

EQ-5D-5L Polish population norms

Dominik Golicki, Maciej Niewada

Department of Experimental and Clinical Pharmacology, Medical University of Warsaw, Warsaw, Poland

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Corresponding author:
Dominik Golicki PhD
Department of Experimental
and Clinical Pharmacology
Medical University of Warsaw
1B Banacha St
02-097 Warsaw, Poland
Phone: +48 501 078 203
Fax: +48 22 116 62 02
E-mail: dominik.golicki@gmail.com

Abstract

Introduction: The new, five-level version of the EQ-5D (EQ-5D-5L) questionnaire has better psychometric properties than the standard three-level version (EQ-5D-3L), including a reduced ceiling effect. Currently, there are few existing population norms for the EQ-5D-5L. The aims of this study were to provide population norms for the EQ-5D-5L in Poland, based on a representative sample of adults, and to compare those with norms from other countries.

Material and methods: Members of the general public, selected through multistage stratified sampling, filled in paper-and-pencil EQ-5D-5L questionnaires in the presence of an interviewer. EQ-5D-5L index values were estimated using an interim value set, based on a crosswalk methodology. Descriptive statistics were calculated for the EQ-5D-5L index. The distribution of answers was obtained for the descriptive part of the EQ-5D-5L.

Results: The sample was representative of the Polish population in terms of age, gender, geographical region, education, and socio-professional group. Population norms were developed based on 3963 questionnaires with no missing data. At least one slight, moderate, severe, and extreme health limitation was reported by 61.5%, 31.1%, 12.4%, and 1.6% of the respondents, respectively. Polish society is characterized by poorer health, as compared to its direct neighbor, Germany, especially with regard to the individuals' perception of pain, as well as anxiety and depression.

Conclusions: Polish population norms for the EQ-5D-5L should encourage clinicians, economists, and policymakers in Poland to use this questionnaire on a broader scale.

Key words: health-related quality of life, patient-reported outcomes, normative values, reference values.

Introduction

Of the many definitions of health, the most widely known is that of the World Health Organization (WHO). In 1946, the WHO defined health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” [1]. This definition was subject to controversy and considered to lack operational value [2]; that was until the development of the health-related quality of life (HRQoL) instruments. Although quality of life holds different meanings for different people, it is generally agreed that the relevant aspects thereof generally include physical, mental, and social well-being [3].

Within the existing HRQoL instruments, one can distinguish between generic and disease-specific instruments [4]. A generic instrument measures general health status, including physical symptoms, function, and

the emotional dimensions of health that are relevant to all health states, including those of healthy individuals [5]. These types of measures are useful for comparisons between diseases and interventions, but because of their broad scope, they may not be sensitive enough for use within specific populations under study. A number of generic measures have been developed and are used, including the Medical Outcomes Study Short Form-36 (SF-36) [6–8], the Short Form-12 (SF-12) [9], the EQ-5D [10], the Nottingham Health Profile (NHP) [11], and the Sickness Impact Profile (SIP) [12]. In contrast, disease-specific instruments are tailored to ask about specific aspects of health that are affected by the condition of interest, but because of their specificity, comparisons between populations with different diseases are rarely possible [4].

The EQ-5D is a widely used, standardized, preference-based measure of health that provides a simple, generic measure for clinical and economic assessment [10, 13]. A five-level version of the EQ-5D (EQ-5D-5L) was developed, so as to improve the sensitivity and other psychometric properties of the original, three-level version (EQ-5D-3L) [14, 15].

Data concerning population norms for generic questionnaires complement the traditional methods of collecting data about morbidity [16, 17]. The EQ-5D could be useful for clinicians, economists, public health specialists, and policymakers. To date, more than thirty sets of population norms for the EQ-5D-3L questionnaire have been published [16, 18–21]. In contrast, there are few EQ-5D-5L population norms. We were able to identify only three studies on this topic [22–24]. Kim *et al.* [22] confirmed the known-groups, convergent, and discriminant validity, and the reliability of the EQ-5D-5L, in a study on the general population of South Korea. In addition, they found that the ceiling effect of the five-level version was lower than that of the EQ-5D-3L, although the difference was modest. In contrast, based on a study of German society, Hinz *et al.* [23] warned that EQ-5D-5L usefulness in general population surveys may be limited, due to the skewness of results. Further evidence of the applicability of the EQ-5D-5L for measuring population health was provided by Craig *et al.* [24], in their study on the general population of the United States. They pointed out that having five levels permits the respondents to not have to “upcode” their health problems.

