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Health-related quality of life in adult population before and after the onset of financial crisis: the case of Athens, Greece

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Abstract

Purpose Trends of person-oriented indices with respect to the general population have not been adequately investigated. In Athens, two Health Surveys in 2003 and 2016 provide the opportunity to analyze HRQL in the general adult population. The objectives of this study were to investigate changes in HRQL of adults in the broader area of Athens between 2003 and 2016 and their association with certain socio-demographic determinants.

Methods We compared participants from pre- and during-crisis cross-sectional surveys. We used data from 982 and 1060 adult residents of Athens from 2003 and 2016 surveys, respectively. Income-related missing data were treated using three alternative methods. Subscale and summary component SF-36 scores were compared with Mann–Whitney tests and linear regression analyses were used to estimate the effect of demographic and socio-economic variables on HRQL before and after the onset of crisis.

Results The analysis was based on the results of the procedure of handling missing income data as a separate income group and showed that physical component summary score (PCS) has improved and Mental Component Summary score has deteriorated. The most important predictors of HRQL were being widowed and during the crisis not being employed. Additionally, socio-demographic characteristics explained a higher proportion of variance of HRQL after the onset of crisis, especially for PCS.

Conclusion Decline in mental and improvement in physical HRQL were observed between 2003 and 2016. HRQL has been certainly affected by the recession, but it is difficult to estimate the exact impact of the financial crisis on HRQL.

Keywords Health-related quality of life (HRQL) · Trends · Financial crisis · Greece

Introduction

Health-related quality of life (HRQL) as a person-reported outcome is a multidimensional concept gaining worldwide acceptance and encompassing physical, mental, emotional, and social functioning associated with health, illness, and treatment [1]. HRQL can be used as a measure of population or individuals' health status in order to evaluate and choose optimum health policies and interventions and to assess the performance of health systems [2], as it examines the quality-of-life consequences of health status [3]. In Greece, only one study has examined the change in HRQL over a period of 6 years during the financial crisis in the adult general population and found a statistically significant decline in both the physical and mental composite scores [4].

In Athens, the capital of Greece, where approximately 35% of the Greek population resides [5], two Health Surveys in 2003 [5] and 2016 have investigated HRQL providing the opportunity to analyze SF-36 trends of HRQL in the general adult population. During this period Greece, after joining the euro zone (2001), was in a phase of moderate growth until 2008, when the country entered a prolonged recession period, known as The Crisis. In late 2009, the disturbance in the markets and Eurozone partners, due to high budget deficits and public debt in relation to GDP, corruption, serious structural deficiencies, and deliberate misreporting of fiscal data, led to financing and credibility problems that

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were in effect in 2016 to differing degree, because the bail-out programs did not succeed in recovering the economy [6]. In order to remain in the Eurozone, Greek governments accepted three structural adjustment programs (in 2010, 2012, and 2015) from the International Monetary Fund, the European Commission, and the European Central Bank (known as the Troika) [7]. According to the commitments of these memorandums, implemented policies were mainly characterized by austerity measures, i.e., tax increases, public spending cuts and structural reforms, that led mainly to negative socio-economic and health effects and deepening social and health inequalities [8].

Under these conditions, all the basic economic and social aspects of the country have been affected. According to the conceptual frameworks describing health consequences of financial crises, through the transformation of the labor market and the austerity policies, social determinants of health have been influenced [9, 10] and many socio-economic and health indicators have deteriorated, as shown in Table 1. Specifically, only life expectancy has improved and all other selected indicators have worsened. Additionally, several adverse and positive effects have been reported, such as deterioration of mental health status [11], increase in suicides, epidemics, decrease in healthcare expenditure [12, 13], and regarding the beneficial impact, positive effects have been observed in certain health-related habits [4, 14], as well as in mortality from accidents [4] and concerning the implementation of structural reforms [15].

Given the above-mentioned health effects and since economic downturns have an impact on environmental and individual factors involved in several conceptual models of HRQL [16–18], the objectives of this study were to analyze changes in HRQL of adults (18 years old and over) in the broader area of Athens between 2003 and 2016 and to study the association of these changes with certain demographic and socio-economic determinants of HRQL. Our hypothesis was that the deterioration of socio-economic conditions during the crisis would impair HRQL in adults of Athens. To explore this issue, we investigated the following research questions:

1. Does HRQL differ between 2003 and 2016 (overall and in socio-economic and demographic subgroups)?
2. Do socio-economic and demographic determinants of HRQL differ between 2003 and 2016 surveys?

