



Five-Year Changes in Health-Related Quality of Life and Related Factors Among Iranian Adults: Evidence from a Population-Based Cohort

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Abstract

Background: Health-related quality of life (HRQoL) reflects individuals' perceptions of their health and daily functioning and has become a widely used outcome measure in population health research.

Objectives: This study investigated factors associated with changes in HRQoL between baseline assessment and the 5-year follow-up in an adult cohort.

Methods: A population-based cohort study was conducted among 106 adults in Shiraz, Iran, who completed HRQoL assessments at baseline in 2019 and at the five-year follow-up in 2024. Participants were recruited using multistage cluster sampling. Data on HRQoL and demographic, socioeconomic, behavioral, and clinical characteristics were collected using the Persian version of the 36-Item Short Form Health Survey (SF-36) questionnaire, physical examinations, laboratory measurements, and self-reported information. Changes in HRQoL were calculated, and factors associated with these changes were examined using multivariable linear regression models.

Results: Among the 106 participants included in the analysis, 59 were female. At baseline, participants had a mean age of 48.4 ± 12.1 years. Comparisons between baseline and follow-up assessments indicated that total HRQoL remained largely unchanged, and the observed increase in mean Mental Component Summary (MCS) was not statistically significant. In regression analyses, older age was associated with greater improvement in MCS ($\beta = 0.48$, $P = 0.006$). Compared with participants who remained married, those who remained single experienced greater declines in total HRQoL ($\beta = -16.04$, $P = 0.01$) and MCS ($\beta = -15.88$, $P = 0.02$). Supplementary insurance status was associated with changes in HRQoL. Compared with participants who remained insured, those who gained supplementary insurance had greater changes in total HRQoL, MCS, and the Physical Component Summary (PCS) ($\beta = 17.55$, $P < 0.001$; $\beta = 14.27$, $P = 0.003$; and $\beta = 21.02$, $P < 0.001$, respectively). Participants who remained uninsured also showed greater changes in MCS ($\beta = 12.41$, $P = 0.01$). Self-rated health status was also associated with changes in HRQoL, with better ratings corresponding to improvements in both total HRQoL ($\beta = -3.59$, $P = 0.01$) and MCS ($\beta = -4.23$, $P = 0.005$).

Conclusions: Over the five-year follow-up period, overall HRQoL remained relatively stable. Although the mean MCS increased slightly, this change was not statistically significant. Age, marital status, supplementary insurance status, and self-rated health were associated with changes in HRQoL. To confirm these findings and improve understanding of the factors influencing changes in HRQoL over time, further long-term studies with larger and more diverse populations are warranted.

Keywords: Quality of Life, Cohort, Marital Status, Supplementary Insurance, Self-rated Health, SF-36, Iran

1. Background

Health-related quality of life (HRQoL) is a multidimensional concept that reflects how an individual's physical and mental health influences daily functioning, well-being, and overall quality of life (1). It is widely recognized as a holistic indicator that captures multiple dimensions of health beyond traditional clinical outcomes (2). In addition to reflecting individuals' health perceptions, HRQoL provides valuable information for

policymakers and health organizations to inform legislation, develop community health strategies, and support the implementation of health programs (1).

A wide range of demographic, socioeconomic, behavioral, and clinical characteristics has been linked to HRQoL. Evidence from different populations suggests the presence of sex-related differences, with women often reporting less favorable HRQoL than men (3-6). However, the relationship between age and HRQoL remains less clear. Although several investigations have observed better

Mental Component Summary (MCS) scores among older adults (7), findings from an Iranian population-based study indicated a decline in mental well-being with increasing age (4). HRQoL has also been linked to marital status, with individuals living with a partner typically reporting better quality-of-life outcomes than unmarried individuals (8).

Individual lifestyle choices can play an important role in shaping HRQoL. Evidence indicates that smoking and alcohol use are associated not only with negative health effects but also with less favorable quality-of-life outcomes (9, 10). Furthermore, chronic diseases can negatively affect HRQoL through both physical limitations and psychological distress related to long-term disease management (11).

