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A Cross-sectional Study on Socioeconomic Status and Health-Related Quality of Life among Elderly Chinese

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A Cross-sectional Study on Socioeconomic Status and Health-Related Quality of Life among Elderly Chinese

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Article focus

- The effect of socioeconomic status on health-related quality of life among elderly Chinese population

Key messages

- Most indicators of socioeconomic status were associated with health-related quality of life among elderly Chinese
- Subjective socioeconomic status indicator showed much stronger association with health-related quality of life than objective indicators
- Educational level, occupational level and economic indicators such as income and expenditure tended to associate with physical dimension of health-related quality of life only among elderly Chinese men.

Strengths and limitations of this study

- This is the first study to examine socioeconomic status and health-related quality of life among elderly Chinese
- Survival bias may exist because the baseline survey was voluntary and we excluded all those who had died in the telephone survey
- A large number of elderly Chinese in Hong Kong receive a welfare payment from the Hong Kong government and they may report this as their monthly income
- There may be floor or ceiling effects for self-reported health because we only have three categories for this variable

ABSTRACT

Objectives: To examine the association between socioeconomic status (SES) and health-related quality of life (HRQOL) in a sample of elderly Chinese people in Hong Kong.

Study Design: Cross-sectional study.

Setting: 18 Elderly Health Centers in Hong Kong.

Participants: This study was based on a cohort aged 65 years or above who were enrolled in the Elderly Health Services from 1998 to 2005 in Hong Kong. Initially 3,324 subjects were randomly sampled from the baseline database. In the end, 2,441 successful cases were obtained for the telephone survey. After excluding cases with missing SES or HRQOL information and the cases whose questionnaires were answered by their family members, 2,347 subjects were included in the final analysis.

Results: Elderly Chinese with less subjective economic hardship reported much better SRH (Odds Ratio (OR) 1.57-4.70, all p<0.01) and higher SF12 scores (β 2.56-10.26, all p<0.01) than those with economic hardship. Male subjects in the highest education and occupation subgroup reported better HRQOL comparing with the baseline subgroup (OR for SRH 1.91-3.26, p<0.01; β 2.63-4.96, p<0.05). Two economic indicators, income and expenditure, only showed significant positive associations with physical SF12 scores for men (β 2.91-5.42, all p<0.05). Housing tenure was associated with SRH (OR 1.34 for men and 1.27 for women, p<0.05) but not SF12 scores.

Conclusions: Economic hardship showed the strongest association with HRQOL among all SES indicators. Educational level, occupational level and economic indicators tended to associate with physical HRQOL only among elderly Chinese men. More attention should be placed on subjective SES indicators when investigating influences on HRQOL among elderly Chinese people.

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BACKGROUND

There is a well-established inverse relationship between socioeconomic status (SES) and health according to which people with higher SES experience fewer health problems compared with people with lower SES.[1-3] This association has been identified in both individual-[4-7] and neighborhood-level SES indicators,[8, 9] for almost all health outcomes including mortality,[10-12] morbidity[13, 14] and disability.[13-16]

With aging populations and increasing burden of chronic diseases, health-related quality of life (HRQOL) has been paid more attention. SES has been linked to several measures of HRQOL in previous studies, including self-rated health (SRH),[17-19] the Medical Outcomes Study short form (SF) 36/20/12,[20-24] and et al. People with higher SES are more likely to report better HRQOL than those with lower SES. Using the most validated instrument of HRQOL, Thumboo et al. found that there were 0.5-0.6 points increase in SF-36 score per year's increase in education and 3.5-4.0 points increase in score with a better housing type.[23] In a Norwegian study using SF12, researchers found that both physical and mental dimensions of HRQOL were correlated with education and occupation.[25]

Although consistent results were reported in previous studies about SES and HRQOL, the evidence was still limited among Asian populations, especially among elderly people. Lam et al. examined the effect of HRQOL on health service utilities and validated the SF12 in a Chinese sample; however, no studies were conducted on SES by them.[26, 27] Cheng et al. used a subjective SES indicator (economic hardship) and found that Chinese who reported economic hardship were more likely to rate lower SRH.[28] To date, no studies have investigated the association between SES and HRQOL among elderly Chinese people.

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This study was designed to measure SES and HRQOL in a representative sample of elderly

Chinese people in Hong Kong, and to identify the potential relationship between SES indicators

and HRQOL. Finding from present study will enhance our understanding on the effect of SES on

HRQOL, and provide recommendations on improvement of HRQOL among elderly Chinese.