Existing Polish 3L normative data [21] are often used in clinical and economic analyses [25–27]; however, Poland lacks EQ-5D-5L population norms. The aim of this study was to obtain nationally representative normative data for the EQ-5D-5L questionnaire in Poland.

Material and methods

Sampling design

Sample recruitment and interviewing was carried out by a market research company (Public Opinion Research Center, CBOS). In order to obtain a representative sample, the Polish adult population was divided into 65 strata, based on geographical characteristics (i.e., the country’s administrative division (16 provinces), as well as the type and size of given localities in each province (from 3 to 9 strata in each voivodeship – most in the provinces of Silesia and Mazovia)). The pre-determined study sample was proportionally allocated into strata, so as to reflect the general population structure. Random sampling was carried out in several stages. First, towns/cities and villages were sampled. Then, small areas (one or several adjacent streets) within the previously drawn towns/cities and villages were randomly selected. Finally, a sample of eight people was drawn from each of the selected areas, based on the Polish Resident Identification Number (PESEL). These persons had to occupy different dwellings and live in separate households. The maximum estimation error for the sample was $\pm 1.55\%$, which means that if the frequency of a given category in the sample was 50%, the true value in the population lies, with 95% probability, between 48.45% and 51.55%.

Survey

Respondents were presented with a set of quality of life questionnaires, including the EQ-5D-5L, and answered general demographic questions. We used the official Polish version of the EQ-5D-5L (with slight amendments introduced by the EuroQol Group in February 2014). The EQ-5D-5L descriptive system consists of the same five dimensions as those of the EQ-5D-3L, which are as follows: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD). However, unlike the EQ-5D-3L, which has three levels of severity (i.e., no problems, some problems, and extreme problems), the EQ-5D-5L comprises five such levels (i.e., no problems, slight problems, moderate problems, severe problems, and extreme problems) [14]. Responses for all of the five dimensions can be combined to form a 5-digit number describing the respondent’s health state (from “11111”, meaning “no problems at all”, to “55555”, meaning “extreme problems” in all five dimensions). A total of 3125 possible health states are defined in this way. The EQ-5D health states may be converted into a single summary index by applying a formula that attaches values to each of the levels in each dimension. In order to calculate the EQ-5D-5L’s index values, we used an interim EQ-5D-5L value set for

Poland [28], based on a crosswalk methodology that was developed by the EuroQol Group [29] and applied to the existing Polish EQ-5D-3L's time trade-off value set [30].

Data collection

The qualified interviewers were required to try to contact each randomly selected respondent at least three times, in order to carry out an interview. No substitutes were permitted. The respondents received a paper-and-pencil version of the questionnaire to fill in on their own. Answers to questions concerning demographic characteristics were collected using the Computer Aided Personal Interviewing (CAPI) technique. Using this technique, an interviewer guided the respondent, who used the computer to answer the questions. A total of 10% of the interviews were subjected to quality control.

Analysis

We calculated the following descriptive statistics: the mean and the standard deviation, and the 25th, 50th, and 75th percentile for the EQ-5D-5L index, and the distribution of answers to the questions in the descriptive part of the EQ-5D-5L. Estimations were presented for the whole sample, as well as for the predefined age groups (18–24, 25–34, 35–44, 45–54, 55–65, 64–75, and 75+ years) in the EuroQol Group's standardized format, to facilitate comparative research [16]. The analysis was carried out using the statistical software, StatsDirect 2.7.8 (StatsDirect Ltd, England). The results were also qualitatively compared (no formal statistical analysis was performed) with existing EQ-5D-5L population norms for other countries, in terms of the prevalence of “no problems” responses in each dimension [22–24].