Methods

Study design, participants, and data collection

Our study is a before–after analysis of two cross-sectional surveys: before the recession (2003) and after its onset

Table 1 Socio-economic and health indicators in Greece, 2003–2016

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GDP growth (annual %)[a]	5.8	5.1	0.6	5.7	3.3	−0.3	−4.3	−5.5	−9.1	−7.3	−3.2	0.7	−0.3	−0.2
People at risk of poverty/social exclusion (%)[b]	32.9	30.9	29.4	29.3	28.3	28.1	27.6	27.7	31.0	34.6	35.7	36.0	35.7	35.6
GINI[b]	34.7	33.0	33.2	34.3	34.3	33.4	33.1	32.9	33.5	34.3	34.4	34.5	34.2	34.2
Unemployment[b]	9.7	10.6	10.0	9.0	8.4	7.8	9.6	12.7	17.9	24.5	27.5	26.5	24.9	23.6
Public health expenditure per capita (€)[c]	828.5	854.2	1006.5	1129.5	1180.4	1195.9	1387.6	1341.6	1118.9	1021.8	861.4	759.0	778.1	838.4
Private health expenditure per capita (€)[c]	513.6	548.4	624.9	643.0	727.8	853.9	637.1	601.0	574.1	513.7	513.5	528.2	535.4	524.8
Life expectancy[c]	79.3	79.4	79.7	79.9	79.7	80.3	80.4	80.7	80.8	80.7	81.4	81.5	81.1	81.5
Suicide rates per 100,000 persons[c]	3.3	3.0	3.4	3.3	2.8	3.1	3.2	3.1	3.9	4.2	4.5	4.7	4.4	–
Very good self-perceived health status (aged 16+, %)[b]	–	–	52.0	51.6	53.5	52.2	51.3	50.1	50.6	47.0	46.0	44.8	44.3	45.0
Unmet needs for medical examination due to financial/transportation problems or long waiting lists (aged 16+, %)[b]	–	–	–	–	–	5.4	5.5	5.5	7.5	8.0	9.0	10.9	12.3	13.1

– not available, *GDP* gross domestic product, *GINI* Gini index

[a]*Source* World Bank

[b]*Source* Eurostat

[c]*Source* Organization for Economic Co-operation and Development (OECD)

(2016). Both surveys involved non-institutionalized adults residing in the broader Athens area and able to understand and speak Greek language, without mental problems significant enough to interfere with the ability of reasoning, decision-making, or communicating. The subjects were collected through a three-staged sampling procedure based on the 2001 and 2011 population census to ensure the representativeness of the samples. Specifically, in the first stage, a random sample of blocks of residences was chosen; in the second stage, households were drawn from every block by systematic sampling; and in the third stage, for every household, an adult member (at least 18 years old) was selected by simple random sampling. Samples in each survey were independently selected. The respondents were recruited by specially trained professional interviewers through door-to-door contact, and face-to-face interviews were conducted in the participants' homes in order to enhance respondents' understanding and responsiveness and minimize missing values. The response rates of the surveys were 70.6% in 2003 and 69.7% in 2016. The samples involved 988 in 2003 and 1060 in 2016 subjects and were representative of the adult population of the broader Athens area in terms of gender and age (Online Supplementary Table S1).

The questionnaire in both surveys included Short Form-36 (SF-36, Greek version 1.0) and questions covering socio-demographic characteristics and other health status and health care utilization issues. It was administered via face-to-face interview in order to enhance participants' understanding and responsiveness and minimize missing values. Data were collected in May of 2003 and in April of 2016. In both surveys, voluntary participation was assured and oral informed consent was obtained. The questionnaires were anonymous and all the pieces of information were kept confidential.

Measures

Data were gathered using a socio-demographic and a HRQL questionnaire. The socio-economic and demographic characteristics were our independent variables and included data on age, gender, level of education (completed compulsory or less, upper secondary, or tertiary education), marital status (single, married, divorced, widowed), household members (1, 2, 3, 4, or more), employment status (employed, unemployed/housewives, unemployed with sources of income such as retired and rentiers, students/soldiers), and self-reported household monthly income (0–1100€, 1100–2250€, > 2250€). Specifically, to be able to compare income of 2003 with income of 2016, we converted nominal values of 2003 in real values of 2016 using the annual Harmonized Index for Consumer Prices for Greece from the Eurostat database. Regarding the income variable, subjects were asked to choose the category that matched their household monthly income and finally the income categories were grouped into the aforementioned three classes.