Access to healthcare services may influence HRQoL, in addition to clinical, behavioral, and demographic factors. Existing evidence remains inconsistent regarding the association between HRQoL and health insurance status. While some research has reported a positive correlation between higher HRQoL and insurance coverage (12, 13), other studies have yielded conflicting findings. For example, a study conducted in Bangladesh with 1,292 participants found that individuals with health insurance had poorer HRQoL than those without insurance. Adverse selection, which increases the likelihood of obtaining insurance coverage among people with underlying medical issues, could account for this outcome (14).

Prior studies on HRQoL in Iran have mostly focused on individuals with specific physical or mental health conditions (10, 15-19). By contrast, fewer studies have examined HRQoL in the general population (5, 10, 20, 21), and longitudinal data remain scarce. Because the determinants of HRQoL may differ across sociocultural and healthcare system contexts, region-specific longitudinal evidence is needed. Evidence regarding longitudinal changes in HRQoL among adults in Shiraz is limited. Understanding the factors associated with HRQoL is crucial for designing targeted interventions and informing public health strategies aimed at improving population well-being in this setting.

2. Objectives

This population-based cohort study evaluated changes in HRQoL from baseline to the five-year follow-up and assessed the contribution of demographic, socioeconomic, behavioral, and clinical characteristics to these changes.

3. Methods

3.1. Study Design and Participants

This study was part of a larger population-based prospective cohort study. Participants in this HRQoL sub-study were adults living in Shiraz, the capital of Fars Province in southern Iran. Baseline data were collected in 2019, and participants were followed up five years later, in 2024.

A multistage cluster sampling approach was used based on postal code data from the seven municipal districts of Shiraz. Eligible participants were adults aged 18 years or older with Iranian nationality. Pregnant women were excluded.

Invitation letters describing the study and its ethical aspects were sent to selected households. Trained study coordinators subsequently contacted each household by telephone and invited one eligible adult who agreed to participate. In the parent cohort, 569 participants completed the baseline assessment in 2019, and 313 returned for the five-year follow-up assessment in 2024. The HRQoL questionnaire was completed by 217 participants at baseline. Of these, 106 also completed it at the five-year follow-up and were included in the longitudinal analysis. The remaining 111 participants did not complete the follow-up HRQoL assessment and were considered lost to follow-up.

3.2. Data Collection and Measures

Data were collected at Motahari Clinic, which is affiliated with Shiraz University of Medical Sciences. Participants were asked to bring any available medical records to their assessment visits. A trained general practitioner administered the Persian version of the 36-Item Short Form Health Survey (SF-36) during face-to-face interviews conducted in a private setting. The validity and reliability of the Persian SF-36 have been reported previously (22). Health-related quality of life (HRQoL) was assessed using the validated Persian version of the SF-36. The questionnaire consists of 36 items covering eight domains: physical functioning (PF), role limitations due to physical health (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH), along with one item assessing self-rated health. Component analyses indicate that the SF-36 captures two distinct dimensions of health-related quality of life: a physical dimension represented by the Physical Component Summary (PCS) and a mental dimension represented by the Mental Component Summary (MCS). In addition, a total HRQoL score can be calculated to reflect the general level of health-related quality of life. PCS was derived from the physical health-related domains, including PF, RP, BP, and GH. MCS was derived from the mental health-related domains, including VT, SF, RE, and MH. PCS, MCS, and total

HRQoL scores were calculated using an Excel-based scoring tool according to the standard SF-36 scoring procedure. The accuracy of the scoring procedure was verified by manually calculating scores for a subset of questionnaires and confirming consistency with the Excel-generated results. All domain, component, and overall scores were transformed to a 0-100 scale, with higher scores indicating better HRQoL. Self-rated health was measured on a five-point scale ranging from 1 (excellent) to 5 (poor), with lower scores indicating better perceived health. Throughout this manuscript, the terms physical HRQoL and mental HRQoL refer to the PCS and MCS scores, respectively.

Anthropometric and clinical measurements were obtained using standardized procedures. Body weight and height were measured with participants wearing light clothing and no shoes. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared.

Laboratory and clinical measurements were used to assess metabolic syndrome. Fasting blood glucose, lipid profile components, blood pressure, and waist circumference were recorded, and participants were classified according to the Adult Treatment Panel III (ATP III) and International Diabetes Federation (IDF) definitions of metabolic syndrome.

