

# Factors Associated With Subjective Life Expectancy: Comparison With Actuarial Life Expectancy

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**Objectives:** Subjective life expectancy (SLE) has been found to show a significant association with mortality. In this study, we aimed to investigate the major factors affecting SLE. We also examined whether any differences existed between SLE and actuarial life expectancy (LE) in Korea.

**Methods:** A cross-sectional survey of 1000 individuals in Korea aged 20-59 was conducted. Participants were asked about SLE via a self-reported questionnaire. LE from the National Health Insurance database in Korea was used to evaluate differences between SLE and actuarial LE. Age-adjusted least-squares means, correlations, and regression analyses were used to test the relationship of SLE with four categories of predictors: demographic factors, socioeconomic factors, health behaviors, and psychosocial factors.

**Results:** Among the 1000 participants, women (mean SLE, 83.43 years; 95% confidence interval, 82.41 to 84.46 years; 48% of the total sample) had an expected LE 1.59 years longer than that of men. The socioeconomic factors of household income and housing arrangements were related to SLE. Among the health behaviors, smoking status, alcohol status, and physical activity were associated with SLE. Among the psychosocial factors, stress, self-rated health, and social connectedness were related to SLE. SLE had a positive correlation with actuarial estimates ( $r=0.61$ ,  $p<0.001$ ). Gender, household income, history of smoking, and distress were related to the presence of a gap between SLE and actuarial LE.

**Conclusions:** Demographic factors, socioeconomic factors, health behaviors, and psychosocial factors showed significant associations with SLE, in the expected directions. Further studies are needed to determine the reasons for these results.

**Key words:** Life expectancy, Socioeconomic factors, Health behavior, Republic of Korea

## INTRODUCTION

Subjective (or self-estimated) life expectancy (SLE) is an individual's expectation regarding the perceived extent of his or

her remaining years [1,2]. SLE is related to actual life expectancy (LE), mortality, and health status, but an individual's expectation of survival goes beyond health [3]. SLE is "a critical indicator of a highly complex attitude toward an emotionally charged topic in our society" [4], providing guidance for apportioning work, leisure, and finances within an adjusted timeframe [5].

An extensive literature has documented the ways in which SLE affects individuals' behavior. SLE has a strong effect on intended retirement age [6-8], even after controlling for demographic factors such as gender, age, income, education, health, marital status, and family longevity [9]. Increasing the length of life creates assurances about the future by reinforcing

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healthy habits [3]. Non-smokers and those who exercise regularly estimate their longevity to be longer [10], whereas people who drink heavily and those with poor nutritional habits expect shorter lives [3].

SLE has been used as a predictor of socioeconomic status and mortality. Individuals who expect to live longer lives achieve higher socioeconomic status, as assessed using educational goals, history of prolonged unemployment, current employment and occupational status, spouse's employment status, household income, and current or past economic hardship [11]. SLE has an independent effect on mortality [12], especially among older people [13].

A small number of prior studies found a positive correlation between SLE and actuarial LE because both depend considerably on current age [10,14]. However, differences between SLE and actuarial estimations are the focus of an ongoing debate. When SLE exceeds actuarial LE, it is due to participants' past increases in longevity [15], because people are extrapolating their past longevity when subjectively evaluating their future [16]. There are four hypotheses for these unresolved issues: (a) the age congruity hypothesis, (b) the cohort-improvement hypothesis, (c) the gender-anomaly hypothesis, and (d) the race-anomaly hypothesis; these hypotheses may explain differences according to age, gender, and race, respectively [17]. Two other main possible factors also discussed in the decision-theoretic literature are cognitive shortcomings and motivational reasons [18].

Because only a single study [19] has examined the relationships among SLE, socioeconomic status, and actuarial LE in Korea, it is important to analyze the effects of demographic, behavioral, and psychosocial factors on SLE, and to replicate such findings with nationally representative data across different age groups.

Based on the previously published literature, we hypothesize 1) that those with high SLE will exhibit several specific demographic, socioeconomic, health behavior-related, and psychological factors; and 2) that the difference between SLE and actuarial LE will be related to those factors.