HRQL was the dependent variable for our analysis. It was assessed using the SF-36 questionnaire, a generic measure of perceived health status, which includes 36 items combined in eight subscales (PF: Physical Functioning, RP: Physical Role, BP: Bodily Pain, GH: General Health, VT: Vitality, SF: Social Functioning, RE: Emotional Role, and MH: Mental Health). Based on these domains, two summary scores were made: physical component summary Score (PCS-comprising the former four dimensions) and Mental Component Summary Score (MCS-comprising the latter four domains) [19–21]. The responses per domain were coded, summed, and transformed into a scale from 0 to 100, with higher scores indicating better health status.

Statistical analyses

Descriptive statistics were calculated for the socio-economic and demographic characteristics and the SF-36 eight subscale and two summary scores. The normality of the distribution of the variables was checked by the Kolmogorov–Smirnov test. Differences between two survey samples SF-36 scores were computed using *U* Mann–Whitney tests. Multiple linear regression analysis was conducted to identify socio-economic and demographic predictors of PCS and MCS in 2003 and 2016. Age and SF-36 scores were used as continuous parameters, while all others were used as categorical (nominal or ordinal) variables. Data were screened for missing values and to ensure that the assumptions of the statistical tests were met. The missing values of SF-36 scores were substituted by the average score of the other non-missing items of the subscale, when the respondent answered at least half of the items of the scale [19], otherwise if more than 50% of the items for a given subscale were missing, then we coded the scale as missing and we excluded the case from the analysis (totally 6 subjects from 2003 survey and no case from 2016). Regarding the independent variables apart from monthly household income, cases with missing data were excluded as they were few (less than 1%), while as for the income variable, we examined our data including a separate income category of participants with missing income values, as it has been suggested [22]. Additionally, alternative techniques of handling missing income data were used and the results are presented in Online Supplementary file. In the first alternative analysis, we excluded respondents with missing income information, and in the second one, we applied the multiple imputation method for the multivariate analyses, but not for the non-parametric Mann–Whitney test because it is not pooled [23]. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25. All reported *P* values are 2-tailed, with a level of 0.05 detecting significant differences.

Results

After excluding cases with missing SF-36 subscale values, we included in our analysis 982 and 1060 participants form 2003 and 2016 surveys, respectively. The demographic and socio-economic characteristics of the aforementioned samples are shown in Table 2 by survey year. The descriptive statistics reveal that the mean age was 46.7 years (SD 18.08, range 18–88) in 2003 and 47.1 years (SD 16.91, range 18–86) in 2016 and most respondents were female. Additionally, most participants had completed upper secondary education and were married. Regarding other socio-economic variables, the majority of participants were employed and lived in households with four persons or more. Finally, most respondents were in the middle-income household group, while 23% and 15% in 2003 and 2016, respectively, refused to provide income information and chose no income category because they did not know the family income or they were not sure or they considered the income question too private or sensitive. Regarding the socio-demographic characteristics, it is noteworthy that the percentage of those having completed compulsory education or less has greatly decreased and the proportion of those having attained upper secondary education and of employed participants have greatly increased. The observed improvement in educational attainment takes place in the context of the overall development of the Greek society as longitudinal trend of Eurostat data on educational attainment level shows and the increase in the percentage of employed persons is associated with a slight increase in unemployed participants and a decrease in housewives and unemployed subjects with some source of income.

Table 2 Demographic and socio-economic characteristics of the participants

Characteristics	2003 sample ($N=982$)		2016 sample ($N=1060$)	
	N	(%)	*N*	(%)
Gender				
Male	450	45.82	501	47.26
Female	532	54.18	559	52.74
Education level				
Compulsory or less	322	32.79	128	12.08
Upper secondary (Lykeion)	399	40.63	633	59.71
University	255	25.97	298	28.11
Missing	6	0.61	0	0.00
Marital status				
Single	250	25.46	297	28.01
Married	604	61.51	649	61.23
Divorced	45	4.58	48	4.53
Widowed	79	8.04	66	6.23
Missing	4	0.41	0	0.00
Household members				
1	113	11.51	169	15.94
2	216	22.00	294	27.74
3	224	22.81	231	21.79
≥4	423	43.07	366	34.53
Missing	6	0.61	0	0.00
Occupational status				
Employed	441	44.91	577	54.44
Unemployed and housewives	222	22.61	180	16.98
Unemployed with some sources of income (retired and rentiers)	237	24.13	222	20.94
Students and soldiers	82	8.35	81	7.64
Income group				
Low	267	27.19	297	28.02
Middle	351	35.74	448	42.26
High	135	13.75	159	15.00
Missing	229	23.32	156	14.72