Medical history, including psychological, endocrine, renal, and gastrointestinal disorders, was obtained through self-report and, whenever possible, from available medical records.

3.3. Statistical Analysis

Before analysis, data distribution was assessed using graphical (Q-Q plots) and statistical (Shapiro-Wilk test) methods. Continuous variables were summarized as mean $\pm$ standard deviation (SD), and categorical variables were presented as frequencies and percentages.

Changes in total HRQoL, Physical Component Summary (PCS), Mental Component Summary (MCS), and each SF-36 domain were calculated by subtracting the baseline score from the corresponding follow-up score (follow-up minus baseline). Positive change scores indicated improvements in HRQoL over the five-year follow-up, whereas negative scores indicated deterioration. In contrast, self-rated health was scored from 1 (excellent) to 5 (poor); therefore, lower scores reflected better perceived health. Consequently, negative regression coefficients for changes in self-rated health indicate that improvements in self-rated health were associated with greater improvements in HRQoL.

The primary outcome was the change in HRQoL between baseline and the five-year follow-up. Change

scores were used as the dependent variables in all regression analyses. Candidate predictors were first examined in univariable linear regression analyses (Table S2 in the Supplementary File), and variables with a P value < 0.20 were entered into separate multivariable linear regression models for changes in total HRQoL, PCS, and MCS. Because the number of potential predictors was relatively large compared with the available sample size, backward variable selection based on the Akaike Information Criterion (AIC) was used to obtain more parsimonious models while reducing unnecessary model complexity. Model selection was performed independently for each outcome, and the final multivariable models are presented in Table 1. Statistical significance was defined as a two-sided P value < 0.05 .

Changes in HRQoL scores between baseline and follow-up were evaluated using paired statistical tests according to data distribution. Normally distributed variables were analyzed using paired t-tests, whereas non-normally distributed variables were compared using the Wilcoxon signed-rank test.

Linear regression assumptions were assessed by examining residual plots for linearity and homoscedasticity, Q-Q plots of standardized residuals for normality, and Cook's distance to identify influential observations. No major violations of the regression assumptions were detected.

All data management and statistical analyses were performed using Stata version 16 (StataCorp, College Station, TX, USA).

3.4. Ethical Considerations

The research protocol received approval from the Ethics Committee of Shiraz University of Medical Sciences (approval code: IR.SUMS.REC.1401.051). The investigation adhered to internationally accepted ethical principles, including those set forth in the Declaration of Helsinki and its later amendments. Written consent was obtained from all participants after they had been informed about the study objectives and procedures. Participation was entirely voluntary, and withdrawal from the study was permitted at any stage. Participant information was stored and managed in a manner that safeguarded privacy and confidentiality.

All assessments were provided free of charge. Participants with clinically significant findings were referred to appropriate medical specialists for further evaluation and management.

4. Results

Table 1. Multivariable Regression Findings for Changes in Total HRQoL and Its Physical and Mental Dimensions^a

Changes in HRQoL	Changes in Total HRQoL		Changes in PCS		Changes in MCS	
	Coefficient	P-Value (95% CI)	Coefficient	P-Value (95% CI)	Coefficient	P-Value (95% CI)
Age	0.19	0.22 (-0.12, 0.52)	-0.04	0.79 (-0.35, 0.27)	0.48	0.006 (0.14, 0.81)
Gender (male)	4.76	0.19 (-2.41, 11.94)	3.45	0.33 (-3.57, 10.48)	^d	^d
Remained in single life ^b	-16.04	0.01 (-28.82, -3.26)	^d	^d	-15.88	0.02 (-29.39, -2.37)
Changed from married life to single life ^b	2.42	0.81 (-18.48, 23.33)	^d	^d	^d	^d
Changed from single life to married life ^b	-6.11	0.50 (-24.41, 12.18)	^d	^d	^d	^d
Remained uninsured ^c	9.02	0.06 (-0.51, 18.55)	3.24	0.49 (-6.09, 12.59)	12.41	0.01 (2.63, 22.18)
Changed from uninsured to insured ^c	17.55	< 0.001 (8.28, 26.82)	14.27	0.003 (5.09, 23.45)	21.02	< 0.001 (11.41, 30.63)
Changed from insured to uninsured	-2.72	0.70 (-16.71, 11.27)	-0.97	0.89 (-14.84, 12.90)	^d	^d
Changes in self-health assessment score ^e	-3.59	0.01 (-6.46, -0.71)	-2.78	0.05 (-5.60, 0.03)	-4.23	0.005 (-7.18, -1.28)

^a Abbreviations: HRQoL, Health-Related Quality of Life; CI, Confidence Interval; MCS, Mental Component Summary; PCS, Physical Component Summary.