## METHODS

### Study Population and Data Collection

A nationwide online panel survey of 1000 adults was conducted by the Research & Research organization on behalf of the Ministry of Health and Welfare of Korea. Participants were

recruited across Korea between August and September 2015, and all respondents gave consent for administering the survey via e-mail. Stratified sampling was used to select 1000 participants based on gender, age, and the postal area. In the sample allocation, proportional allocation was applied to correspond with the population and sample distribution ratios using stratification variables. All participants responded via e-mail to a survey questionnaire on a wide range of health and demographic indicators (response rate, 100%). Altogether, the survey contained six sections of questions (general characteristics, health behavior, health service use, social environment, social medicine, patient choice of hospital), with a total of 24 items to be completed. Inclusion criteria were being between 19 years old and 59 years old, inclusive. The study protocol was approved by the institutional review board (IRB) at Seoul National University Hospital, Seoul, Korea (IRB no. 1508-064-694).

### Measures

#### *Subjective life expectancy*

In general, two common elicitation formats are distinguished. The first approach is a direct measurement of the point estimate of SLE, and the second approach is the percentage chance of living to a certain age [20]. While the direct method is simple and straightforward, the indirect assessment can capture uncertainty easily [21]. Based on the answer to the question, "to what age do you expect to live?", responses were given as age in years.

#### *Demographic variables*

Gender (1, men; 0, women), age, and health conditions were included in this category. Age was measured as a continuous variable in years, and identified by the unique registration number of each Korean resident. Health conditions referred to ever having received a diagnosis of any of the following 12 conditions: hypertension, hyperlipidemia, angina pectoris, osteoarthritis, lung tuberculosis, asthma, diabetes mellitus, thyroid disease, cancer, depression, liver cirrhosis, and renal failure. This information was elicited via an adaptation of the Korean Community Health Survey 2016 questionnaire [22].

#### *Socioeconomic variables*

Variables within this category of predictors included 1) residential area, 2) household income, 3) educational qualifications, 4) occupation, 5) the type of real estate contract through

which the respondent obtained housing, and 6) the type of insurance. Residential areas were recoded as follows: 1, metropolitan area; 2, urban area; and 3, rural area [23]. Household income was defined as income per month in Korean won (KRW) after taxes, and was categorized on a scale ranging from 1 (<2 000 000 KRW per month) to 4 (>6 000 000 KRW per month) [24]. The highest educational qualification (from 1 [high school diploma or lower] to 3 [graduate school degree or higher]) [25] and current occupation (1, manual; 2, non-manual; 3, others) were obtained. The type of real estate contract was coded as 1 (freely offered housing), 2 (monthly rent), 3 (lease), and 4 (ownership), and the type of insurance was coded as 1 (medical aid), 2 (community-based insurance), or 3 (work-based insurance).

### Health behavior variables

The health behavior variables were: 1) history of smoking (1, current smoker; 2, ex-smoker; 3, never smoker); 2) alcohol consumption (1, 0 drinks per month; 2, 1-4 drinks per month; 3, 2-3 drinks per week; 4, 4 or more drinks per week), using an adaptation of the National Health and Nutrition Examination Survey from the Korea Centers for Disease Control and Prevention; and 3) physical activity (1, 2 or fewer days with physical exercise per week; 2, 3 or more days with physical exercise per week) [26-28].

### Psychosocial variables

The following variables were assessed. Psychological distress was measured through a question asking "How often do you feel hopeless?" Subjects reported the frequency of each experience on a 4-point scale ranging from 'most of the time' to 'none of the time,' which is an adaptation of the Kessler Psychological Distress Scale [29]. Depression was assessed by determining whether participants had ever been diagnosed with depression. Social connectedness was measured by asking participants "Do you have the opportunity to spend time with family, friends, or any other social group?" Self-rated health reflects an individual's psychological state [30]. The question about perceived health asked "In general, how would you rate your health?" [31]. Responses were coded on a scale ranging from 1 (poor) to 5 (excellent) [32].

### Statistical Analysis

Initially, we estimated the unadjusted mean age and 95% confidence intervals (CIs) of the 4 proposed categories of SLE predictors to assess the correlations of individual variables with

SLE. We then estimated the age-adjusted least-squares means (LSMEANS) age of SLE using the genmod procedure and LSMEANS statement, as age was expected to change the relationship of socioeconomic status factors with SLE. The *t*-test and analysis of variance (ANOVA), according to both general and occupational characteristics, were performed. This analysis was conducted separately for men and women. The descriptive statistics of samples, mean SLE, age-adjusted LSMEANS SLE, and *t*-test and ANOVA analyses of each set of factors are provided in Tables 1 and 2.

Second, the correlation between SLE and actuarial LE was evaluated using the Pearson correlation coefficient. The Pearson correlation evaluates the linear relationship between two continuous variables. Actuarial LE was obtained from Statistics Korea [33]. We matched SLE and actuarial LE with participants' age and gender.