Eight subscales and two component summary scores of SF-36 were calculated and compared between the two surveys (2003 and 2016). Kolmogorov–Smirnov normality tests showed non-normal distributions for all scale and summary scores ($P<0.001$), therefore non-parametric Mann–Whitney tests were used for comparisons. Table 3 presents descriptive statistics on SF-36 dimensions and relevant component summary scales in each survey sample. As shown in Table 3, there were statistically significant differences in most computed scores. More specifically, the participants in 2016 survey had significantly lower (median) scores in the domains of RP, VT, SF, RE, MH, and in MCS subscale than those of 2003, significantly higher scores in PF, BP, and PCS, while GH score did not change significantly.

Table 4 and Online Supplementary Table S2 show the PCS and MCS in different survey groups according to demographic and socio-economic characteristics of the samples and the results of Mann–Whitney tests when participants with missing income data constitute a separate category. Regarding PCS, overall the participants as well as both genders, single, persons having completed tertiary education, employed, students/soldiers, those living in a three or more persons household, and persons not belonging in the high-income category (low, middle, and missing income) scored significantly higher in 2016. The unemployed respondents who had other sources of income (retired and rentiers) of the latter survey reported significantly lower PCS score compared with that of the 2003 survey sample, while in other socio-demographic classes (those not having completed tertiary education, being married/divorced/widowed, living in one or two-person households, unemployed/housewives, and belonging in high-income households), there were no statistically significant differences. Additionally, MCS seems

Table 3 Descriptive statistics on SF-36 subscales and component summary scales and comparison of pre- and post-2009 scores

	2003		2016		*P* value[a]
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	
PF	79.60 (26.36)	90 (70–100)	82.19 (26.48)	100 (70–100)	**0.000**
RP	78.62 (38.62)	100 (75–100)	76.56 (38.46)	100 (50–100)	**0.039**
BP	72.40 (31.96)	84 (51–100)	79.14 (26.73)	100 (62–100)	**0.000**
GH	66.62 (23.72)	72 (52–87)	65.66 (25.85)	72 (47–87)	0.773
VT	65.96 (22.42)	70 (55–85)	61.80 (21.60)	65 (50–80)	**0.000**
SF	81.38 (28.65)	100 (75–100)	78.63 (25.65)	87.50 (62.50–100)	**0.000**
RE	81.09 (36.70)	100 (100–100)	77.67 (37.22)	100 (66.67–100)	**0.002**
MH	68.17 (21.05)	72 (56–84)	65.26 (19.03)	68 (52–80)	**0.000**
PCS	48.62 (11.15)	52.27 (43.06–56.78)	50.18 (11.29)	54.95 (43.51–58.69)	**0.000**
MCS	49.22 (11.27)	52.27 (44.35–57.01)	46.73 (9.67)	48.50 (41.05–54.04)	**0.000**

SD standard deviation, *IQR* interquartile range, *PF* physical functioning, *RP* role physical, *BP* bodily pain, *GH* general health, *VT* vitality, *SF* social functioning, *RE* role emotional, *MH* mental health, *PCS* physical component summary score, *MCS* mental component summary score

[a]Significant at the $P < 0.05$ level (two-sided Mann–Whitney *U* test)

to have deteriorated significantly in 2016 among most demographic and socio-economic groups. However, MCS showed no significant difference between the two surveys in the case of single and widowed, students and soldiers, and missing income subgroup. Similar results are observed when missing income cases are excluded (Online Supplementary Table S2). Generally, in 2016, the participants demonstrated higher scores in PCS and lower in MCS.

Multiple regression analysis was applied for PCS and MCS in 2003 and 2016 separately (Tables 5, 6, respectively). A continuous variable (age) and six categorical variables—after being converted into dummy variables—entered into the analyses as explanatory variables. No violations of the necessary assumptions were detected and the statistically significant predictors are indicated in bold (Tables 5, 6). The results indicated that regression on PCS scores of 2016 was a rather good fit, as 47.6% of the variance in PCS was explained by the model, while the models for 2003 PCS (adjusted $R^2 = 0.276$) and MCS of both surveys ($R^2_{2003} = 0.095$ and $R^2_{2016} = 0.182$) were a poor fit. However, the percentage of variation explained by the aforementioned variables increased in 2016 for both summary scores. With regard to the PCS score (Table 5), in 2003 age, female gender, low and middle household income, being widowed, and having completed the compulsory or less educational level had statistically significant negative impact. In 2016, age, female gender, middle educational level, widowhood, and not being employed were found to have a statistically significant adverse influence on PCS score. As for the MCS score (Table 6), in 2003, age, female gender, low educational level, i.e., compulsory or less, and being single or widowed had a statistically significant negative impact. In 2016, age, being unemployed or housewife or retired or rentier and belonging to the low- or middle-income category seemed to influence MCS adversely, while being single was shown to have a positive effect.