^b Remained married.

^c Remained insured.

^d Not retained in the final model.

^e Self-rated health was coded from 1 (excellent) to 5 (poor); therefore, lower scores indicate better perceived health. Negative regression coefficients represent improvements in self-rated health.

4.1. Demographic, Socioeconomic, Behavioral, and Medical Characteristics

The longitudinal analysis included 106 participants who completed the HRQoL questionnaire at both baseline (2019) and the five-year follow-up assessment (2024). Of the 217 participants who completed the HRQoL questionnaire at baseline, 106 (48.8%) completed the follow-up assessment, and the remaining 111 participants were considered lost to follow-up.

At baseline, the study sample comprised 59 women (55.7%) and 47 men (44.3%), with a mean age of 48.4 ± 12.1 years. Most participants were married ($n = 93$, 87.7%). Regarding socioeconomic characteristics, 40 participants (37.7%) had a university-level education, 41 (38.7%) were employed, and 56 (52.8%) had supplementary insurance. Regarding lifestyle behaviors, 11 participants (10.4%) were current smokers, and 3 (2.8%) reported alcohol consumption.

To evaluate potential attrition bias, baseline characteristics were compared between participants who completed the five-year follow-up and those who were lost to follow-up. No statistically significant differences were observed between the two groups in age, sex, marital status, educational level, occupational status, supplementary insurance status, or cigarette smoking (all $P > 0.05$; Table S1 in the Supplementary File). These findings suggest that the measured baseline characteristics were similar between participants retained in the study and those lost to follow-up.

Participant characteristics at the five-year follow-up are presented in Table 2.

4.2. Factors Associated with Changes in HRQoL

Table 1 presents the factors independently associated with changes in HRQoL according to the multivariable regression models.

Older age was associated with greater improvements in MCS during follow-up ($\beta = 0.48$, $P = 0.006$). Compared with participants who remained married at both time points, those who remained single had less favorable changes in total HRQoL and MCS ($\beta = -16.04$, $P = 0.01$ and $\beta = -15.88$, $P = 0.02$, respectively).

Regarding supplementary insurance status, participants who remained without supplementary insurance at both assessments showed improvements in MCS compared with those who had supplementary insurance at both time points ($\beta = 12.41$, $P = 0.01$). Participants who gained supplementary insurance by the follow-up assessment had more favorable changes in total HRQoL ($\beta = 17.55$, $P < 0.001$), PCS ($\beta = 14.27$, $P = 0.003$), and MCS ($\beta = 21.02$, $P < 0.001$).

Better self-rated health was associated with more favorable changes in total HRQoL and MCS ($\beta = -3.5$, $P = 0.01$; $\beta = -4.2$, $P = 0.005$, respectively). A weaker association was observed for PCS, which was borderline statistically significant ($\beta = -2.7$, $P = 0.05$).

Only variables retained after backward elimination based on the Akaike Information Criterion (AIC) are

Table 2. Demographic, Socioeconomic, Behavioral, and Medical Characteristics of Participants at Baseline (2019) and Five Years Later (2024) (N = 106)^a