Finally, the characteristics of those who appeared to have underrated or overrated their LE were examined [1]. We recoded this difference variable to create three groups: (a) participants whose SLE was within 5-year of their actuarial estimate, (b) participants whose SLE was greater by 5-year or more than their actuarial estimate (overestimated SLE), and (c) participants whose SLE was lower by 5-year or more than the actuarial estimate (underestimated SLE). Multinomial logistic regression was used to identify factors that distinguished these groups in a separate analysis.

All analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). Statistical testing was conducted with a conventional 2-tailed alpha level of 0.05.

## RESULTS

### Tests of the four Sets of Variables

Men comprised 52.0% of the sample. The average age of the participants was 42.03 years, and the average SLE was 82.70 years. When asked to estimate the LE of participants of their gender, women estimated their LE to be 83.43 years (95% CI, 82.41 to 84.46 years), while men estimated it to be 81.84 years (95% CI, 80.72 to 82.96 years), yielding a difference of 1.59 years. Age showed a J-shaped relationship with SLE. People with a disease estimated a shorter LE, and 48.0% said they had an illness that would limit their LE.

Two variables, household income and the type of real estate contract, were significant socioeconomic factors. We found regions where income was not related to SLE in the expected di-

**Table 1.** Demographic properties, mean age, and age-adjusted least-squares mean age of SLE with 95% CIs according to demographic and socioeconomic factors (n = 1000)

Predictors of SLE	Men		Women		Combined	
	n (%)	Unadjusted	Adjusted	n (%)	Unadjusted	Adjusted
<b>Demographic factors</b>						
Gender						
Men	520 (52.0)	82.09 (81.09, 83.09)	82.09 (81.10, 83.09)	480 (48.0)	83.35 (82.33, 84.38)	83.35 (82.35, 84.36)
Women						
Age (y)						
<30	119 (22.9)	80.32 (77.91, 82.73)		108 (22.5)	83.35 (82.33, 84.38)	81.21 (79.28, 83.14)*
30-39	125 (24.0)	81.46 (79.57, 83.35)		116 (24.2)	79.21 (77.30, 81.12)	80.36 (79.03, 81.69)*
40-49	143 (27.5)	81.20 (79.55, 82.84)		133 (27.1)	83.16 (81.89, 84.63)	82.14 (81.00, 83.27)*
≥50	133 (25.6)	85.24 (83.18, 87.30)		123 (25.6)	87.67 (85.23, 90.12)	86.49 (84.92, 88.06)*
<b>Health condition</b>						
Disease (+)	283 (54.4)	81.33 (79.98, 82.86)	80.78 (79.40, 82.15)	197 (41.0)	83.78 (82.15, 85.40)	82.34 (81.29, 83.38)
Disease (-)	237 (45.6)	83.00 (81.51, 84.49)	83.67 (82.16, 85.17)	283 (59.0)	83.06 (81.74, 84.38)	83.03 (82.05, 84.02)