In alternative analyses (Online Supplementary Table S3) when we excluded cases with missing income data, minor differences were observed; whereas when multiple imputation technique was used, the models became more complicated and explained a slightly higher proportion of PCS and MCS variance.

In summary, before and during crisis, the studied demographic and socio-economic explanatory variables demonstrated different predictive capacity. In 2016, not being working (58% of the sample)—even when there was some source of income, such as in retired participants—was the most prominent predictor for both summary scores. Additionally, being widowed showed significant predictive capacity in both surveys for PCS and in 2003 MCS regression models. In general, socio-demographic characteristics explain a higher proportion of variance for PCS than in MCS in both years and their predictive capability was greater in 2016.

Discussion

HRQL, demographic, and socio-economic data from two different health surveys with similar survey methods, sampling frames, and response rates were compared. To our knowledge, this is the first study in Greece comparing HRQL and its predictors before and after the onset of crisis. Our findings (1) suggest improvement of physical and deterioration of mental HRQL and (2) confirm the higher predictive value of the socio-demographic determinants during the recession. A possible explanation for the increase in physical dimension of HRQL might be that in developed countries the financial crisis can determine procyclical impact on

Table 4 PCS and MCS in demographic and socio-economic groups by year of survey and comparison of pre- and post-2009 PCS and MCS

	PCS			MCS		
	2003	2016	*P* value[a]	2003	2016	*P* value[a]
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Total	48.62 (11.15)	50.18 (11.29)	**0.000**	49.22 (11.27)	46.73 (9.67)	**0.000**
Gender						
Male	50.50 (10.15)	51.80 (10.42)	**0.000**	51.60 (9.82)	47.66 (9.02)	**0.000**
Female	47.03 (11.70)	48.72 (11.83)	**0.000**	47.20 (12.00)	45.90 (10.16)	**0.001**
Education level						
Compulsory or less	44.02 (13.02)	42.38 (13.56)	0.281	45.74 (12.68)	41.83 (10.73)	**0.000**
Upper secondary (Lykeion)	50.83 (9.09)	49.89 (11.13)	0.331	50.09 (10.58)	47.06 (9.36)	**0.000**
University	50.95 (9.56)	54.17 (8.30)	**0.000**	52.23 (9.10)	48.16 (9.22)	**0.000**
Marital status						
Single	53.40 (8.30)	57.05 (5.45)	**0.000**	50.75 (10.05)	51.61 (7.41)	0.593
Married	48.14 (10.46)	48.64 (11.08)	0.052	49.60 (11.00)	45.45 (9.42)	**0.000**
Divorced	49.11 (10.44)	49.32 (10.82)	0.702	49.00 (12.40)	43.75 (11.19)	**0.008**
Widowed	36.61 (14.57)	35.04 (12.64)	0.507	41.78 (13.30)	39.61 (10.82)	0.256
Household members						
1	44.65 (13.83)	46.87 (13.81)	0.054	47.91 (12.16)	45.63 (10.79)	**0.020**
2	45.98 (12.69)	45.01 (12.80)	0.573	48.88 (10.73)	44.18 (10.03)	**0.000**
3	48.59 (10.20)	53.06 (8.33)	**0.000**	50.28 (11.34)	48.56 (8.98)	**0.001**
≥ 4	51.06 (9.18)	54.04 (7.74)	**0.000**	49.32 (11.16)	48.14 (8.75)	**0.000**
Occupational status						
Employed	52.36 (8.25)	54.14 (7.50)	**0.000**	50.93 (9.99)	48.62 (8.27)	**0.000**
Unemployed and housewives	47.53 (11.29)	47.60 (12.74)	0.328	46.96 (12.40)	44.54 (10.93)	**0.005**
Unemployed, but having sources of income (retired and rentiers)	41.92 (12.58)	39.03 (11.61)	**0.003**	47.74 (12.06)	41.41 (10.30)	**0.000**
Students and soldiers	55.12 (4.81)	58.23 (2.72)	**0.000**	51.67 (9.54)	52.73 (5.89)	0.563
Income group						
Low	43.97 (13.21)	45.93 (13.22)	**0.023**	46.25 (12.45)	44.55 (10.13)	**0.004**
Middle	49.59 (10.17)	51.23 (10.18)	**0.000**	50.69 (10.64)	46.43 (9.55)	**0.000**
High	52.04 (7.80)	52.73 (8.42)	0.150	50.42 (10.35)	48.90 (8.45)	**0.013**
Missing	50.53 (9.95)	52.63 (10.74)	**0.000**	49.70 (10.66)	49.53 (9.25)	0.445