Results

A total of 3978 respondents from the general Polish adult population completed the EQ-5D-5L questionnaire from March to June 2014. Fifteen questionnaires (0.4%) were deficient. There were eight, six, five, four, and three missing answers for the dimensions UA, SC, AD, PD, and MQ, respectively.

The Polish population norms were ultimately estimated on the basis of 3963 questionnaires with complete answers. The sample approximated to the general adult Polish population in terms of age, gender, geographic region, education, and socio-professional group (Table I). The respondents were aged 18–87 years (mean age = 48.3 years, SD = 17.9), and there was a slight predominance of women (53.2%).

Tables II–IV depict the frequency of problems for particular EQ-5D-5L dimensions, presented

Table I. Study sample characteristics and comparison with Polish general adult population

Parameter	Sample (N = 3963)		Polish adult population* (N = 31 500 297)
	N	%	%
Gender:			
Male	1853	46.8	47.7
Female	2110	53.2	52.3
Age group [years]:			
18–24	456	11.5	10.6
25–34	617	15.6	19.4
35–44	654	16.5	17.9
45–54	612	15.4	15.1
55–64	797	20.1	17.7
65–74	525	13.2	10.2
75+	302	7.6	9.0
Region (voivodeship):			
Lower Silesian	347	8.8	7.7
Kuyavian-Pomeranian	218	5.5	5.4
Lublin	198	5.0	5.6
Lubusz	95	2.4	2.6
Lodz	275	6.9	6.7
Lesser Poland	362	9.1	8.6
Masovian	490	12.4	13.8
Opole	97	2.4	2.7
Subcarpathian	228	5.8	5.4
Podlaskie	132	3.3	3.1
Pomeranian	203	5.1	5.8
Silesian	514	13.0	12.2
Świętokrzyskie	130	3.3	3.3
Warmian-Masurian	150	3.8	3.7
Greater Poland	352	8.9	8.9
West Pomeranian	172	4.3	4.5
Place of living:			
Town	2550	64.3	60.4
Country	1413	35.7	39.6
Educational level**:			
Low	710	17.9	16.6
Medium	2286	57.7	60.5
High	967	24.4	22.9
Occupational status:			
Employed	1881	47.5	46.3
Unemployed	261	6.6	5.6
Retired	976	24.6	22.0
Student	285	7.2	6.4
Domestic	135	3.4	No data
Other	335	8.5	No data

*Central Statistical Office of Poland: Demographic Yearbook of Poland 2013 and Statistical Yearbook of Poland 2013, **Educational level: low – incomplete primary education, primary education or lower secondary education, medium – secondary education with/without final exams, high – college, higher education with engineering, bachelor, master, doctor or higher degree.

Table II. Problems in EQ-5D-5L dimensions (raw numbers, proportions) by age group: total population