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METHODS

Study Design and Study Population

This was a follow-up study with baseline data and a subsequent telephone survey several years later. The subjects in the baseline database were recruited by the Elderly Health Services (EHS) of the Department of Health, Hong Kong Government, in their Elderly Health Centers (EHC), from 1998 to 2005. The subjects were ambulatory, aged at least 60 at enrollment and likely to be representative of the healthy elderly Chinese in Hong Kong. When the participants first registered, a detailed face-to-face interview was performed by trained nurses of EHC using a standardized questionnaire comprising basic demographic, lifestyle, socioeconomic, health-related, and disease-related information, including sex, birth, marriage, height, weight, housing, educational level, smoking, alcohol use, exercise, nutrition, hospitalization, active diseases, number of falls, medication, self-rated health, family history, social contact and finance. In order to collect information about SES and HRQOL, a telephone survey was performed aimed at 3,324 subjects randomly sampled from the baseline database after stratification by age and gender from October 2006 to January 2007. In order to obtain most update data, information on marriage, smoking, alcohol use, exercise, and hospitalization was also collected during the telephone interview even though we had such information from the baseline survey. In the end, 2,441 successful cases were obtained for the telephone survey. After excluding cases with missing SES or HRQOL information and the cases whose questionnaires were answered by their family members, 2,347 subjects were included into the final analysis. The telephone interview was performed in Cantonese.

Measures

Six SES indicators were included in this study: education, housing tenure, previous occupation, monthly income, monthly expenditure, and economic hardship. Education was coded into five categories from the highest post-secondary, through secondary, primary, uneducated but can read and write, to the lowest, illiterate. Housing tenure was defined as self-owned or other. Since most subjects were now retired from work, the question about occupation sought information on the job with the longest duration in the past. For occupation, three categories for men (professional, technical and elementary workers) and four categories for women (professional, technical, unemployed, and elementary workers) were coded, because only a few men were unemployed for long periods. Monthly income was coded into six categories, <1,000, 1,000-1,999, 2,000-2,999, 3,000-5,999, 6,000-9,999, and ≥10,000 HK dollars and monthly expenditure was coded into five categories, <2,000, 2,000-2,999, 3,000-5,999, 6,000-9,999, and ≥10,000 HK dollars. A simple question was used to evaluate self-rated economic hardship, "Do you think you have sufficient money to cover your daily expenses?", and the answers were "more than enough", "enough", "just right" and "insufficient".[28]

HRQOL information was collected in the telephone survey based on SRH and SF12. SRH was measured by a simple question in which subjects were asked to rate their health status compared to their peers, and the possible answers were "better", "normal", or "worse". The SF12, an abbreviated version of the SF-36 health questionnaire, covers 8 domains with 12 items and measures HRQOL in a physical component score (PCS12) and a mental component score (MCS12).[29] The instrument has been validated in Hong Kong and, by using the same scoring system as the standard SF12 but weighting using the Chinese (HK) specific PCS and MCS

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regression coefficients for each item response,[30] the PCS12 and MCS12 scores could range from 0 to 100. A higher score indicated a better HRQOL and vice versa.[29-30]

Covariates in this study included age, marriage (married, single, ex-married including widowed and divorced), living alone or not (yes, no), smoking history (never smoking, current smoking, quit smoking), alcohol use (drink at least one day per week in the past one month or not), exercise (times/week), BMI, hospitalization (yes, no), diagnosis of hypertension, diabetes mellitus, heart diseases, musculoskeletal disease, chronic pulmonary disease and hearing loss (yes, no).

Statistical Analysis

The data were entered into Excel (Microsoft) and, by matching subjects' unique Hong Kong ID numbers the data from the telephone survey were merged with the baseline database. Means and proportions were compared between men and women for continuous and categorical variables by T-test or Chi-square test, respectively. Because significant difference was found among most of the variables between two genders, all the multivariate analyses were performed with stratification on gender. Ordinal Logistic regression models were used to examine the effect of SES on SRH, since there were three ordered scales for SRH. General Linear Models (GLM) were used to identify the association between SF12 score (PCS12 and MCS12) and SES. Colinearity and interactions were examined in all models. Only one variable was kept in the model if colinearity was detected between the variables. Significant interaction terms were included in the models if detected. All covariates above were included in the models unless colinearity was found. When examining the association between an SES indicator with HRQOL outcomes, all other SES indicators were included in the adjusted models as covariates. Because

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correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the adjusted models. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two. The level of statistical significance was set at $p<0.05$. All statistical analyses were performed using SAS 9.2 (Cary, NC, USA).