Variables	2019 / 2024	P-Value
Age (y)	48.4 ± 12.1 / 54.2 ± 12.0	0.001 >
Gender		
Male	47 (44.3) / 47 (44.3)	-
Female	59 (55.7) / 59 (55.7)	-
Marital status		0.73
Single	8 (7.6) / 5 (4.7)	
Married	93 (87.7) / 94 (88.7)	
Divorced	0 / 1 (0.9)	
Widowed	5 (4.7) / 6 (5.7)	
Education (years)		0.999 <
≤ 12	66 (62.3) / 65 (61.3)	
> 12	40 (37.7) / 41 (38.7)	
Occupational status		0.66
Employed	41 (38.7) / 36 (34)	
Unemployed	24 (22.6) / 32 (30.1)	
Homemaker	41 (38.7) / 36 (34)	
Family Dimension	3.44 ± 1.03 / 2.00 ± 1.31	0.001 >
Supplementary insurance		0.02
Yes	56 (52.8) / 69 (65.1)	
No	50 (47.2) / 35 (33)	
Cigarette smoking		0.999 <
Current smoker	11 (10.4) / 10 (9.4)	
Former smoker	0 / 2 (1.9)	
Non-smoker	95 (89.6) / 92 (86.8)	
Hookah smoking		0.45
Current smoker	7 (6.6) / 10 (9.4)	
Non-smoker	99 (93.4) / 94 (88.7)	
Alcohol consumption		0.001 >
Yes	3 (2.8) / 15 (14.2)	
No	103 (97.2) / 89 (84)	
Opium use		0.37
Yes	1 (1) / 4 (3.7)	0.37
No	105 (99) / 101 (95.3)	0.37
BMI (kg/m²)	27.1 ± 4.4 / 27.8 ± 4.8	0.001 >
Psychiatric disorders		0.33
Yes	12 (11.3) / 17 (16)	0.33
No	94 (88.7) / 89 (84)	0.33
Fatty liver (based on ultrasound)		0.001 >
Yes	39 (36.8) / 71 (67)	
No	67 (63.2) / 35 (33)	
Hypertension		0.72
Yes	28 (26.4) / 31 (29.2)	
No	78 (73.6) / 75 (70.8)	
Diabetes Mellitus		0.77
Yes	14 (13.2) / 16 (15.1)	
No	92 (86.8) / 90 (84.9)	
Hyperlipidemia		0.02
Yes	22 (20.8) / 34 (32.1)	
No	84 (79.2) / 72 (67.9)	
Kidney disease		0.07
Yes	35 (33) / 25 (23.6)	
No	70 (66) / 81 (76.4)	
Gastrointestinal Disease (excluding liver diseases)		0.999 <
Yes	33 (31.1) / 34 (32.1)	
No	73 (68.9) / 72 (67.9)	
MetS (ATP III)		0.87
Yes	42 (39.6) / 40 (37.7)	
No	64 (60.4) / 66 (62.3)	
MetS (IDF)		0.999 <
Yes	53 (50) / 52 (49)	
No	53 (50) / 54 (51)	

^a Values are expressed as mean ± SD or No. (%). Abbreviations: BMI, Body Mass Index; kg, kilograms; m, meter; MetS (IDF), Metabolic Syndrome (International Diabetes Federation); MetS (ATP III), Metabolic Syndrome (Adult Treatment Panel); SD, Standard Deviation; N, Number of Participants. P values were calculated using the paired t-test or Wilcoxon signed-rank test for continuous variables, depending on data distribution, and the McNemar or McNemar-Bowker test for paired categorical variables.

presented. Candidate predictors with $P < 0.20$ in univariable analyses (Table S2 in the Supplementary File) were considered for inclusion in the multivariable models.

4.3. Changes in HRQoL Components

Paired comparisons of HRQoL components between 2019 and 2024 are presented in Table 3. Overall, mean HRQoL scores remained stable over the five-year follow-up

period. Total HRQoL showed a slight increase from 71.9 to 72.2 ($P = 0.6$), whereas PCS decreased marginally from 71.4 to 70.9 ($P = 0.7$). MCS increased from 69.5 to 72.6; however, this change was not statistically significant ($P = 0.2$).