Parameter	Age															Total									
	18-24			25-34			35-44			45-54			55-64			65-74			75+						
	n	%		n	%		n	%		n	%		n	%		n	%		n	%		n	%		
Total	456		617		654		612		797		525		302		3963										
Mobility																									
No problems	431	94.5	584	94.7	607	92.8	495	80.9	507	63.6	238	45.3	80	26.5	2942	74.2									
Slight problems	19	4.2	22	3.6	30	4.6	64	10.5	136	17.1	123	23.4	46	15.2	440	11.1									
Moderate problems	6	1.3	6	1.0	9	1.4	31	5.1	88	11.0	90	17.1	72	23.8	302	7.6									
Severe problems	0	0	4	0.6	8	1.2	18	3.0	60	7.5	66	12.6	99	32.8	255	6.4									
Incapacity	0	0	1	0.2	0	0	4	0.7	6	0.8	8	1.5	5	1.7	24	0.6									
Self-care																									
No problems	450	98.7	608	98.5	639	97.7	582	95.1	702	88.1	437	83.2	184	60.9	3602	90.9									
Slight problems	4	0.9	4	0.6	11	1.7	15	2.5	45	5.6	41	7.8	46	15.2	166	4.2									
Moderate problems	2	0.4	4	0.6	3	0.5	9	1.5	38	4.8	32	6.1	43	14.2	131	3.3									
Severe problems	0	0	1	0.2	1	0.2	3	0.5	12	1.5	8	1.5	26	8.6	51	1.3									
Incapacity	0	0	0	0	0	0	3	0.5	0	0	7	1.3	3	1.0	13	0.3									
Usual activities																									
No problems	440	96.5	594	96.3	614	93.9	535	87.4	610	76.5	354	67.4	128	42.4	3275	82.6									
Slight problems	13	2.9	15	2.4	30	4.6	45	7.4	118	14.8	85	16.2	61	20.2	367	9.3									
Moderate problems	3	0.7	6	1.0	9	1.4	17	2.8	45	5.6	56	10.7	73	24.2	209	5.3									
Severe problems	0	0	2	0.3	1	0.2	12	2.0	21	2.6	24	4.6	35	11.6	95	2.4									
Incapacity	0	0	0	0	0	0	3	0.5	3	0.4	6	1.1	5	1.7	17	0.4									
Pain/discomfort																									
No	356	78.1	446	72.3	394	60.2	275	44.9	266	33.4	119	22.7	37	12.3	1893	47.8									
Slight	78	17.1	136	22.0	185	28.3	208	34.0	253	31.7	173	33.0	55	18.2	1088	27.5									
Moderate	19	4.2	27	4.4	61	9.3	98	16.0	193	24.2	160	30.5	124	41.1	682	17.2									
Severe	3	0.7	7	1.1	14	2.1	27	4.4	84	10.5	68	13.0	79	26.2	282	7.1									
Extreme	0	0	1	0.2	0	0	4	0.7	1	0.1	5	1.0	7	2.3	18	0.5									
Anxiety/depression																									
No	356	78.1	446	72.3	429	65.6	356	58.2	395	49.6	230	43.8	106	35.1	2318	58.5									
Slight	82	18.0	130	21.1	180	27.5	181	29.6	247	31.0	176	33.5	88	29.1	1084	27.4									
Moderate	13	2.9	31	5.0	38	5.8	52	8.5	114	14.3	89	17.0	86	28.5	423	10.7									
Severe	4	0.9	7	1.1	5	0.8	21	3.4	36	4.5	28	5.3	21	7.0	122	3.1									
Extreme	1	0.2	3	0.5	2	0.3	2	0.3	5	0.6	2	0.4	1	0.3	16	0.4									

Table III. Problems in EQ-5D-5L dimensions (raw numbers, proportions) by age group: males