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RESULTS

Characteristics of the sample for the telephone survey were summarized by gender in **Table 1**. The average age of male and female subjects was the same because we sampled the subjects by age and gender. Male respondents were more inclined to be married, to be current smokers and alcohol users, and to have lower BMI than female respondents. Elderly Chinese men were more likely to have a higher educational level, live in a self-owned house, have a lower monthly income and a higher monthly expenditure, report less economic hardship, and have a higher level of occupation than similarly aged women. For the outcomes of HRQOL, men were more likely to report better SRH than women in this study. Both physical and mental component SF12 scores were higher in men than in women in this sample.

Table 2 showed the results of adjusted ordinal logistic regression for SRH and each SES indicator. Subjects with higher educational levels reported better SRH than those with lower educational levels, especially for men with post-secondary and secondary level education. Elderly people living in their own houses were more likely to report better SRH than those living in rented or public housing. Compared to the lowest income group, men with 6,000-9,999 HK$ monthly income reported better SRH; however, no difference was found between other groups. Male professional or technical workers and female professional or unemployed workers were more likely to report better SRH than elementary workers. Economic hardship showed the strongest relationship with SRH among all the SES indicators. For men, current smoking, hospitalization in past 12 months, and diagnosis of chronic diseases were associated with worse SRH. For women, only hospitalization and diagnosis of chronic diseases were associated with worse SRH.

The results on associations between SES indicators and PCS12 as well as MCS12 scores were presented in **Table 3** and **Table 4**, respectively. For men, a significant association was found between PCS12 score and SES for all SES indicators except housing tenure, which indicated that men with higher SES were more likely to report a higher PCS12 score. Only education and economic hardship were found to be related with PCS12 scores for elderly women. Significant associations were found for education (post-secondary vs illiterate), occupation (professional and technical vs elementary for men, professional vs elementary for women), and economic hardship with MCS12. Economic hardship was identified as the strongest predictor for both mental and physical SF12 score among six SES indicators. For the covariates, elderly Chinese with older age, hospitalization in past months and diagnosis of chronic diseases experienced lower PCS12 score. Exercise was positively associated with MCS12, but BMI was negatively associated with MCS12 in men. Women with younger age, ex-married marriage status, hospitalization, and diagnosis of chronic diseases experienced lower MCS12.

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DISCUSSION

Most elderly people reported SRH not worse than their peers. The average PCS12 score was 40.3 and MCS12 score was 51.5 among this elderly Chinese sample. Men tended to report better HRQOL than women. Educational level and occupation were positively associated with HRQOL. Housing tenure was significantly associated with SRH only. Economic SES indicators (monthly income and expenditure) only showed a weak association with physical SF12 scores in men. Economic hardship showed the strongest association with HRQOL among all SES indicators in both men and women.

Using SRH and SF12 as measurements of HRQOL, our results confirmed the association between HRQOL and education[5, 31-36] and occupation among a Chinese sample.[6, 37, 38] Housing tenure was only found to be related with SRH for both men and women. This result confirmed the findings in Dunn's study that the people living in rented houses were approximately 3 times as likely to report worse SRH than those living in self-owned houses.[4] In this study, we present results similar to previous studies which showed that HRQOL inequalities by SES are larger in the physical domain than in the mental domain of HRQOL.

Objective economic SES indicators (monthly income and expenditure) showed only a weak association with the physical domain of HRQOL in the present study, which conflicts with findings from several previous studies.[7, 36] However subjective economic SES indicators of economic hardship showed strong associations with all HRQOL measurements in both men and women. The findings of non-significant associations between HRQOL and economic SES indicators might be because many of our poorer elderly subjects received a welfare payment from the Hong Kong Government. Because income was not a good indicator for people after retirement, we included monthly expenditure in our telephone survey. However, expenditure

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showed no associations with any HRQOL measures. Because many elderly Chinese live with their children or other family members, we cannot tell if the expenditure was for the whole family or themselves. Economic hardship showed the strongest association with HRQOL in the present study. There might be several explanations for this association. Firstly, economic hardship might be a better measurement, reflecting information on the money people have access to but information on income does not necessarily do this. Secondly, feelings of economic hardship themselves may indicate impact of stress and depression which might affect health and HRQOL.