Baseline HRQoL scores were positively associated with the corresponding five-year follow-up scores across all domains, including total HRQoL, PCS, and MCS ($\beta = 0.626$, 0.649, and 0.591, respectively; all $P < 0.001$). These findings

Table 3. Subcomponent Analysis of Health-Related Quality of Life ^a

SF-36 and Sub-Components	2019	2024	P-Value
Physical Component Summary (PCS)			
Physical Functioning	83.7 ± 18.5	76.8 ± 22.3	0.001 >
Role Physical	74.0 ± 37.6	69.5 ± 35.5	0.23
Bodily Pain	69.4 ± 31.5	68.1 ± 28.4	0.95
General Health	66.4 ± 21.5	75.0 ± 20.5	0.001 >
physical dimension	71.4 ± 21.2	70.9 ± 20.0	0.76
Mental Component Summary (MCS)			
Vitality	64.4 ± 23.9	65.4 ± 22.4	0.90
Social Functioning	80.5 ± 25.9	83.0 ± 22.3	0.49
Role Emotional	68.5 ± 41.1	70.7 ± 40.3	0.53
Mental Health	67.7 ± 20.7	69.3 ± 19.6	0.63
mental dimension	69.5 ± 22.0	72.6 ± 19.7	0.28
Total Score (out of 100)	71.9 ± 21.6	72.2 ± 19.1	0.65

^a Values are expressed as mean ± SD. Abbreviations: SF-36, Short Form-36; PCS, Physical Component Summary; MCS, Mental Component Summary.

indicate that individuals with higher HRQoL scores at baseline tended to maintain higher scores at follow-up.

5. Discussion

This prospective cohort study followed adults in Shiraz, Iran, for five years to evaluate changes in HRQoL. Overall, HRQoL and its physical and mental dimensions remained relatively stable over time. However, distinct sociodemographic and health-related factors were associated with differential changes in HRQoL. In particular, increasing age and improvements in self-rated health were linked to better MCS, whereas being single was associated with poorer outcomes over time. Changes in supplementary insurance status were also related to changes in HRQoL.

Few population-based studies in Iran have followed adults over time to investigate changes in HRQoL and the factors influencing these changes. This study helps address that gap by providing data from a community-based cohort in the southern part of the country. Most previous studies have been cross-sectional, limiting the ability to infer temporal changes in HRQoL.

In our study, increasing age was associated with improved MCS, whereas a decline in PCS was also observed; however, only the association with MCS reached statistical significance. Previous research has not reached a consistent conclusion regarding how age influences HRQoL, and reported patterns have varied considerably across studies. Some research has suggested that the mental dimension of HRQoL tends to improve with age (23, 24), whereas a population-based study conducted in

Bandar Abbas, Iran, found a decrease in this dimension with advancing age (4). Such inconsistencies may be partly attributable to variations in sociodemographic characteristics across study populations, including education level, employment status, and marital status. Notably, age remained an independent predictor of MCS in our multivariable model after adjustment for these covariates.

We observed that, over the five-year period, women showed greater improvements in total HRQoL and PCS than men, while experiencing a decline in MCS; however, these patterns did not meet the predefined threshold for statistical significance. Previous studies have reported associations between gender and HRQoL, with women often found to be at higher risk of lower HRQoL scores (3-7, 25). These findings may reflect underlying differences in health status between men and women. Previous evidence has shown a higher burden of chronic illness, disability, and coexisting medical conditions among women (26), factors that could influence perceived quality of life.

Variation in HRQoL between the two assessments differed according to participants' marital status. Participants who were single at both baseline and follow-up exhibited greater reductions in both total HRQoL and MCS than those who were married at both time points. This observation aligns with evidence suggesting that marriage may confer health-related benefits through mechanisms such as emotional support and stronger social networks. Nevertheless, findings from previous investigations have not been uniform, with some studies reporting more favorable HRQoL among single individuals within particular demographic subgroups.

Findings from the Tehran Lipid and Glucose Study ($n = 1,036$) indicated more favorable PCS and MCS among single individuals, with the association being stronger in women than in men (5). However, interpretation of these findings should consider the possibility that widowed individuals were included in the single category. Differences between studies may be attributable to methodological factors. Unlike cross-sectional investigations that evaluate participants at a single assessment point, our longitudinal design enabled the examination of changes in HRQoL over time and may therefore capture patterns that are not detectable in cross-sectional analyses. Furthermore, sociocultural distinctions between Tehran and Shiraz could have contributed to the differing results.