Parameter	Age														Total			
	18-24		25-34		35-44		45-54		55-64		65-74		75+		n	%	n	%
	n	%	n	%	n	%	n	%	n	%	n	%	n	%				
Total	238	311	294	94.5	282	93.4	239	81.0	241	63.6	119	52.2	32	32.0	1433	77.3	1853	
Mobility																		
No problems	226	95.0	294	94.5	282	93.4	239	81.0	241	63.6	119	52.2	32	32.0	1433	77.3		
Slight problems	9	3.8	11	3.5	11	3.6	35	11.9	56	14.8	37	16.2	14	14.0	173	9.3		
Moderate problems	3	1.3	3	1.0	3	1.0	12	4.1	37	9.8	39	17.1	22	22.0	119	6.4		
Severe problems	0	0	2	0.6	6	2.0	8	2.7	41	10.8	30	13.2	30	30.0	117	6.3		
Incapacity	0	0	1	0.3	0	0	1	0.3	4	1.1	3	1.3	2	2.0	11	0.6		
Self-care																		
No problems	236	99.2	305	98.1	295	97.7	284	96.3	327	86.3	193	84.6	60	60.0	1700	91.7		
Slight problems	2	0.8	3	1.0	6	2.0	5	1.7	22	5.8	14	6.1	13	13.0	65	3.5		
Moderate problems	0	0	2	0.6	0	0	2	0.7	24	6.3	16	7.0	15	15.0	59	3.2		
Severe problems	0	0	1	0.3	1	0.3	2	0.7	6	1.6	3	1.3	11	11.0	24	1.3		
Incapacity	0	0	0	0	0	0	2	0.7	0	0	2	0.9	1	1.0	5	0.3		
Usual activities																		
No problems	232	97.5	298	95.8	281	93.0	266	90.2	278	73.4	164	71.9	44	44.0	1563	84.3		
Slight problems	4	1.7	8	2.6	15	5.0	19	6.4	58	15.3	32	14.0	21	21.0	157	8.5		
Moderate problems	2	0.9	4	1.3	5	1.7	4	1.4	26	6.9	17	7.5	23	23.0	81	4.4		
Severe problems	0	0	1	0.3	1	0.3	4	1.4	15	4.0	13	5.7	9	9.0	43	2.3		
Incapacity	0	0	0	0	0	0	2	0.7	2	0.5	2	0.9	3	3.0	9	0.5		
Pain/discomfort																		
No	190	79.8	236	75.9	194	64.2	144	48.8	134	35.4	68	29.8	10	10.0	976	52.7		
Slight	37	15.5	59	19.0	77	25.5	98	33.2	109	28.8	73	32.0	23	23.0	476	25.7		
Moderate	9	3.8	12	3.9	26	8.6	45	15.3	91	24.0	61	26.8	46	46.0	290	15.7		
Severe	2	0.8	4	1.3	5	1.7	7	2.4	45	11.9	26	11.4	19	19.0	108	5.8		
Extreme	0	0	0	0	0	0	1	0.3	0	0	0	0	2	2.0	3	0.2		
Anxiety/depression																		
No	193	81.1	235	75.6	206	68.2	178	60.3	196	51.7	114	50	38	38.0	1160	62.6		
Slight	39	16.4	625	19.9	77	25.5	88	29.8	110	29.0	72	31.6	29	29.0	477	25.7		
Moderate	4	1.7	11	3.5	16	5.3	20	6.8	52	13.7	33	14.5	28	28.0	164	8.9		
Severe	2	0.8	2	0.6	2	0.7	9	3.1	17	4.5	9	3.9	5	5.0	46	2.5		
Extreme	0	0	1	0.3	1	0.3	0	0	4	1.1	0	0	1	1.0	6	0.3		

Table IV. Problems in EQ-5D-5L dimensions (raw numbers, proportions) by age group: females

