

Can EuroQol Instruments Be Used to Study Climate Change? Validity and Responsiveness of the EQ-5D-5L, EQ-HWB and EQ-HWB-S to Measure Health and Wellbeing Impact of Heatwaves Among Older Adults

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OBJECTIVE

To assess the validity and responsiveness of EQ-5D-5L, EQ-HWB and EQ-HWB-S for measuring the health and wellbeing impact of heatwaves among older adults.

METHOD

Study population: a cohort of community-dwelling residents aged ≥60 living in Fuzhou city, China

Survey time: four time points, including before summer in May (pre-heatwave), during heatwaves in June to July ((heatwave 1) and August (heatwave 2), and after summer in October (post-heatwave), 2023

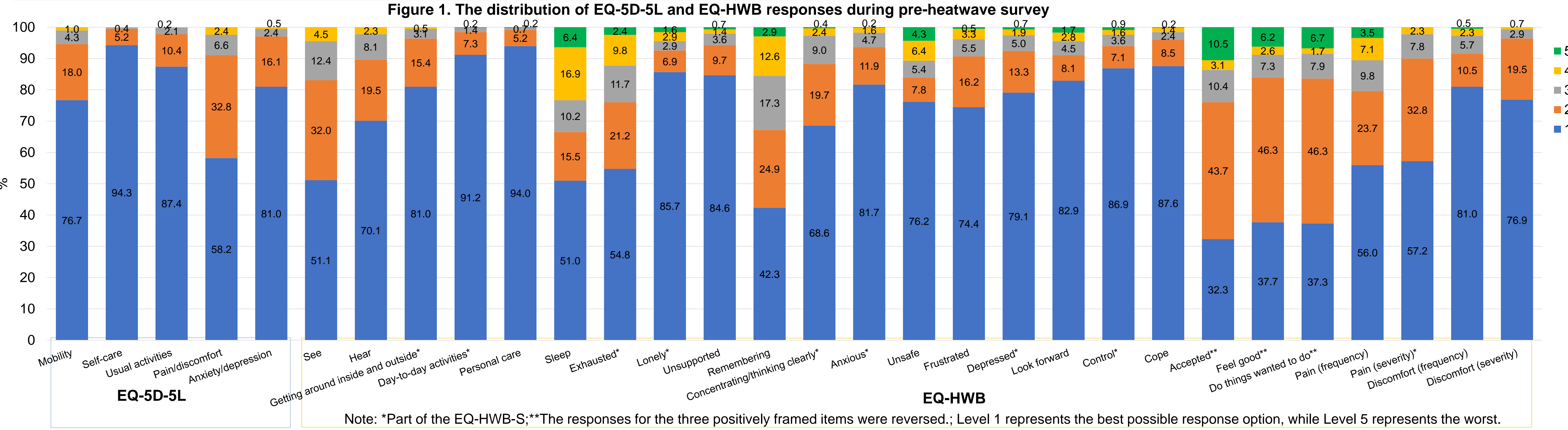
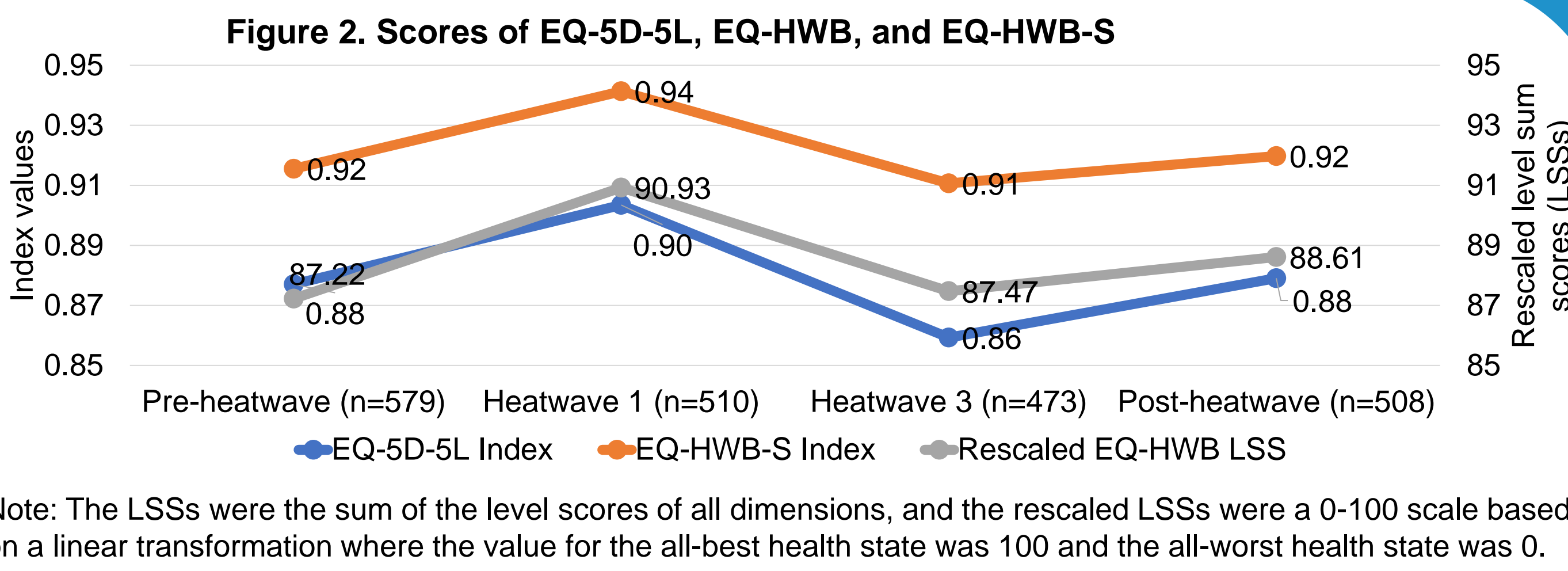
Instruments: EQ-5D-5L, EQ-HWB and self-designed questions assessing self-perceived effects of heatwaves