Men were more likely to report better HRQOL than women in the present study, which confirmed findings based on western populations in previous studies.[18, 21] For objective SES indicators (education, housing tenure, occupation and income), men showed stronger associations with HRQOL than women. However for subjective SES indicators of economic hardship, the association with HRQOL was a little stronger in women than in men. The difference between men and women for the relationship between HRQOL and economic SES indicators might be contributed to by the fact that the income of the whole family is often managed by the wife in Chinese families.

Several limitations need to be considered. First, as mentioned in many SES and health studies, the cross-sectional design was the most important limitation in this study. Even though we have baseline data and a follow-up telephone survey, our design was still cross-sectional because no longitudinal data were collected and used. Second, survival bias may exist because the attendance which gave rise to enrollment and the baseline survey was voluntary and we excluded all those who had died in the telephone survey. Third, there were some flaws in the SES indicators. A large number of elderly Chinese in Hong Kong receive a welfare payment

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from the Hong Kong government and they may report this as their monthly income. We grouped

housing tenure into self-owned house and others, so we did not know the size and quality of the

houses. Fourth, there may be floor or ceiling effects for SRH because we only have three

categories for SRH.

Elderly Chinese men reported better HRQOL than women. Economic hardship, education,

housing tenure, and occupation were identified to be associated with HRQOL among elderly

Chinese. Subjective SES indicators might impact more on HRQOL among elderly people than

more traditional objective measures. Future research is needed to interpret the strong association

between subjective SES indicator and HRQOL among elderly population.

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Table 1. Characteristics of the sample for telephone survey by gender

	Male		Female		P Value
	N	**%**	**N**	**%**	
Sample Size	1,201	51.2	1,146	48.8	
Age, years (Mean, SD)	77.3	6.6	77.3	6.6	0.959
Marital Status					
Ex-married	194	16.2	734	64.0	<0.001
Single	31	2.6	22	1.9	
Married	974	81.2	389	34.0	
Smoking History					<0.001
Never	375	31.2	498	43.5	
Current	606	50.5	437	38.1	
Quit	220	18.3	211	18.4	
Alcohol Use	410	34.1	199	17.4	<0.001
Exercise, times/week (Mean, SD)	5.6	2.6	5.4	2.7	0.068
BMI, kg/m^2 (Mean, SD)	23.7	3.1	24.1	3.9	<0.01
Hospitalization	218	18.2	219	19.1	0.560
Self-Rated Health					<0.001
Better	452	37.6	302	26.4	
Normal	632	52.6	643	56.1	
Worse	117	9.7	201	17.5	
PCS12 score (Mean, SD)	42.9	10.8	37.6	11.1	<0.001
MCS12 score (Mean, SD)	52.8	9.0	50.2	10.8	<0.001

Table 1. Characteristics of the sample for telephone survey by gender (cont.)

	Male		Female		P Value
	N	%	N	%	
Education Level					<0.001
Post-secondary	105	8.7	19	1.7	
Secondary	300	25.0	101	8.8	
Primary	610	50.8	355	31.0	
Uneducated	127	10.6	242	21.1	
Illiterate	59	4.9	429	37.4	
House Tenure					<0.001
Self-owned	627	52.2	500	43.6	
Non-self-owned	574	47.8	646	56.4	
Income					<0.001
>10,000	46	3.8	25	2.2	
6,000-9,999	102	8.5	97	8.5	
3,000-5,999	321	26.7	421	36.7	
2,000-2,999	295	24.6	339	29.6	
1,000-1,999	260	21.7	150	13.1	
<1,000	177	14.7	114	10.0	
Expenditure					<0.001
>10,000	21	1.8	21	1.8	
6,000-9,999	196	16.3	135	11.8	
3,000-5,999	434	36.1	467	40.8	
2,000-2,999	410	34.1	345	30.1	
<2,000	140	11.7	178	15.5	
Economic Hardship					<0.001
More than enough	85	7.1	39	3.4	
Enough	551	45.9	447	39.0	
Just right	372	31.0	440	38.4	
Insufficient	193	16.1	220	19.2	
Occupation					<0.001
Professional	261	21.7	79	6.9	
Workers	747	62.2	436	38.1	
Elementary	185	15.4	466	40.7	
Unemployed	8	0.7	165	14.4	