Parameter	Age														Total	
	18-24		25-34		35-44		45-54		55-64		65-74		75+		n	%
	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
Total	218		306		352		317		418		297		202		2110	
Mobility																
No problems	205	94.0	290	94.8	325	92.3	256	80.8	266	63.6	119	40.1	48	23.8	1509	71.5
Slight problems	10	4.6	11	3.6	19	5.4	29	9.1	80	19.1	86	29.0	32	15.8	267	12.7
Moderate problems	3	1.4	3	1.0	6	1.7	19	6.0	51	12.2	51	17.2	50	24.8	183	8.7
Severe problems	0	0	2	0.7	2	0.6	10	3.2	19	4.5	36	12.1	69	34.2	138	6.5
Incapacity	0	0	0	0	0	0	3	1.0	2	0.5	5	1.7	3	1.5	13	0.6
Self-care																
No problems	214	98.2	303	99.0	344	97.7	298	94.0	375	89.7	244	82.2	124	61.4	1902	90.1
Slight problems	2	0.9	1	0.3	5	1.4	10	3.2	23	5.5	27	9.1	33	16.3	101	4.8
Moderate problems	2	0.9	2	0.7	3	0.9	7	2.2	14	3.3	16	5.4	28	13.9	72	3.4
Severe problems	0	0	0	0	0	0	1	0.3	6	1.4	5	1.7	15	7.4	27	1.3
Incapacity	0	0	0	0	0	0	1	0.3	0	0	5	1.7	2	1.0	8	0.4
Usual activities																
No problems	208	95.4	296	96.7	333	94.6	269	84.9	332	79.4	190	64.0	84	41.6	1712	81.1
Slight problems	9	4.1	7	2.3	15	4.3	26	8.2	60	14.4	53	17.8	40	19.8	210	10.0
Moderate problems	1	0.5	2	0.7	4	1.1	13	4.1	19	4.5	39	13.1	50	24.8	128	6.1
Severe problems	0	0	1	0.3	0	0	8	2.5	6	1.4	11	3.7	26	12.9	52	2.5
Incapacity	0	0	0	0	0	0	1	0.3	1	0.2	4	1.3	2	1.0	8	0.4
Pain/discomfort																
No	166	76.1	210	68.6	200	56.8	131	41.3	132	31.6	51	17.2	27	13.4	917	43.5
Slight	41	18.8	77	25.2	108	30.7	110	34.7	144	34.4	100	33.7	32	15.8	612	29.0
Moderate	10	4.6	15	4.9	35	9.9	53	16.7	102	24.4	99	33.3	78	38.6	392	18.6
Severe	1	0.5	3	1.0	9	2.6	20	6.3	39	9.3	42	14.1	60	29.7	174	8.2
Extreme	0	0	1	0.3	0	0	3	1.0	1	0.2	5	1.7	5	2.5	15	0.7
Anxiety/depression																
No	163	74.8	211	69.0	223	63.4	178	56.2	199	47.6	116	39.1	68	33.7	1158	54.9
Slight	43	19.7	68	22.2	103	29.3	93	29.3	137	32.8	104	35.0	59	29.2	607	28.8
Moderate	9	4.1	20	6.5	22	6.3	32	10.1	62	14.8	56	18.9	58	28.7	259	12.3
Severe	2	0.9	5	1.6	3	0.9	12	3.8	19	4.5	19	6.4	16	7.9	76	3.6
Extreme	1	0.5	2	0.7	1	0.3	2	0.6	1	0.2	2	0.7	1	0.5	10	0.5

according to age group for the total population, and men and women, respectively. Perfect health (the “11111” health state) was reported by 1526 (38.5%) respondents, and significantly more often by men than women (43.2% vs. 34.4%; $p < 0.0001$, Fisher’s exact test). At least one slight, moderate, severe, and extreme health limitation was reported by 61.5%, 31.1%, 12.4%, and 1.6% of the respondents, respectively. For all of the dimensions, the distribution of the answers was skewed (with a high frequency of the “no problems” answers), and the number of reported limitations increased for the subsequent age groups (18–24, 25–34, 35–44, 45–54, 55–65, 64–75, and 75+ years). The frequency of limitations was higher for the PD and AD dimensions (52.2% and 41.5%), as compared to the 25.8%, 17.4%, and 9.1% obtained for MO, UA, and SC, respectively. Women of all age groups reported limitations related to AD and PD more frequently than did men (except for the group aged > 75 years, for PD).

Similar trends were observed for the EQ-5D-5L index values (Table V). Among all age groups, except for the group aged 55–64 years, mean health state utilities were found to be higher among men than among women.

In the between-countries comparison, the South Korean population had the highest prevalence of the “no problems” answers for the majority of the EQ-5D-5L dimensions, as compared to the German, United States, and Polish populations (Figure 1). In terms of the MO, SC, and UA dimensions, Poland resembles its immediate neighbor, Germany. However, Germans reported lack of limitations in the PD and AD dimensions at a considerably higher rate (38.1% and 32.3% relatively more often, respectively), and they also reported being in “perfect health” 23.4% more often than did the Polish population.

Discussion

Based on a representative sample of the Polish population, we estimated population norms with regard to age and gender, for the descriptive part of the EQ-5D-5L questionnaire, as well as for the EQ-5D-5L index. The normative population data that have been obtained can be used as reference values.