Data collection: one-on-one, face-to-face interviews in the community centers of participants' residences

Data analysis: response distributions, ceiling/floor, known-group validity (using Cohen's d effect sizes) and responsiveness (using standardized response mean [SRM]) of EQ-5D-5L, EQ-HWB and EQ-HWB-S (including index values and level sum scores [LSSs]).

RESULTS

- The responses of 579, 510, 473 and 508 residents were analysed in the four waves of survey, respectively.
- Ceiling:**
 - The ceiling for EQ-5D-5L items ranged from 58.2% (pain/discomfort) to 94.3% (self-care), while for EQ-HWB items, it ranged from 32.3% (accepted) to 94.0% (personal care) (Figure 1).
 - At the instrument level, both the EQ-5D-5L (47.0%) and EQ-HWB-S (27.8%) exhibited ceiling effects.
- All the scores suggested that the health and wellbeing of the cohort was the best during the heatwave 1 survey. (Figure 2)



- Known-group Validity:** The EQ-5D-5L and EQ-HWB-S index values, and EQ-HWB LSSs demonstrated discriminative ability in distinguishing between different groups based on the self-perceived impact of heatwaves, with most of the effect sizes being small (Cohen's d: 0.08-0.40 for EQ-5D-5L; 0.16-0.34 for EQ-HWB-S; 0.28-0.45 for EQ-HWB).

Table 1. Known-groups validity for EQ-5D-5L, EQ-HWB, and EQ-HWB-S based on heatwaves related symptoms and adaptation.

Excessive sweating	Heatwave 1 (n=510)							Heatwave 2 (n=473)						
	No excessive sweating (n=398)			Excessive sweating (n=112)				No excessive sweating (n=245)			Excessive sweating (n=228)			
	Mean	SD	Mean	SD	Mean difference ^a	Cohen's d	Cohen's d 95%CI	Mean	SD	Mean	SD	Mean difference ^a	Cohen's d	Cohen's d 95%CI
EQ-5D-5L Index	0.91	0.14	0.89	0.13	0.01	0.08	(-0.13, 0.29)	0.89	0.13	0.83	0.15	0.06***	0.40	(0.22, 0.58)
EQ-HWB-S Index	0.94	0.10	0.93	0.11	0.02	0.16	(-0.05, 0.37)	0.93	0.10	0.89	0.14	0.04***	0.34	(0.16, 0.53)
EQ-HWB LSS	33.53	8.65	36.00	9.57	-2.47*	-0.28	(-0.49, -0.07)	35.49	9.79	39.71	12.37	-4.22***	-0.38	(-0.56, -0.20)
Self-perceived adaptation to weather	Not adapted to weather (n=182)			Adapted to weather (n=328)				Not adapted to weather (n=169)			Adapted to weather (n=304)			
	Mean	SD	Mean	SD	Mean difference ^a	Cohen's d	Cohen's d 95%CI	Mean	SD	Mean	SD	Mean difference ^a	Cohen's d	Cohen's d 95%CI
	0.88	0.14	0.91	0.14	-0.03*	-0.21	(-0.39, -0.03)	0.83	0.14	0.87	0.14	-0.04**	-0.27	(-0.46, -0.08)
EQ-5D-5L Index	0.87	0.15	0.90	0.12	-0.02	-0.19	(-0.40, 0.02)	0.86	0.15	0.89	0.14	-0.03*	-0.21	(-0.38, -0.04)
EQ-HWB-S Index	0.92	0.12	0.93	0.11	-0.01	-0.12	(-0.34, 0.09)	0.89	0.13	0.92	0.11	-0.03**	-0.24	(-0.40, -0.09)
EQ-HWB LSS	37.67	11.19	35.85	9.71	1.83	0.20	(-0.01, 0.41)	40.12	11.19	35.70	9.41	4.42***	0.44	(0.28, 0.61)