<b>Socioeconomic factors</b>						
<b>Residential area</b>						
Metropolitan area	106 (20.4)	82.08 (79.91, 84.24)	82.11 (79.90, 84.32)	104 (21.7)	82.91 (80.97, 84.86)	82.49 (81.04, 83.94)
Urban area	132 (25.4)	82.28 (80.17, 84.39)	82.27 (80.30, 84.25)	126 (26.3)	83.84 (81.64, 86.05)	83.04 (81.53, 84.56)
Rural area	282 (54.2)	82.01 (80.67, 83.35)	81.99 (80.63, 83.34)	250 (52.1)	83.29 (81.87, 84.72)	82.61 (81.64, 83.59)
<b>Monthly household income (10<sup>6</sup> KRW)</b>						
<2	61 (11.7)	83.52 (80.11, 86.94)**	83.55 (80.68, 86.41)	71 (14.8)	81.96 (78.58, 85.34)	82.68 (80.30, 85.06)*
2-4	215 (41.3)	80.00 (78.57, 81.42)**	80.36 (78.78, 81.94)	170 (35.4)	82.66 (81.04, 84.29)	81.17 (80.10, 82.25)*
4-6	166 (31.9)	83.47 (81.73, 85.21)**	82.96 (81.18, 84.74)	166 (34.6)	83.67 (82.15, 85.19)	83.57 (82.42, 84.72)*
>6	78 (15.0)	83.82 (80.99, 86.65)**	83.54 (80.94, 86.14)	73 (15.2)	85.60 (82.59, 88.62)	84.47 (82.66, 86.29)*
<b>Educational qualification</b>						
High school diploma or lower	75 (14.4)	80.51 (77.45, 83.57)	80.17 (77.54, 82.79)	102 (21.3)	82.81 (80.18, 85.44)	81.28 (79.58, 82.97)
Bachelor's degree	392 (75.4)	82.32 (81.20, 83.43)	82.44 (81.29, 83.58)	341 (71.0)	83.59 (82.48, 84.70)	82.68 (82.15, 83.74)
<b>Occupation</b>						
Manual	53 (10.2)	82.68 (79.38, 85.98)	82.25 (79.13, 85.38)	37 (7.7)	82.68 (77.97, 87.38)	81.49 (77.73, 85.26)
Non-manual	140 (26.9)	80.20 (78.18, 82.22)	80.03 (78.12, 81.94)	80 (16.7)	83.88 (81.26, 86.49)	81.54 (79.93, 83.14)
Others <sup>2</sup>	275 (52.9)	82.97 (81.71, 84.23)	82.55 (81.16, 83.93)	174 (36.3)	81.40 (79.78, 83.02)	82.85 (81.97, 83.73)
<b>Type of real estate contract</b>						
Free offer	16 (3.1)	86.00 (80.23, 91.77)	86.58 (80.91, 92.25)	10 (2.1)	76.80 (86.04, 85.56)*	82.46 (77.60, 87.32)*
Monthly rent	78 (15.0)	80.90 (78.00, 83.80)	81.05 (78.48, 83.61)	62 (12.9)	80.10 (76.30, 83.89)*	80.84 (78.24, 82.84)*
Lease	112 (21.5)	81.21 (79.31, 83.10)	81.46 (79.32, 83.61)	92 (19.2)	83.10 (80.86, 85.33)*	82.06 (80.61, 83.50)*
Ownership	314 (60.4)	82.51 (81.20, 83.82)	82.35 (81.06, 83.63)	316 (65.8)	84.28 (83.10, 85.45)*	83.39 (82.51, 84.27)*
<b>Type of insurance</b>						
Medical aid	43 (8.3)	83.63 (79.61, 87.65)	84.72 (81.19, 88.24)	33 (6.9)	82.09 (76.93, 87.26)	82.96 (79.84, 86.08)
Community-based insurance	166 (31.9)	80.64 (78.83, 82.45)	80.83 (79.07, 82.59)	192 (40.0)	83.20 (81.59, 84.82)	82.01 (80.81, 83.22)
Work insurance	311 (59.8)	82.66 (81.40, 83.91)	82.40 (81.11, 83.69)	255 (53.1)	83.63 (82.27, 84.99)	83.10 (82.17, 84.02)