The use of an interim value set, based on a cross-walk methodology, to estimate the EQ-5D-5L index, was a major limitation of the study [28]. It would be desirable to use a directly measured

Table V. EQ-5D-5L index values based on Polish Interim EQ-5D-5L Value Set, by age group and gender

EQ-5D-5L index value (Polish Interim EQ-5D-5L Value Set)		Age						Total	
		18–24	25–34	35–44	45–54	55–64	65–74		75+
Total	<i>N</i>	456	617	654	612	797	525	302	3963
	Mean	0.963	0.953	0.938	0.898	0.856	0.813	0.723	0.888
	Standard error	0.003	0.003	0.003	0.006	0.005	0.008	0.011	0.002
	25 th percentile	0.933	0.915	0.887	0.873	0.816	0.755	0.597	0.848
	50 th percentile	1.000	1.000	0.940	0.915	0.887	0.848	0.770	0.915
	75 th percentile	1.000	1.000	1.000	1.000	1.000	0.915	0.864	1.000
Males	<i>N</i>	238	311	302	295	379	228	100	1853
	Mean	0.967	0.958	0.942	0.910	0.851	0.837	0.740	0.900
	Standard error	0.004	0.005	0.005	0.007	0.008	0.011	0.019	0.003
	25 th percentile	0.940	0.915	0.894	0.873	0.814	0.784	0.655	0.868
	50 th percentile	1.000	1.000	1.000	0.915	0.887	0.868	0.779	0.925
	75 th percentile	1.000	1.000	1.000	1.000	1.000	0.940	0.876	1.000
Females	<i>N</i>	218	306	352	317	418	297	202	2110
	Mean	0.959	0.948	0.934	0.887	0.861	0.793	0.715	0.877
	Standard error	0.004	0.005	0.004	0.009	0.007	0.011	0.014	0.003
	25 th percentile	0.915	0.915	0.887	0.868	0.816	0.749	0.586	0.836
	50 th percentile	1.000	1.000	0.940	0.915	0.887	0.842	0.761	0.915
	75 th percentile	1.000	1.000	1.000	1.000	0.940	0.887	0.851	1.000

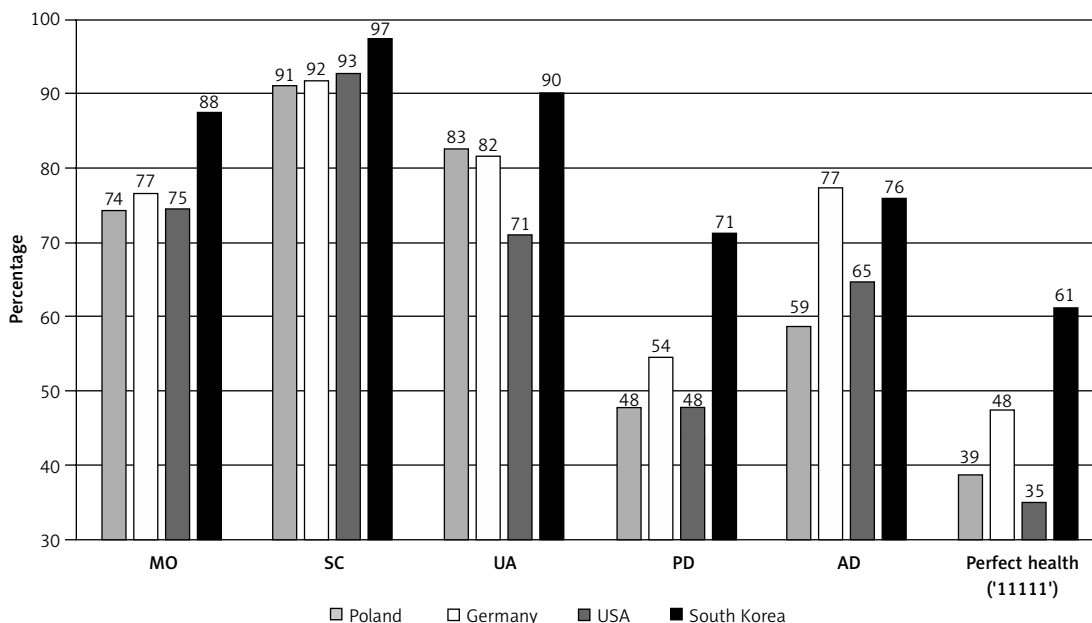


Figure 1. Prevalence of 'No problems' responses according to the EQ-5D-5L dimension and country

value set; however, work on the EuroQol Group's new official valuation protocol is still in progress [31, 32]. EQ-5D-5L index norms should be re-estimated when a directly measured Polish value set becomes available.

