.93	0.83	15.75%
Immunologic	1.80	0.78	1.99	0.86	-10.03%	2.25	0.97	1.94	0.84	14.80%
Neurologic	2.15	0.92	2.03	0.87	5.74%	2.28	0.98	1.93	0.83	16.63%

H' = Shannon's Index; J' = Pielou's Shannon's Evenness Index; f = frequency; s = severity

Table 1- Correlations Between Pain and Discomfort Items on EQ-HWB and EQ-5D-5L

Measure	EQ-HWB Pain Freq	EQ-HWB Pain Sev	EQ-HWB Discomf Freq	EQ-HWB Discomf Sev	EQ-5D Pain/Discomf
EQ-HWB Pain Freq	1				
EQ-HWB Pain Sev	0.81	1			
EQ-HWB Discomf Freq	0.65	0.62	1		
EQ-HWB Discomf Sev	0.73	0.81	0.71	1	
EQ-5D Pain/Discomf	0.74	0.76	0.58	0.71	1

Table 3- IRT - Analysis of Parameters of EQ-HWB and EQ-5D-5L Pain and Discomfort Items

	a1	d1	d2	d3	d4
EQ-HWB Pain Sev	6.227	7.003	0.623	-5.601	-10.334
EQ-HWB Pain Freq	3.863	4.614	1.272	-1.546	-4.063
EQ-HWB Discomf Sev	4.446	5.259	-0.242	-4.513	-8.401
EQ-HWB Discomf Freq	2.245	2.039	-0.191	-2.150	-4.252
EQ-5D Pain/Discomf	3.373	2.664	-0.495	-3.581	-6.571

a = difficulty parameters and d = threshold parameters

DISCUSSION POINTS

- Both scales strongly correlated and capturing overlapping constructs. This aligns with previous research. (2)
- OLR: a higher endorsement of frequency scale in most health conditions.

- DIF: respondents interpreted and responded differently to the pain frequency and severity scales, but not for discomfort.
- Shannon's indices: frequency scales may provide superior discriminatory power and descriptive efficiency in capturing pain and discomfort experiences.

CONCLUSIONS

Frequency and severity scales provide distinct information in assessing pain and discomfort. Frequency scales provide higher informativity across trait levels, while severity scales provide better discrimination at higher intensity levels.

For longer instruments, including both scales is preferable for their unique contributions. However, for shorter instruments like the EQ-HWB-S, the frequency scale may be preferred for its higher informativity and broader capture of pain experiences.

REFERENCES

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