Values are presented as mean SLE (95% CI).

SLE, subjective life expectancy; CI, confidence interval; KRW, Korean won.

<sup>1</sup>Adjusted for age.

<sup>2</sup>Homemakers, students, unemployed, and others.

\* $p < 0.05$ , \*\* $p < 0.01$ .

**Table 2.** Demographic properties, mean age, and age-adjusted least-squares mean age of SLE with 95% CIs according to health behavior and psychosocial factors (n = 1000)

Predictors' of SLE	Men		Women		Combined	
	n (%)	Unadjusted	Adjusted	n (%)	Unadjusted	Adjusted
Health behavior factors						
History of smoking						
Current smokers	188 (36.2)	81.26 (79.57, 82.95)	81.43 (79.99, 82.86)	29 (6.0)	79.69 (73.93, 85.45)*	80.42 (77.52, 83.32)
Ex-smokers	197 (37.9)	82.75 (81.05, 84.44)	82.17 (80.19, 84.16)	82 (17.1)	80.56 (78.09, 83.03)*	79.96 (76.99, 82.94)
Non-smokers	135 (26.0)	82.30 (80.48, 84.13)	83.25 (81.21, 85.29)	369 (76.9)	84.26 (83.14, 85.39)*	84.30 (83.17, 85.44)
Alcohol consumption						
≥4 drinks/wk	44 (8.5)	79.39 (75.93, 82.85)	78.60 (75.17, 82.03)	15 (3.1)	73.73 (65.91, 81.56)**	73.31 (67.71, 78.93)
2-3 drinks/wk	130 (25.0)	81.85 (79.82, 83.87)	81.63 (79.64, 83.61)	50 (10.4)	81.92 (79.20, 84.64)**	81.90 (78.83, 84.97)
1-4 drinks/mo	299 (57.5)	82.83 (81.52, 84.14)	83.10 (81.79, 84.42)	307 (64.0)	84.54 (83.33, 85.75)**	84.64 (83.40, 85.88)
0 drinks/mo	47 (9.0)	80.60 (77.03, 84.16)	80.22 (76.92, 83.51)	108 (22.5)	81.98 (79.56, 84.40)**	81.76 (79.66, 83.85)
Physical activity (times/wk)						
0-2	287 (55.2)	81.28 (79.98, 82.58)	81.29 (79.96, 82.63)**	292 (60.8)	82.43 (81.07, 83.79)*	82.53 (81.23, 83.82)**
≥3	233 (44.8)	84.36 (81.54, 84.64)	83.05 (81.57, 84.53)**	188 (39.2)	84.79 (83.25, 86.32)*	84.67 (83.06, 86.28)**
Psychosocial factors						
Psychological distress						
Most of the time	60 (11.5)	81.48 (78.63, 84.34)	81.64 (78.72, 84.56)	56 (11.7)	76.91 (73.45, 80.37)**	77.28 (84.40, 80.17)
Some of the time	270 (51.9)	81.41 (80.04, 82.79)	81.54 (80.16, 82.92)	245 (51.0)	82.93 (81.46, 84.40)**	83.03 (81.65, 84.40)
A little of the time	178 (34.2)	82.97 (81.20, 84.74)	82.73 (81.02, 84.43)	170 (35.4)	85.58 (84.14, 87.03)**	85.35 (83.69, 87.00)
None of the time	12 (2.3)	87.42 (79.94, 94.90)	87.35 (80.82, 93.88)	9 (1.9)	92.89 (85.94, 99.83)**	92.36 (85.18, 99.54)
Depression						
Yes	27 (5.2)	81.19 (76.29, 86.08)	81.55 (77.18, 85.91)	35 (7.3)	83.06 (78.19, 78.92)	82.75 (79.01, 86.49)
No	493 (94.8)	82.14 (81.12, 83.17)	82.12 (81.10, 83.14)	445 (92.7)	83.38 (82.33, 84.42)	83.40 (82.35, 84.45)
Social connectedness						
No	205 (39.4)	79.92 (78.41, 81.42)**	81.30 (80.25, 82.36)	251 (52.3)	81.89 (80.48, 83.30)**	82.34 (80.92, 83.75)**
Yes	315 (60.6)	83.51 (82.20, 84.82)**	83.87 (82.90, 84.83)	229 (47.7)	84.96 (83.49, 86.43)**	84.47 (82.99, 85.95)**
Self-rated health						
Poor	9 (1.7)	82.89 (68.58, 97.19)**	81.29 (73.87, 88.71)	3 (0.6)	73.33 (35.39, 111.28)	70.94 (58.48, 83.41)**
Fair	61 (11.7)	77.23 (73.93, 80.53)**	76.53 (73.68, 79.39)	65 (13.5)	79.75 (76.48, 83.03)	79.49 (76.52, 81.88)**
Good	177 (34.0)	80.70 (79.17, 82.23)**	80.53 (78.86, 82.20)	195 (40.6)	82.31 (80.79, 83.82)	81.89 (80.34, 83.44)**
Very good	233 (44.8)	84.12 (82.73, 85.50)**	84.29 (82.84, 85.74)	196 (40.8)	85.67 (84.19, 87.15)	86.20 (84.66, 87.76)**
Excellent	40 (7.7)	83.70 (78.93, 88.47)**	84.87 (81.32, 88.42)	21 (4.4)	84.05 (77.22, 90.88)	84.98 (80.27, 89.69)**

Values are presented as mean SLE (95% CI).

SLE, subjective life expectancy; CI, confidence interval.

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

rection. In 86.8% of participants whose income was over 2 million KRW per month, a higher household income was associated with a higher expectation of life. Of these respondents, 82.3% had graduated from a university. In individuals overall, SLE was not significantly associated with educational qualifications, but we generally found that people with higher educational qualifications estimated their LE optimistically. The age-adjusted least-squares mean of educational qualifications showed a clearer gap than did the mean that was not age-adjusted. This occurred because, in Korea, older people are more likely to have less formal education than younger people. Occupation was not statistically significant. For men, 52.9% had a non-manual occupation, 26.9% engaged in manual labor, and only 20.2% were classified as 'other.' In contrast, almost half of the women were classified as 'other' because homemakers were included in this variable. The non-manual labor group expected their LE to be longer than did the manual labor group, and the 'others' group showed more optimistic expectations. The type of real estate contract was significantly related to SLE: 63.0% owned their dwelling, and they had the most optimistic attitude about their LE. Of the respondents, 56.6% had work-based insurance, and 36.8% had community-based insurance. People covered by work-based insurance estimated a longer LE than people covered by community-based insurance.