[a]Significant at the $P < 0.05$ level (two-sided Mann–Whitney *U* test)

health via the inhibition of harmful health-related habits or other behaviors [24, 25]. However, the mental dimension decline could be attributed to the negative effect of the worsening socio-economic conditions [26] through countercyclical mechanisms, such as stress, aggression, and restricted budget [25] that lead individuals to unhealthy behaviors, psychological distress, and ineffective coping strategies. Regarding the socio-economic factors and considering the conceptual frameworks of HRQL, they affect individual characteristics (education, income, employment, and marital status) and environmental characteristics (socio-economic and psychological support networks) [16, 17]. In our study, individual characteristics have been included, while support networking could not be studied as no measure of support was available. Future research on this topic should take such variables into account and investigate long-term trends in order to better understand the determinants of HRQL and the health consequences of economic cycles. In recent years, trends in HRQL have been examined mainly in the context of studies investigating the impact of the financial crisis on health, and worsening mental health has been associated with economic recession in many surveys [27]. The period 2003–2016 in Greece has been marked by the financial crisis and its consequences, and social dimension of well-being and health generally—through the interaction with other dimensions—has been certainly affected by recession and implemented policies.

HRQL and its determinants

Regarding mental HRQL, our results are in line with those of most studies, which over these years (2003–2016) have

Table 5 Multiple regression analyses for PCS in 2003 and 2016, when missing income cases are a separate income group

	PCS							
	2003				2016			
	B[a]	SE_B[b]	β[c]	P[d]	B[a]	SE_B[b]	β[c]	P[d]
Constant	**63.768**	**2.283**		**0.000**	**69.223**	**2.040**		**0.000**
Age	**−0.227**	**0.033**	**−0.368**	**0.000**	**−0.326**	**0.028**	**−0.488**	**0.000**
Gender								
Male	0.000*				0.000*			
Female	**−2.342**	**0.698**	**−0.105**	**0.001**	**−1.725**	**0.544**	**−0.076**	**0.002**
Education level								
Compulsory or less	**−1.867**	**0.920**	**−0.079**	**0.043**	−0.358	0.999	−0.010	0.720
Upper secondary (Lykeion)	−0.650	0.804	−0.029	0.419	**−1.702**	**0.636**	**−0.074**	**0.008**
University	0.000*				0.000*			
Marital status								
Single	−0.635	1.017	−0.025	0.533	0.750	0.889	0.030	0.400
Married	0.000*				0.000*			
Divorced	1.744	1.548	0.033	0.260	1.537	1.328	0.028	0.248
Widowed	**−3.362**	**1.414**	**−0.083**	**0.018**	**−3.900**	**1.392**	**−0.084**	**0.005**
Household members								
1	0.000*				0.000*			
2	0.389	1.190	0.015	0.744	−0.595	1.044	−0.024	0.569
3	−0.014	1.277	−0.001	0.991	0.615	1.139	0.022	0.589
≥ 4	1.592	1.244	0.071	0.201	1.397	1.110	0.059	0.208
Occupational status								
Employed	0.000*				0.000*			
Unemployed and housewives	−1.273	0.924	−0.048	0.168	**−3.378**	**0.774**	**−0.112**	**0.000**
Unemployed, having sources of income (retired and rentiers)	−1.376	1.117	−0.055	0.218	**−4.349**	**0.923**	**−0.157**	**0.000**
Students and soldiers	−0.563	1.366	−0.013	0.680	**−2.958**	**1.195**	**−0.070**	**0.014**
Income groups								
Low	**−3.647**	**1.125**	**−0.146**	**0.001**	−1.358	0.980	−0.054	0.166
Middle	**−1.985**	**1.001**	**−0.086**	**0.048**	−0.265	0.783	−0.012	0.735
High	0.000*				0.000*			
Missing	−1.682	1.068	−0.064	0.116	−0.045	0.938	−0.001	0.961
R^2	**0.288**				**0.484**			
Adjusted R^2	**0.276**				**0.476**			