Table 2. Results of adjusted ordinal logistic regression models for SRH and SES indicators

	Male (OR, 95% CI)	Female (OR, 95% CI)
Education		
Post-secondary	3.26 (1.68, 6.33)**	1.32 (0.53, 3.32)
Secondary	2.43 (1.37, 4.28)**	1.67 (1.07, 2.61)*
Primary	1.55 (0.91, 2.65)	1.49 (1.12, 1.99)**
Uneducated	1.67 (0.90, 3.10)	0.98 (0.72, 1.35)
Illiterate	1.00	1.00
House Tenure		
Self-owned	1.34 (1.06, 1.70)*	1.27 (1.00, 1.61)*
Rented	1.00	1.00
Income		
>10,000	1.95 (0.99, 3.85)	0.99 (0.41, 2.37)
6,000~9,999	1.96 (1.19, 3.22)**	1.49 (0.86, 2.60)
3,000~5,999	1.11 (0.77, 1.61)	1.10 (0.72, 1.67)
2,000~2,999	1.41 (0.97, 2.04)	1.03 (0.67, 1.57)
1,000~1,999	1.40 (0.96, 2.05)	1.06 (0.65, 1.73)
<1,000	1.00	1.00
Expenditure		
>10,000	1.05 (0.42, 2.65)	0.50 (0.20, 1.25)
6,000~9,999	1.57 (1.01, 2.43)	1.07 (0.68, 1.67)
3,000~5,999	1.28 (0.88, 1.88)	0.94 (0.66, 1.32)
2,000~2,999	1.41 (0.96, 2.07)	0.92 (0.64, 1.32)
<2,000	1.00	1.00
Occupation		
Professionals	1.91 (1.30, 2.82)**	2.28 (1.40, 3.71)**
Technical Workers	1.50 (1.09, 2.07)*	1.16 (0.89, 1.51)
Unemployed	--	1.51 (1.05, 2.16)*
Elementary Workers	1.00	1.00
Economic Hardship		
More than enough	4.61 (2.54, 8.37)**	4.70 (2.26, 9.77)**
Enough	2.06 (1.46, 2.91)**	2.12 (1.52, 2.97)**
Just right	1.72 (1.20, 2.46)**	1.57 (1.13, 2.18)**
Insufficient	1.00	1.00

*p<0.05, **p<0.01.

Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

Table 3. Results of adjusted general linear model for PCS12 and SES indicators

	Male (β, 95% CI)	Female (β, 95% CI)
Education		
Post-secondary	4.96 (1.87, 8.05)**	-0.95 (-5.64, 3.74)
Secondary	3.10 (0.45, 5.76)*	1.55 (-0.71, 3.81)
Primary	2.73 (0.21, 5.24)*	2.52 (1.06, 3.98)**
Uneducated	2.87 (-0.04, 5.79)	1.10 (-0.50, 2.70)
Illiterate	0.00	0.00
House Tenure		
Self-owned	0.74 (-0.37, 1.86)	0.29 (-0.92, 1.49)
Rented	0.00	0.00
Income		
>10,000	5.42 (2.27, 8.57)**	1.90 (-2.57, 6.37)
6,000~9,999	3.75 (1.42, 6.08)**	1.28 (-1.54, 4.10)
3,000~5,999	3.11 (1.37, 4.86)**	1.48 (-0.65, 3.61)
2,000~2,999	2.94 (1.18, 4.69)**	0.87 (-1.30, 3.04)
1,000~1,999	3.15 (1.34, 4.95)**	1.17 (-1.31, 3.65)
<1,000	0.00	0.00
Expenditure		
>10,000	4.62 (0.25, 9.00)*	-2.06 (-6.73, 2.61)
6,000~9,999	3.40 (1.33, 5.47)**	0.42 (-1.85, 2.69)
3,000~5,999	3.02 (1.21, 4.82)**	-0.88 (-2.63, 0.87)
2,000~2,999	2.91 (1.10, 4.73)**	-0.86 (-2.70, 0.98)
<2,000	0.00	0.00
Occupation		
Professionals	2.63 (0.82, 4.45)**	0.75 (-1.73, 3.23)
Technical Workers	0.96 (-0.55, 2.46)	1.31 (-0.02, 2.65)
Unemployed	--	1.53 (-0.29, 3.36)
Elementary Workers	0.00	0.00
Economic Hardship		
More than enough	5.60 (2.95, 8.24)**	5.95 (2.33, 9.56)**
Enough	3.61 (2.02, 5.20)**	4.39 (2.73, 6.05)**
Just right	2.56 (0.90, 4.22)**	2.73 (1.09, 4.36)**
Insufficient	0.00	0.00

*p<0.05, **p<0.01.

Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

Table 4. Results of adjusted general linear model for MCS12 and SES indicators

	Male (β, 95% CI)	Female (β, 95% CI)
Education		
Post-secondary	3.00 (0.09, 5.91)*	6.58 (1.69, 11.47)**
Secondary	0.46 (-2.04, 2.96)	0.51 (-1.83, 2.87)
Primary	0.03 (-2.34, 2.41)	0.27 (-1.25, 1.79)
Uneducated	-0.63 (-3.36, 2.11)	0.44 (-1.23, 2.11)
Illiterate	0.00	0.00
House Tenure		
Self-owned	0.63 (-0.41, 1.68)	1.01 (-0.26, 2.27)
Rented	0.00	0.00
Income		
>10,000	-0.60 (-3.55, 2.35)	1.56 (-3.10, 6.22)
6,000~9,999	-0.70 (-2.89, 1.49)	1.51 (-1.43, 4.45)
3,000~5,999	0.27 (-1.37, 1.90)	1.32 (-0.90, 3.53)
2,000~2,999	0.29 (-1.36, 1.94)	0.92 (-1.35, 3.18)
1,000~1,999	0.49 (-1.20, 2.19)	0.09 (-2.50, 2.67)
<1,000	0.00	0.00
Expenditure		
>10,000	-2.97 (-7.06, 1.12)	-2.35 (-7.22, 2.52)
6,000~9,999	-1.32 (-3.26, 0.61)	-2.31 (-4.68, 0.06)
3,000~5,999	-1.17 (-2.86, 0.53)	-0.92 (-2.74, 0.91)
2,000~2,999	-0.91 (-2.61, 0.79)	-0.98 (-2.90, 0.94)
<2,000	0.00	0.00
Occupation		
Professionals	3.39 (1.69, 5.10)**	3.65 (1.08, 6.22)**
Technical Workers	2.00 (0.59, 3.42)**	1.20 (-0.19, 2.58)
Unemployed	--	0.74 (-1.16, 2.63)
Elementary Workers	0.00	0.00
Economic Hardship		
More than enough	9.57 (7.17, 11.97)**	10.26 (6.56, 13.96)**
Enough	7.03 (5.58, 8.48)**	6.98 (5.28, 8.68)**
Just right	4.38 (2.87, 5.88)**	3.93 (2.25, 5.60)**
Insufficient	0.00	0.00

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

Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	*8*
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6,8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10-11
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	22-23
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-11, 22-25
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-11
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

A Cross-sectional Study on Socioeconomic Status and Health-Related Quality of Life among Elderly Chinese

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A Cross-sectional Study on Socioeconomic Status and Health-Related Quality of Life among Elderly Chinese

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Key Words: socioeconomic status, quality of life, elderly, Hong Kong, Chinese

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Article focus

- The effect of socioeconomic status on health-related quality of life among elderly Chinese population

Key messages

- Most indicators of socioeconomic status were associated with health-related quality of life among elderly Chinese
- Subjective socioeconomic status indicator showed much stronger association with health-related quality of life than objective indicators
- Educational level, occupational level and economic indicators such as income and expenditure tended to associate with physical dimension of health-related quality of life only among elderly Chinese men.

Strengths and limitations of this study

- This is the first study to examine socioeconomic status and health-related quality of life among elderly Chinese
- Survival bias may exist because the baseline survey was voluntary and we excluded all those who had died in the telephone survey
- A large number of elderly Chinese in Hong Kong receive a welfare payment from the Hong Kong government and they may report this as their monthly income
- There may be floor or ceiling effects for self-reported health because we only have three categories for this variable

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ABSTRACT

Objectives: To examine the association between socioeconomic status (SES) and health-related quality of life (HRQOL) in a sample of elderly Chinese people in Hong Kong.

Study Design: Cross-sectional study.

Setting: 18 Elderly Health Centers in Hong Kong.

Participants: This study was based on a cohort aged 65 years or above who were enrolled in the Elderly Health Services from 1998 to 2005 in Hong Kong. Initially 3,324 subjects were randomly sampled from the baseline database. In the end, 2,441 successful cases were obtained for the telephone survey. After excluding cases with missing SES or HRQOL information and the cases whose questionnaires were answered by their family members, 2,347 subjects were included in the final analysis.