All three variables in the health behavior category (history of smoking, alcohol consumption, and physical activity) showed significant relationships in the hypothesized direction. Current smokers, ex-smokers, and non-smokers comprised 36.2, 37.9, and 26.0% of the sample, respectively. Non-smokers were likely to estimate their LE to be higher than current smokers by 2.30 years.

The psychosocial factors of psychological distress, social connectedness, and self-rated health were significantly related to SLE in the expected direction. Participants who felt distressed most of the time estimated their LE as 79.28 years (95% CI, 77.04 to 81.51 years), while participants who felt distressed none of the time estimated theirs as 89.76 years (95% CI, 84.85 to 94.68 years), yielding a difference of 10.48 years. Depression was not a significant factor, while the 54.4% of participants who reported strong social connectedness had an SLE that was 3.12 years higher. For self-related health, responses of poor, fair, good, very good, and excellent were provided by 1.2, 12.6, 37.2, 42.9, and 6.1% of the sample, respectively. People who answered 'fair' had the most pessimistic SLE estimates, and those who answered 'excellent' had the most optimistic estimations.

**Table 3.** Correlation between actuarial LE and SLE

	Pearson correlation coefficient		
	Men	Women	Combined
Actuarial life expectancy vs. SLE	0.53***	0.49**	0.61***

LE, life expectancy; SLE, subjective life expectancy.  
\*\* $p < 0.01$ , \*\*\* $p < 0.0001$ .

### Comparison Between Subjective Life Expectancy and Actuarial Life Expectancy

As shown in Table 3, the Pearson correlation test showed a positive correlation between SLE and actuarial LE using the 2015 Korean life tables for men and women ( $r = 0.61, p < 0.001$ ).

Table 4 shows the demographic properties of the four factors associated with the presence of a gap between SLE and actuarial LE. Of the participants, 41.7% reported an SLE within 5-year of their actuarial LE, 25.3% underestimated it by 5-year or more, and 33.0% reported an SLE that was 5 or more years greater than their actuarial estimate.

Table 5 presents the multiple regression analyses of factors explaining the gap between SLE and actuarial estimates. We formed the reference group from participants with an SLE within 5-year of their actuarial LE. Having a disease and experiencing distress increased the odds of underestimating one's LE by 31.0 and 39.0%, respectively. Being optimistic about one's health increased the odds of overestimating one's LE by 69.0%. Other significant factors were gender, household income, history of smoking, depression, and social connectedness.

## DISCUSSION

In this article, we studied the impact of demographic, socioeconomic, health behavior, and psychosocial factors on SLE in a cross-sectional study of 1000 people in Korea aged 19-59. The results support our hypothesis that demographic, socioeconomic, health behavior, and psychosocial factors would influence individuals' expectations of their remaining lifetime and the difference between SLE and actuarial estimates.

Demographic factors were related to SLE in ways consistent with prior research and actual LE. Women expected a higher LE than men did. However, compared to the 2015 Korean life tables, women reported an SLE that was 1.77 years lower than the actuarial estimate, while men had an SLE that was 2.84 years higher. These findings suggest that women tend to be more accepting of the reality of death than men [4]. Perhaps this is because men in Korea consider themselves to be more

**Table 4.** Descriptive statistics for predictors of SLE, including demographic factors, health conditions, socioeconomic factors, and psychosocial factors, for the full sample and according to the gap between SLE and actuarial LE