*Denotes reference category

[a]Unstandardized beta

[b]Standard error of beta

[c]Standardized beta

[d]*P* value; bold entries are significant at the $P < 0.05$ level

found deterioration in mental health status and have attributed it to the recession-related conditions and measures. Specifically, studies comparing MCS derived from SF-12 questionnaire, in Greece between 2008 and 2015 [4] and in Italy between 2005 and 2013 [19], found significant deterioration in MCS score. On the other hand, there are contradictory findings about PCS, as some studies confirm positive [28] and other negative [4] trends in the context of the financial crisis. Another study about trends in HRQL using SF-36 and covering 1995–2016 in France, found a substantial decline in almost all subscales of SF-36 with the largest decrease being in the mental health dimension [29].

Investigation on determinants of HRQL confirm the present association of lower HRQL scores with increasing unemployment rates due to economic downturns, implying that job and income loss and the consequential economic distress have a detrimental effect on physical and mental health [30]. Additionally, Milner et al. showed

Table 6 Multiple regression analyses for MCS in 2003 and 2016, when missing income cases are a separate income group

	MCS							
	2003				2016			
	B^a	SE_B^b	β^c	P^d	B^a	SE_B^b	β^c	P^d
Constant	**60.958**	**2.583**		**0.000**	**53.757**	**2.185**		**0.000**
Age	**−0.121**	**0.037**	**−0.194**	**0.001**	**−0.114**	**0.030**	**−0.198**	**0.000**
Gender								
Male	0.000*				0.000*			
Female	**−3.101**	**0.789**	**−0.138**	**0.000**	−0.745	0.582	−0.038	0.201
Education level								
Compulsory or less	**−3.717**	**1.041**	**−0.155**	**0.000**	−0.186	1.070	−0.006	0.862
Upper secondary (Lykeion)	−1.786	0.910	−0.078	0.050	0.601	0.681	0.030	0.378
University	0.000*				0.000*			
Marital status								
Single	**−2.794**	**1.151**	**−0.109**	**0.015**	**3.179**	**0.953**	**0.148**	**0.001**
Married	0.000*				0.000*			
Divorced	−1.740	1.751	−0.032	0.321	−1.475	1.423	−0.032	0.300
Widowed	**−4.880**	**1.600**	**−0.119**	**0.002**	−1.265	1.491	−0.032	0.397
Household members								
1	0.000*				0.000*			
2	−0.759	1.347	−0.028	0.573	0.237	1.118	0.011	0.832
3	−1.626	1.445	−0.061	0.261	0.807	1.220	0.034	0.508
≥ 4	−2.389	1.407	−0.105	0.090	−0.120	1.189	−0.006	0.920
Occupational status								
Employed	0.000*				0.000*			
Unemployed and housewives	−0.330	1.045	−0.012	0.752	**−2.675**	**0.830**	**−0.104**	**0.001**
Unemployed, having sources of income (retired and rentiers)	2.224	1.264	0.089	0.079	**−2.819**	**0.989**	**−0.119**	**0.004**
Students and soldiers	1.418	1.546	0.034	0.359	−1.290	1.281	−0.035	0.314
Income groups								
Low	−1.752	1.273	−0.070	0.169	**−2.171**	**1.050**	**−0.101**	**0.039**
Middle	0.625	1.133	0.027	0.581	**−2.022**	**0.838**	**−0.103**	**0.016**
High	0.000*				0.000*			
Missing	−0.068	1.209	−0.003	0.955	0.284	1.004	0.010	0.778
R^2	**0.110**				**0.195**			
Adjusted R^2	**0.095**				**0.182**			

*Denotes reference category

[a]Unstandardized beta

[b]Standard error of beta

[c]Standardized beta

[d]P value; bold entries are significant at the $P < 0.05$ level

that multiple spells of unemployment are associated with declines in the mental HRQL [31] and Molarious et al. [32] investigating the relationship between HRQL and socio-economic conditions provided evidence that worse mental health is related with unemployment, economic hardship, and female gender, while the educational level was not statistically significant for mental HRQL. Our results confirm the role of the above-mentioned determinants, but in 2016 the negative impact of the female gender was not detected. Moreover, belonging to the missing income group was not a significant predictor for HRQL using as a reference group the high-income class, probably because those who did not answer the income question had similar income to that of the reference category. Finally, our finding about the protective effect of employment does not support that of a French study that connects employment with negative and worsening trends in HRQL between 1995 and 2016 [29].