Results: Elderly Chinese with less subjective economic hardship reported much better self-rated health (SRH) (Odds Ratio (OR) 1.57-4.70, all p<0.01) and higher SF12 scores (β 2.56-10.26, all p<0.01) than those with economic hardship. Male subjects in the highest education and occupation subgroup reported better HRQOL comparing with the baseline subgroup (OR for SRH 1.91-3.26, p<0.01; β 2.63-4.96, p<0.05). Two economic indicators, income and expenditure, only showed significant positive associations with physical SF12 scores for men (β 2.91-5.42, all p<0.05). Housing tenure was associated with SRH (OR 1.34 for men and 1.27 for women, p<0.05) but not SF12 scores.

Conclusions: Economic hardship showed the strongest association with HRQOL among all SES indicators. Educational level, occupational level and economic indicators tended to associate with physical HRQOL only among elderly Chinese men. More attention should be placed on subjective SES indicators when investigating influences on HRQOL among elderly Chinese people.

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BACKGROUND

There is a well-established inverse relationship between socioeconomic status (SES) and health according to which people with higher SES experience fewer health problems compared with people with lower SES.[1-3] This association has been identified in both individual-[4-7] and neighborhood-level SES indicators,[8, 9] for almost all health outcomes including mortality,[10-12] morbidity[13, 14] and disability.[13-16]

With aging populations and increasing burden of chronic diseases, health-related quality of life (HRQOL) has been paid more attention. SES has been linked to several measures of HRQOL in previous studies, including self-rated health (SRH),[17-19] the Medical Outcomes Study short form (SF) 36/20/12,[20-25] and other measures.[26, 27] People with higher SES are more likely to report better HRQOL than those with lower SES. Using the most validated instrument of HRQOL, Thumboo et al. found that there were 0.5-0.6 points increase in SF-36 score per year's increase in education and 3.5-4.0 points increase in score with a better housing type.[23] In a Norwegian study using SF12, researchers found that both physical and mental dimensions of HRQOL were correlated with education and occupation.[28]

Although consistent results were reported in previous studies about SES and HRQOL, the evidence was still limited among Chinese populations, especially among elderly people. Lam et al. examined the effect of HRQOL on health service utilities and validated the SF12 in a Chinese sample; however, no studies were conducted on SES by them.[29, 30] Cheng et al. used a subjective SES indicator (economic hardship) and found that Chinese who reported economic hardship were more likely to rate lower SRH.[31] Several recent studies examined SES and HRQOL among Chinese, however, all focused on special populations such as elderly living alone,[32] elderly with

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hearing impairment[33] or patients with some diseases.[34] To date, no studies have investigated the association between SES and HRQOL among healthy elderly Chinese.

This study was designed to measure SES and HRQOL in a representative sample of elderly Chinese people in Hong Kong, and to identify the potential relationship between SES indicators and HRQOL. Finding from present study will enhance our understanding on the effect of SES on HRQOL, and provide recommendations on improvement of HRQOL among elderly Chinese.

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METHODS

Study Design and Study Population

This was a cross-sectional study with combination of baseline data and a subsequent telephone survey several years later. The subjects in the baseline database were recruited by the Elderly Health Services (EHS) of the Department of Health, Hong Kong Government, in their Elderly Health Centers (EHC), from May 1998 to December 2005. The subjects were ambulatory, aged at least 65 at enrollment and likely to be representative of the healthy elderly Chinese in Hong Kong. When the participants first registered, a detailed face-to-face interview was performed by trained nurses of EHC using a standardized questionnaire developed by EHS comprising information on demographic (age, sex, marital status, height, weight), lifestyle (smoking, alcohol use, exercise), socioeconomic (educational level, living alone or not, social contact and finance), health-related, and disease-related information (hospitalization, active diseases, number of falls, medication, self-rated health, family history of chronic diseases). In order to collect information about SES and HRQOL, a telephone survey was performed aimed at 3,324 subjects randomly sampled from the baseline database after stratification by age and gender from October 2006 to January 2007. The mean time of gap from baseline interview to telephone survey was 1985±765 days (ranged from 302 to 3137 days). In order to obtain most update data, information on marriage, smoking, alcohol use, exercise, hospitalization and living alone or not was also collected during the telephone interview even though we had such information from the baseline survey. In the end, 2,441 successful cases were obtained for the telephone survey with a crude response rate 67.4% (2,441/3,324) and an adjusted response rate 92.6% (2,441/(2,441+49 refused+147 unreached)). After excluding cases with missing SES or HRQOL information (N=78) and the cases whose questionnaires were answered by their family

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members (N=16), 2,347 subjects were included into the final analysis. The telephone interview

was performed in Cantonese. The study was approved by the Ethics Committees of the

University of Hong Kong and of the Department of Health.