Predictors of SLE	SLE ≤5 y of LE (n=253)	SLE within 5 y of LE (n=417)	SLE ≥5 y of LE (n=330)
Demographic factors			
Gender			
Men	147 (58.1)	201 (48.2)	172 (52.1)
Women	106 (41.9)	216 (51.8)	158 (47.9)
Age (y)			
< 30	49 (19.4)	98 (23.5)	80 (24.2)
30-39	86 (34.0)	87 (20.9)	68 (20.6)
40-49	65 (25.7)	127 (30.5)	84 (25.5)
≥ 50	53 (21.0)	105 (25.2)	98 (29.7)
Health condition			
Disease (+)	141 (55.7)	194 (46.5)	145 (43.9)
Disease (-)	112 (44.3)	223 (53.5)	185 (56.1)
Socioeconomic factors			
Residential area			
Metropolitan area	53 (20.9)	86 (20.6)	71 (21.5)
Urban area	68 (26.9)	108 (25.9)	82 (24.9)
Rural area	132 (52.2)	223 (53.5)	177 (53.6)
Monthly household income (10 <sup>6</sup> KRW)			
<2	36 (14.2)	47 (11.3)	49 (14.9)
2-4	116 (45.9)	163 (39.1)	106 (32.1)
4-6	68 (26.9)	153 (36.7)	111 (33.6)
>6	33 (13.0)	54 (12.9)	64 (19.4)
Educational qualification			
High school diploma or lower	57 (22.5)	63 (15.1)	57 (17.3)
Bachelor's degree	174 (68.8)	320 (76.7)	239 (72.4)
Master's degree or higher	22 (8.7)	34 (8.2)	34 (10.3)
Occupation			
Manual	62 (24.5)	95 (22.8)	63 (19.1)
Non-manual	110 (43.5)	203 (48.7)	136 (41.2)
Other	81 (32.0)	119 (28.5)	131 (39.7)
Type of real estate contract			
Free offer	7 (2.8)	11 (2.6)	8 (2.4)
Monthly rent	49 (19.4)	48 (11.5)	43 (13.0)
Lease	51 (20.2)	93 (22.3)	60 (18.2)
Ownership	146 (57.7)	265 (63.6)	219 (66.4)
Type of insurance			
Medical aid	21 (8.3)	28 (6.7)	27 (8.2)
Community-based insurance	130 (51.4)	246 (59.0)	190 (57.6)
Work-based insurance	102 (40.3)	143 (34.3)	113 (34.2)
Health behavior factors			
History of smoking			
Current smokers	180 (54.5)	220 (52.8)	104 (41.1)
Ex-smokers	55 (16.7)	84 (20.1)	50 (19.8)
Non-smokers	95 (28.8)	113 (27.1)	99 (39.1)
Alcohol consumption			
≥ 4 drinks/wk	23 (9.1)	20 (4.8)	16 (4.9)
2-3 drinks/wk	51 (20.2)	81 (19.4)	48 (14.6)
1-4 drinks/mo	135 (53.4)	252 (60.4)	219 (66.4)
0 drinks/mo	44 (17.4)	64 (15.4)	47 (14.2)
Physical activity (times/wk)			
0-2	107 (42.3)	162 (38.9)	111 (33.6)
≥ 3	146 (57.7)	255 (61.1)	219 (66.4)

(Continued to the next page)

**Table 4.** Continued from the previous page

Predictors of SLE	SLE ≤ 5 y of LE (n=253)	SLE within 5 y of LE (n=417)	SLE ≥ 5 y of LE (n=330)
Psychosocial factors			
Psychological distress			
Most of the time	48 (19.0)	38 (9.1)	30 (9.1)
Some of the time	139 (54.9)	217 (52.0)	159 (48.2)
A little of the time	64 (25.3)	157 (37.7)	127 (38.5)
None of the time	2 (0.8)	5 (1.2)	14 (4.2)
Depression			
No	230 (90.9)	405 (96.4)	306 (92.7)
Yes	23 (9.1)	15 (3.6)	24 (7.3)
Social connectedness			
No	130 (51.4)	201 (48.2)	125 (37.9)
Yes	123 (48.6)	216 (51.8)	205 (62.1)
Self-rated health			
Poor	6 (2.4)	1 (0.2)	5 (1.5)
Fair	63 (24.9)	39 (9.4)	24 (7.3)
Good	102 (40.3)	179 (42.9)	91 (27.6)
Very good	72 (28.5)	177 (42.5)	180 (54.6)
Excellent	10 (4.0)	21 (5.0)	30 (9.1)

Values are presented as number (%).

SLE, subjective life expectancy; LE, life expectancy; KRW, Korean won.

**Table 5.** Multinomial logistic regression, using the group whose SLE was within 5 years of their actuarial estimate as the reference category