Other health outcomes

In accordance with the present results, more studies have investigated the self-rated health and other health outcomes and have found that mental health has deteriorated. Specifically, Drydakis showed that unemployed faced more impaired mental health and poorer self-rated health than employed and this difference was smaller at the beginning of the recession and was widening as the crisis was deepening [33]. Other studies in Greece showed that the prevalence of good and very good self-rated health decreased after the onset of crisis [34] or that the prevalence of poor self-rated health increased [35, 36] supporting the adverse trends. In line with these findings, data from Italy suggest that health inequalities between permanent workers and temporary workers, first job seekers and unemployed individuals widen during crisis confirming its negative impact [37] and the declining trend of the present study. Japan also underwent a prolonged economic recession in the 1990s and self-rated health appeared to improve in absolute terms throughout this period. However, occupational class-based inequalities in poor health widened [38].

Contrary to the evidence that supports adverse trends in health due to crisis, certain studies in Spain, confirming the procyclical mechanism, suggest that specific health indicators have improved during the first years of the crisis. For example, premature mortality from several causes, except from cancer and prevalence of poor self-rated health continued to fall during financial crisis at a rate equal or higher than in pre-crisis period [39]. The procyclical effect is also observed in other studies in Spain, which found better self-rated health, diagnosed morbidity, and mental health for young people in 2012 than in 2006 [40] and that the probability of good self-rated health increased in 2012 versus 2001 [26]. An improvement in HRQL and certain health-related habits was also observed in children in Catalonia after the onset of crisis, although children with a maternal primary education and unemployed families showed poorer HRQL scores [41]. Thus, our finding of improvement in physical health is in accordance with the above positive results and supports the hypothesis of the positive effects of crisis on health, at least in the short run [28, 30].

Strengths and limitations

The strengths of our study are the multistage sampling procedure, the large representative samples, the use of a well-validated scale for detection of HRQL and that it is composed of generally comparable surveys across two time points, before and after the onset of the recession. Furthermore, the face-to-face interviews decrease non-response sample bias [42, 43]; the study provides evidence about the trends in HRQL and the long-term impact of financial crisis on HRQL; and participants with missing income information were included in the analysis; therefore, the potential bias of excluding participants with missing income—that could lead us to underestimate the proportion of subjects in more vulnerable (not high income) groups—was limited [22]. Our study has also some limitations. The analysis was restricted to an urban adult population, so the results should not be generalized to other populations. As our design includes a 13-year gap—6 years before and 6 years after the start of the financial crisis—between the two surveys, no causal inference can be drawn and the generalizability of the findings may be considerably limited by the uniqueness of this case with respect to the specific timeframe. Moreover, the unanticipated increase in the percentage of adult employed persons should be considered with caution as it differs from European Union employment rates and because it refers to the total adult sample and not to the total labor force and no adjustment for seasonal variation was applied. Additionally, reported monthly household income was susceptible to recall bias or to reluctance on the part of respondents to disclose such sensitive information; consequently, the proportion of missing income data was high; the missing income group was included without examining how they differed from other income groups with respect to other socio-demographic characteristics [22]. Some more limitations were that it was not possible to treat income variable as a continuous one, because it was measured in grouped form in both surveys, and that we used self-reported household income instead of widely used equivalized disposable income, which is a better indicator for comparisons but it could not be calculated. Finally, the results should be interpreted with caution as other variables, independent of socio-economic conditions, such as utilization of health care services, health habits, and chronic conditions, may be involved in the HRQL [44].

Conclusions

Contrary to our initial hypothesis, physical HRQL improved and only mental HRQL declined in 2016 in the adult general population residing in the broader area of Athens. Additionally, socio-economic factors seemed to be more important under recession conditions and not being employed was the main negative socio-economic determinant of the physical and mental HRQL in 2016. Our findings are certainly influenced by the financial crisis, but it is difficult to estimate the exact impact of the 2009 economic crisis on HRQL. These results deserve special attention from public health researchers and public health and social policymakers who should focus on the social support mechanisms, as they are directly affected by the financial constraints and affect all the aspects of HRQL.

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Compliance with ethical standards

Conflict of interest The authors declare that no competing interests exist.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No physical samples were collected as part of this study. The 2003 study protocol was approved by the Review Board of the Hellenic Open University and the 2016 study protocol by the Ethics Committee of the 1st Regional Health Authority of Attica.

Informed consent Informed consent was obtained from all individual participants included in the study.

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