The lower HRQoL observed among single individuals in the present study may be related to lower levels of social support, a factor frequently associated with better psychological well-being. However, because social support was not directly assessed, this explanation remains speculative. Consistent with the inconsistency of existing evidence, another cross-sectional study involving 1,675 Iranian adults found no meaningful relationship between marital status and HRQoL (6). Evidence from a large Korean population study including 594,202 individuals suggested that the association between marital status and quality of life was not uniform across demographic groups. More favorable quality-of-life ratings were observed among unmarried younger adults, whereas married individuals aged 40 - 69 years generally exhibited better outcomes (8). Given the variability of findings across populations and research designs, additional longitudinal investigations are warranted to further elucidate the influence of marital status on long-term HRQoL patterns.

Socioeconomic position encompasses multiple dimensions, including education and employment, both of which may influence health and well-being. Findings from previous studies indicate that educational attainment and employment status are often associated with more favorable HRQoL outcomes (27, 28). In the present study, however, neither educational level nor occupational status was significantly associated with longitudinal changes in HRQoL. These results may indicate that, although education and employment contribute to differences in HRQoL at a given point in time, variation in these factors is not necessarily reflected in changes in HRQoL over a five-year follow-up period.

We also observed that changes in supplementary insurance status were associated with changes in HRQoL. In this study, compared with participants who had supplementary insurance at both baseline and follow-up, those who remained without coverage at both time points showed significant improvements in MCS. In addition,

individuals who were uninsured at baseline but obtained supplementary insurance during follow-up demonstrated significant improvements in total HRQoL, PCS, and MCS. These findings may reflect underlying differences across groups. Participants who remained uninsured may represent a subgroup with relatively better baseline health status and a lower perceived need for supplementary coverage, which could partly explain their observed improvement in HRQoL over time. Conversely, the observed improvements among individuals who obtained insurance during follow-up may be related to improved access to healthcare services, increased use of preventive and diagnostic care, and greater financial protection following insurance enrollment. Evidence from previous research has largely indicated beneficial effects of health insurance on HRQoL (12, 13). Nevertheless, the literature is not entirely consistent. Some investigations have reported less favorable associations, often explained by adverse selection, whereby individuals experiencing poorer health are more inclined to seek or obtain insurance coverage (14, 29).

Self-rated health status emerged as an important factor related to changes in HRQoL, with better ratings associated with more favorable outcomes in both total HRQoL and MCS. Consistent with our results, evidence from an international study suggested that individuals' perceptions of their own health are closely linked to quality-of-life measures and also reflect actual health conditions (30). Taken together, these findings underscore the potential utility of self-rated health as a practical measure for evaluating HRQoL in both research and public health settings (30).

Although increases in BMI were associated with declines in HRQoL, this relationship did not achieve statistical significance. This finding differs from evidence reported in a systematic review that identified a dose-dependent association between BMI and HRQoL (31). Several explanations may account for this inconsistency. One possibility is that the degree of BMI variation during the five-year follow-up was too limited to meaningfully affect quality-of-life outcomes. Unmeasured factors may also have contributed. Lifestyle-related behaviors, particularly exercise patterns and nutritional habits, may influence both BMI and HRQoL and may therefore have shaped the association between them.

Previous studies have generally reported lower quality-of-life scores among cigarette smokers (10, 32); however, a similar pattern was not supported in the present study. One possible explanation is social desirability bias, whereby participants may have underreported their smoking behavior, resulting in an underestimation of its potential impact on HRQoL.

Previous studies have linked alcohol-related problems to lower HRQoL scores (9); however, such a pattern was not evident in our cohort. One possible explanation relates to the cultural and legal environment in Iran, where concerns about social judgment may discourage participants from accurately disclosing alcohol use. Furthermore, alcohol intake was assessed using a simple dichotomous measure rather than detailed information on the frequency or quantity of consumption. As a result, the analysis may have lacked sufficient sensitivity to identify potential dose-dependent effects of alcohol use on HRQoL.

Available evidence regarding the relationship between substance use, especially opium consumption, and HRQoL remains scarce. In addition, exposure information was obtained through self-report, and variables were grouped into relatively broad categories. These methodological limitations may have introduced exposure misclassification, potentially reducing the likelihood of detecting true associations between substance use and HRQoL (33).

