COMPARATIVE ANALYSIS OF PUBLISHED ITALIAN UTILITY EQUATIONS: A STUDY ON SIMULATED EQ-5D DATA

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Introduction

The EuroQol five-dimensional (EQ-5D) questionnaire is a standardized measure of health which evaluates five dimensions of health and wellbeing. There exist two versions of the questionnaire: the three-level (3L) version, in which each dimension is measured by three levels of severity (1 "no problems", 2 "some problems", 3 "extreme problems"), and the five-level (5L) version, in which each dimension is measured by five levels of severity (1 "no problems", 2 "slight problems", 3 "moderate problems", 4 "severe problems", 5 "extreme problems").[1]
Since the EQ-5D is preferred instrument to measure health-related quality of live in economic evaluations by many regulatory bodies, including the English National Institute of Health and Care Excellence (NICE),[2-4] many studies have been conducted to compare differences in the utilities yielded by the two questionnaires in this setting.[2-4]
While Italian guidelines on economic evaluation don't provide indications on the use of EQ-5D, they suggest to include utilities pertaining to the Italian setting.[5,6]
In Italy there are two different published equations which can be used to obtain utility values for EQ-5D health states with country-specific tariffs, Scalone et al. (2013)[7] for the 3L version of the questionnaire and Finch et al. (2022)[8] for the 5L version. This analysis builds on previous literature and assesses the differences in the applications of these two equations, using simulated sets of EQ-5D values.

Methods

A synthetic cohort of 10,000 individuals was generated using the statistical software Stata/MP® (StataCorp LP, Texas, USA). Each individual within the cohort was assigned 3L values based on a uniform distribution across all five dimensions, which ensured to cover all 243 potential combinations of EQ-5D-3L values.

Then, the 3L values were converted into 5L values using two different methodologies:

1. The first set of 5L values – the "Van Hault set" – was obtained using the mapping function developed by Van Hault and Shaw;[9]
2. The second set of 5L values – the "corresponding values set" – was obtained by converting all 2-values from the 3L states into 3-values of the 5L states, and 3L 3-values into 5L 5-values. Using this methodology, starting for example from the 3L state "13321" we obtained the 5L state "15531".

The three resulting sets of EQ-5D values were then transformed into utilities through the respective equations (Scalone et al., for the 3L set and Finch et al., for the two 5L sets).
In line with methodologies from similar analyses in different settings, the two equations were evaluated and compared through descriptive statistics, and graphically inspected using kernel density distributions.[3,4] Furthermore, changes in utility across adjacent states (i.e., health states with only one dimension changing by a 1-unit increase at the time) were conducted for all five dimensions of EQ-5D, in order to understand how changes in severity between health states translate into changes in utility, using the two equations and three samples.[4]

Results

The main results of the analysis are presented in *Table 1* and *Figure 1*. The analysis shows that the Scalone equation yielded an average utility of 0.436 (Standard Deviation [SD]: 0.289), while the Finch equation resulted in lower averages of 0.359 (SD: 0.295) for the Van Hault set and 0.353 (SD: 0.305) for the corresponding values set. Consistently, the percentage of health states worse than death was 8.49% for the 3L set, 11.58% for the Van Hault set, and 13.05% for the latter set.

The Finch equation provided higher values for better health states, but lower values for middle and worse health states, including states valued worse than death.
When assessing utility decrements between different health states by varying one dimension at the time, the study showed that changes from no problems to some (or moderate) problems are valued more with the Scalone equation for almost all dimensions, except for anxiety/depression *(Table 2)*. On the other hand, changes from no problems to extreme problems are valued more with the Scalone equation for mobility and self-care, while they are valued more with the Finch equation for usual activities, pain/discomfort and anxiety/depression.

Finally, the biggest unit change for each dimension was from "some problems" to "extreme problems" (i.e., 21111 → 31111) for the 3L set and from "moderate problems" to "severe problems" (i.e., 31111 → 41111) for 5L sets, in line with findings from the literature.[4]

Conclusions

This study shows that in a simulated setting, the equation based on Italian-specific tariffs for EQ-5D-3L values provides higher average utilities than the equation for EQ-5D-5L values. These differences may impact the results of cost-effectiveness analyses. Further assessments may be conducted to evaluate the performance of the two equations with real-world data, taking into account the socio-demographic characteristics of the Italian population.