	SLE ≤ 5 y of LE				SLE ≥ 5 y of LE			
	β	Exp β	95% CI		β	Exp β	95% CI	
			Lower	Upper			Lower	Upper
Demographic factors								
Gender	-0.40	0.67*	0.49	0.92	-0.16	0.86	0.64	1.14
Age	-0.07	0.93	0.81	1.07	0.03	1.03	0.90	1.17
Health condition	-0.37	0.69*	0.51	0.95	0.10	1.11	0.83	1.48
Socioeconomic factors								
Household income	-0.10	0.90*	0.82	0.99	0.04	1.04	0.95	1.13
Educational qualification	-0.08	0.93	0.54	1.60	0.17	1.19	0.74	1.91
Occupation	0.00	1.00	0.95	1.06	0.07	1.07*	1.01	1.13
Type of real estate contract	-0.03	0.97	0.81	1.17	0.19	1.22*	1.01	1.46
Health behavior factors								
History of smoking	-0.22	0.81	0.71	0.92	-0.01	1.00***	0.88	1.13
Alcohol consumption	-0.04	0.96	0.85	1.09	0.06	1.06	0.93	1.21
Physical activity	-0.14	0.87	0.63	1.19	0.23	1.25	0.93	1.70
Psychosocial factors								
Psychological distress	-0.50	0.61***	0.48	0.77	0.15	1.16	0.94	1.44
Depression	0.99	2.68**	1.37	5.24	0.74	2.10*	1.08	4.08
Social connectedness	-0.13	0.88	0.64	1.02	0.42	1.53**	1.14	2.05
Self-rated health	-0.32	0.72***	0.60	0.87	0.54	1.69***	1.40	2.06

Exp β refers to change in the odds ratio with a 1-unit change in the predictor.

SLE, subjective life expectancy; LE, life expectancy; CI, confidence interval.

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

masculine than women, such that the emphasis placed on the men role in this society may contribute to men's tendency to overestimate their LE. Socioeconomic factors influenced SLE.

Low household income, educational qualifications, occupation, and type of real estate contract were associated with pessimistic SLE estimates. People in low socioeconomic positions



were a concern since they may underestimate their SLE. This underestimation could leave them vulnerable to underfunding their retirement [34], and therefore they might experience challenges during financial and career planning sessions [1].

All health behavior variables had an impact on an individual's estimation of their LE. Because individuals are aware that smoking, high alcohol intake, and low physical activity have a negative association with mortality through information disseminated in the public media, these factors caused individuals to view their LE more pessimistically [1]. It is interesting that participants who did not drink alcoholic beverages at all estimated their LE to be lower than people who consumed 1-4 drinks per month. Previous research has shown that the relationship between alcohol consumption and total mortality is U-shaped or J-shaped [35]. Several explanations have been proposed for this relationship. Persons who never drink alcohol might have given up drinking alcohol for health reasons, and the systematic underreporting of alcohol consumption may be possible. Misclassification must also be considered, as well as possible errors due to untruthful responses by respondents when asked about the frequency of drinking.

Psychosocial factors are internal representations of situations that are constructed based on unique life experience, perceptions, and understandings of the world [36]. Prior studies have proposed and tested a mental model for identifying the factors associated with SLE [37]. Distress, social connectedness, and self-rated health had a positive relation with SLE. Depression had a U-shaped relationship with the gap between SLE and actuarial LE. It may be the case that patients with depression have difficulty perceiving both their objective and subjective status clearly. Because the trade-off between realism and optimism explains these perceptions, they may exert many independent effects [38].

We established that people who expect to live longer than their actuarial LE tend to have a better education, to own their residence, to have less stress, to be more socially connected, and to evaluate their health more optimistically. This finding may encourage governmental policy initiatives on education, housing, and suicide that would be in line with expectations of increased longevity.

The results presented here should be interpreted with caution. First, the comparison with the 2015 Korean life tables was not precise, because compared with the population life tables, these data were drawn from a relatively small sample ( $n = 1000$ ). Second, the method of administering the survey has several

limitations. Online survey administration is limited in that not everyone has access to the Internet, and has been associated with a lower response rate than is found for paper surveys [39]. Moreover, the growth of Internet-based research has surpassed the development of ethical guidelines [40]. To moderate this problematic weakness of an online survey, we used a survey URL (opt-in survey), and all online panels were selected to be demographically balanced. Third, some limitations are present in the validation techniques, such as simulation and testing. However, the survey we describe included logic for verification techniques to be used in model checking, so we ensured that the quality of the survey method was satisfactory for verification and validation. A final potential problem is the restrictions on survey methodology that were present because we used cross-sectional data. To assess the impact of these factors, a time-trend study would be necessary in the future, involving a more in-depth investigation of these factors on a larger scale.

The strengths of this research include its theoretical basis and its examination of a comprehensive set of variables, extending prior research. Participants' SLE was found to be related to demographic, socioeconomic, health behavior, and psychosocial factors, and the presence of a gap between SLE and actuarial LE was associated with these four sets of variables. Public policies regarding the underestimation of SLE and its association with health risks need to be developed, and the issues raised by this study will be an important component of any such policy.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

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