Some of the strengths of the present study are the sampling design, which ensures sample reliability and representativeness, and the relatively large sample size, which is the largest of all in the published studies on EQ-5D-5L population norms [22–24]. The fact that a paper-and-pencil questionnaire was used in this study is not insignificant. Although it would have been easier to conduct a telephone or online survey, in order to establish population norms (as is the case of the United States study, where adults were recruited via the Internet from an established panel [24]), we were aware of the fact that the majority of EQ-5D users in Poland choose a paper-and-pencil version of the questionnaire in their studies.

Within the Polish population, similarly to the German and South Korean studies on EQ-5D-5L, quality of life was particularly poor among elderly and female respondents [22, 23]. We have noticed that the number of reported limitations increases in successive age groups (18–24, 25–34, 35–44, 45–54, 55–65, 64–75, and 75+ years) and that the EQ-5D-5L index has an almost linear downward age trend. These findings are also common in studies based on other quality of life questionnaires, such as the EQ-5D-3L [16, 19, 21, 33–36], the SF-36 [37], and the SF-12 [38]. In our sample, women reported limitations with regard to anxiety/depression and pain/discomfort more frequently than did men. Kim *et al.* [22] found similar gender-specific differences in quality of life within

the Korean population, with the addition of the mobility dimension. Hinz *et al.* [23] identified male gender as an independent factor of better HRQoL in the German population. Some studies using the three-level EQ-5D reached similar conclusions [36, 39, 40], though others did not show gender differences [41]. In the Polish population, the highest frequency of reported problems was with regard to the pain and discomfort dimension. This finding was common in EQ-5D-5L [22–24] and EQ-5D-3L studies [16] in other populations.

Since the EQ-5D-5L is a generic questionnaire, it enables a comparison of the Polish population's state of health with that of citizens of other countries. In general, South Korean society was characterized by the best health status, according to all EQ-5D-5L dimensions, as well as the summary index [22]. This result can be partially explained by cultural and ethnic differences. Simply, Asians are more likely to report being in full health, given the same health status [42]. German, United States, and Polish citizens had similar frequency of "no problem" responses in the mobility and self-care dimensions. Americans had more limitations in performing usual activities than did Poles [24]. Polish society was characterized by poorer health than their neighbors, Germans, especially with regard to the perception of pain and discomfort, as well as anxiety and depression [23]. This finding was also confirmed in a study of Polish immigrants living in Germany [43]. Similar differences in PD and AD dimensions can be observed in population studies using the three-level EQ-5D [21, 33], with Polish society closely resembling other Central European populations, such as Slovenian [35] and Hungarian populations [34].

Estimated EQ-5D-5L norms could contribute to improvement of the overall health status of the Polish population. Population norms can be used by clinicians as reference data, for instance to enable comparisons of information about a patient with a specific condition with that of an average person of the same age and gender in the general population. Such norms can also be used by researchers to form control groups in case series or other types of uncontrolled studies [25]. Public health specialists and epidemiologists may use population norms to assess the health needs of Polish society and the burden of a given disease, and to study and explain cross-country or within-country differences in self-reported health. Pharmacoeconomists and health technology assessment (HTA) analysts could use EQ-5D-5L population norms during national adaptations of global health economic models, to ensure that they better reflect the characteristics of Polish society [26, 27]. In short, such data could be used by various stakeholders, to indirectly improve the health status of the populations [16].

Future studies in Poland should include an EQ-5D-5L valuation study based on a direct elicitation of preferences for different health states (i.e., the time trade-off method, a discrete choice experiment, or both) [31, 32, 44]. Further cross-country comparisons should be conducted as population norms for other countries become available.

In conclusion, Polish EQ-5D-5L population norms for different age and gender subgroups have been estimated, and can be used as reference values in future studies concerning health-related quality of life.

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Conflict of interest

The authors declare no conflict of interest.

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