CI, confidence interval; LSS, level sum score; SD, standard deviation;
^a Using two sample t-test. * p<0.05, ** p<0.01, *** p<0.001

- Responsiveness:** Most of the EQ scores exhibited negligible responsiveness to improvements in self-perceived effects of heat (SRM:0.08 to 0.25). Unexpectedly, all EQ scores showed improvements in health and well-being during heatwave 1 compared to pre-heatwave.

Table 2. Responsiveness for EQ-5D-5L, EQ-HWB, and EQ-HWB-S.

Worsening	Excessive sweating (n=86)							Self-perceived adaptation to weather (n=142)						
	Pre-heatwave (no excessive sweating)			Heatwave 1(excessive sweating)				Pre-heatwave (adapted to weather)			Heatwave 1 (not adapted to weather)			
	Mean	SD	Mean	SD	Mean difference ^a	SRM	SRM 95% CI	Mean	SD	Mean	SD	Mean difference ^a	SRM	SRM 95% CI
EQ-5D-5L Index	0.87	0.15	0.90	0.12	-0.02	-0.19	(-0.40, 0.02)	0.86	0.15	0.89	0.14	-0.03*	-0.21	(-0.38, -0.04)
EQ-HWB-S Index	0.92	0.12	0.93	0.11	-0.01	-0.12	(-0.34, 0.09)	0.89	0.13	0.92	0.11	-0.03**	-0.24	(-0.40, -0.09)
EQ-HWB LSS	37.67	11.19	35.85	9.71	1.83	0.20	(-0.01, 0.41)	40.12	11.19	35.70	9.41	4.42***	0.44	(0.28, 0.61)
Improvement	Excessive sweating (n=186)							Self-perceived adaptation to weather (n=150)						
	Heatwave 2 (excessive sweating)			Post-heatwave (no excessive sweating)				Heatwave 2 (not adapted to weather)			Post-heatwave (adapted to weather)			
	Mean	SD	Mean	SD	Mean difference ^a	SRM	SRM 95% CI	Mean	SD	Mean	SD	Mean difference ^a	SRM	SRM 95% CI
EQ-5D-5L Index	0.83	0.15	0.86	0.13	-0.04**	-0.25	(-0.38, -0.12)	0.84	0.14	0.86	0.15	-0.02	-0.15	(-0.33, 0.02)
EQ-HWB-S Index	0.89	0.15	0.90	0.12	-0.02	-0.14	(-0.27, 0.00)	0.89	0.14	0.90	0.13	-0.01	-0.08	(-0.24, 0.07)
EQ-HWB LSS	40.17	12.76	38.31	12.20	1.86*	0.18	(0.04, 0.32)	40.24	12.85	38.68	11.89	1.56	0.15	(-0.01, 0.31)

CI, confidence interval; LSS, level sum score; SD, standard deviation; SRM, standardized response mean (mean difference/SD of the mean difference)
^a Using paired t-test. * p<0.05, ** p<0.01, *** p<0.001

CONCLUSIONS

- The EQ-5D-5L, EQ-HWB and EQ-HWB-S demonstrated satisfactory known-groups validity but limited responsiveness in measuring the health and wellbeing impact of heatwaves among older adults.
- Further research is warranted to better understand the health and wellbeing impacts of heatwaves and other climate events on various populations, as well as to determine the most suitable outcome measures for this purpose.

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