Table 1. ***Descriptive statistics on the three samples***

	Original 3L Set	Van Haul 5L Set	Corresponding 5L Set
Equation	Scalone et al., 2013[7]	Finch et al., 2022[8]	
Average utility (SD)	0.436 (0.289)	0.359 (0.295)	0.353 (0.305)
% of health states worse than death	8.49%	11.58%	13.05%
Evaluation of utility for selected health states			
11111	1.000	1.000	1.000
11211	0.915	0.950	0.950
12111	0.900	0.954	0.954
22222 (3L) / 33333 (5L)	0.718	0.619	0.619
33333 (3L) / 55555 (5L)	-0.380	-0.571	-0.571

Acronyms: SD = Standard Deviation; 3L = three-level; 5L = five-level

Figure 1. ***Kernel density distribution of utility values, by sample***

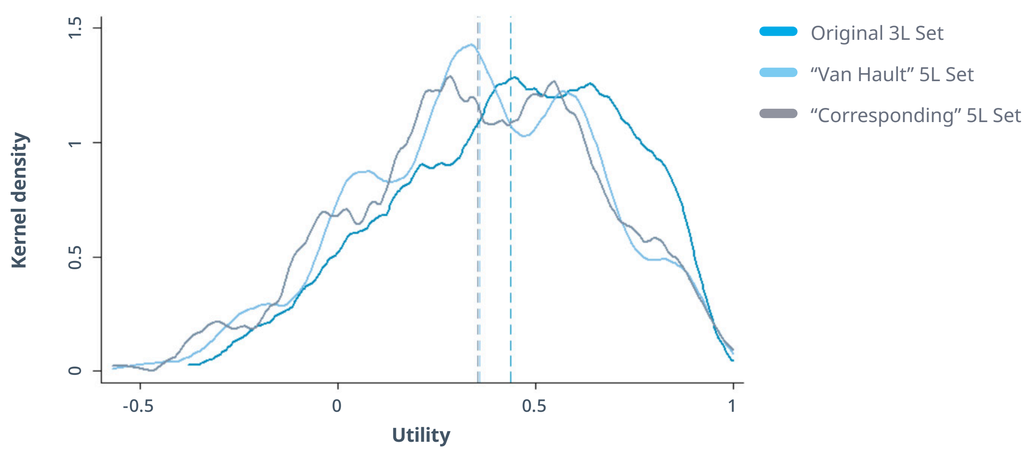

Table 2. ***Assessment of each dimension, by sample***

	3L Sample		5L Samples	
Mobility				
Decrement from no to some / moderate problems	11111 → 21111	**-7.6%**	11111 → 31111	-6.4%
Decrement from no to extreme problems	11111 → 31111	**-51.8%**	11111 → 51111	-31.9%
Biggest unit decrement	21111 → 31111	-47.8%	31111 → 41111	-19.2%
Self-care				
Decrement from no to some / moderate problems	11111 → 12111	**-10.0%**	11111 → 13111	-5.6%
Decrement from no to extreme problems	11111 → 13111	**-28.9%**	11111 → 15111	-25.7%
Biggest unit decrement	12111 → 13111	-21.0%	13111 → 14111	-17.0%
Usual activities				
Decrement from no to some / moderate problems	11111 → 11211	**-8.5%**	11111 → 11311	-6.4%
Decrement from no to extreme problems	11111 → 11311	-19.8%	11111 → 11511	**-25.5%**
Biggest unit decrement	11211 → 11311	-12.4%	11311 → 11411	-17.2%
Pain / discomfort				
Decrement from no to some / moderate problems	11111 → 11121	**-9.8%**	11111 → 11131	-8.8%
Decrement from no to extreme problems	11111 → 11131	-33.4%	11111 → 11151	**-40.8%**
Biggest unit decrement	11121 → 11131	-26.4%	11131 → 11141	-29.1%
Anxiety / depression				
Decrement from no to some / moderate problems	11111 → 11112	-9.5%	11111 → 11113	**-10.9%**
Decrement from no to extreme problems	11111 → 11113	-21.3%	11111 → 11115	**-32.2%**
Biggest unit decrement	11111 → 11113	-13.0%	11113 → 11114	-23.5%

Acronyms: 3L = three-level; 5L = five-level

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