Across demographic and geographic settings, chronic medical conditions have repeatedly been linked to less favorable HRQoL outcomes (34). Compared with individuals with normal blood pressure, those with hypertension frequently demonstrate poorer HRQoL (35, 36). Similar patterns have been reported for diabetes (37, 38), as well as for reduced kidney function indicated by lower estimated glomerular filtration rate, all of which have been linked to poorer HRQoL outcomes (39, 40).

In contrast, our analysis did not identify statistically meaningful relationships between chronic diseases and changes in HRQoL over time. Several factors may account for this inconsistency. Interpretation of these findings should consider several methodological constraints. Chronic disease status was assessed using participant-provided information, which may not always accurately reflect true clinical status. Furthermore, relatively few participants had some of the chronic conditions under investigation, reducing the likelihood of detecting small effect sizes. Finally, we did not have data on disease severity or treatment adherence; therefore, it is possible that well-managed or less severe conditions had minimal impact on HRQoL trajectories during the follow-up period.

In our study, changes in metabolic syndrome (MetS) status, assessed using both ATP III and IDF criteria, were not statistically significant. Research examining the impact of MetS on HRQoL has yielded heterogeneous findings. Lower physical and mental HRQoL among older adults with MetS has been reported in some populations (41). However, an eight-year population-based cohort study observed an association only with worsening mental HRQoL, while changes in the physical component were not

apparent (42). After adjustment for sociodemographic characteristics, obesity, and other medical conditions, analyses from the Korea National Health and Nutrition Examination Survey did not identify a significant association between MetS and HRQoL, a finding that aligns with the results of the current study (43).

5.1. Strengths and Limitations

Longitudinal evidence on factors associated with changes in HRQoL in the Iranian general population remains limited. This study evaluated five-year changes in HRQoL and examined associations between these changes and demographic, socioeconomic, behavioral, and clinical characteristics. The prospective cohort design enabled the assessment of changes in HRQoL over time and the evaluation of potential factors associated with these changes.

Several limitations should be considered. First, the relatively small sample size and number of candidate predictors may have increased the risk of overfitting and unstable regression estimates. Therefore, the findings should be interpreted cautiously and require confirmation in larger prospective studies.

Second, although participants were initially recruited using a multistage cluster sampling approach, only 106 of the 217 participants completed the five-year follow-up assessment. Reasons for loss to follow-up were not systematically recorded, and unmeasured differences between participants retained in the study and those lost to follow-up cannot be excluded. However, comparisons of measured baseline characteristics showed no statistically significant differences between the two groups (Table S1 in the Supplementary File), suggesting no evidence of differences in measured baseline characteristics.

Third, information on medical conditions and lifestyle behaviors was based on self-report, and complete verified medical records were not available for all participants. Therefore, recall bias and exposure misclassification may have affected the results. Furthermore, disease severity and treatment adherence were not assessed, which may have limited interpretation of the observed associations between chronic conditions and HRQoL changes.

Residual confounding is also possible because some potentially relevant factors, including baseline HRQoL, healthcare needs, and socioeconomic indicators such as income, were not fully incorporated into the analyses. Therefore, the association between supplementary insurance status and changes in HRQoL should not be interpreted as causal.

The limited sample size may also have reduced statistical power to detect modest associations between

clinical or behavioral factors and HRQoL changes. In addition, the distribution of educational attainment was polarized, which may have limited the assessment of potential dose-response relationships. Occupational classification may also have introduced heterogeneity because students were categorized in the unemployed group despite potentially having different socioeconomic and psychosocial characteristics.

Future studies with larger cohorts, more detailed clinical assessments, and objective measurements of lifestyle behaviors and disease status are needed to further clarify factors associated with HRQoL changes in the general population.

5.2. Conclusions

The findings of this five-year population-based cohort study suggest that HRQoL and its domains remained largely unchanged over time. Nevertheless, variation in HRQoL was related to several individual and social characteristics, including age, marital status, supplementary insurance coverage, and self-rated health. Replication of these findings in larger longitudinal cohorts would strengthen the evidence base and help clarify the contribution of social, behavioral, and clinical factors to changes in HRQoL.

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Supplementary Material

Supplementary material(s) is available [here](#) [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

AI Use Disclosure: The authors declare that no generative AI tools were used in the creation of this article.

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