Measures

Six SES indicators were included in this study: education, housing tenure, previous

occupation, monthly income, monthly expenditure, and economic hardship. Education was coded

into five categories from the highest post-secondary, through secondary, primary, uneducated but

can read and write, to the lowest, illiterate. Housing tenure was defined as self-owned or non-

self-owned. Since most subjects were now retired from work, the question about occupation

sought information on the job with the longest duration in the past. For occupation, three

categories for men (professional, technical and elementary workers) and four categories for

women (professional, technical, unemployed, and elementary workers) were coded, because only

a few men were unemployed for long periods. Monthly income was coded into six categories,

<1,000, 1,000-1,999, 2,000-2,999, 3,000-5,999, 6,000-9,999, and ≥10,000 HK dollars and

monthly expenditure was coded into five categories, <2,000, 2,000-2,999, 3,000-5,999, 6,000-

9,999, and ≥10,000 HK dollars. A simple question was used to evaluate self-rated economic

hardship, "Do you think you have sufficient money to cover your daily expenses?", and the

answers were "more than enough", "enough", "just right" and "insufficient".[31]

HRQOL information was collected in the telephone survey based on SRH and SF12. SRH

was measured by a simple question in which subjects were asked to rate their health status

compared to their peers, and the possible answers were "better", "normal", or "worse". The SF12,

an abbreviated version of the SF-36 health questionnaire, covers 8 domains with 12 items and

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measures HRQOL in a physical component score (PCS12) and a mental component score (MCS12).[35] The instrument has been validated in Hong Kong and, by using the same scoring system as the standard SF12 but weighting using the Chinese (HK) specific PCS and MCS regression coefficients for each item response,[36] the PCS12 and MCS12 scores could range from 0 to 100. A higher score indicated a better HRQOL and vice versa.[29-30]

Covariates in this study included age, marriage (married, single, ex-married including widowed and divorced), living alone or not (yes, no), smoking history (never smoking, current smoking, quit smoking), alcohol use (drink at least one day per week in the past one month or not), exercise (times/week), BMI, hospitalization (yes, no), diagnosis of hypertension, diabetes mellitus, heart diseases, musculoskeletal disease, chronic pulmonary disease and hearing loss (yes, no).

Statistical Analysis

The sample size calculation was based on being able to identify a difference of ± 0.1 in the weight measure which ranged from 0 to 1.0. With an alpha of 5%, power of 90% and a 2-sided test, a minimum of 1,680 subjects was needed. The calculation was conducted by G-power software. To allow for incomplete and inconsistent data, we planned to aim for 2,400 subjects to be interviewed. In addition, considering the dead cases, missing cases and non-response cases during interview, according to the experiences of former studies based on this EHS database (response rate was about 71.1%) and the outcome of a pilot study (response rate was 88.5%), 3,400 cases were initially be sampled to meet the target 2400 cases. The data were entered into Excel (Microsoft) and, by matching subjects' unique Hong Kong ID numbers the data from the telephone survey were merged with the baseline database. Means and proportions were

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compared between men and women for continuous and categorical variables by T-test or Chi-square test, respectively. Because significant difference was found among most of the variables between two genders, all the multivariate analyses were performed with stratification on gender. Ordinal Logistic regression models were used to examine the effect of SES on SRH, since there were three ordered scales for SRH. General Linear Models (GLM) were used to identify the association between SF12 score (PCS12 and MCS12) and SES. Colinearity and interactions were examined in all models. Only one variable was kept in the model if colinearity was detected between the variables. Significant interaction terms were included in the models if detected. All covariates above were included in the models unless colinearity was found. When examining the association between an SES indicator with HRQOL outcomes, all other SES indicators were included in the adjusted models as covariates. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the adjusted models. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two. The level of statistical significance was set at p<0.05. All statistical analyses were performed using SAS 9.2 (Cary, NC, USA).

RESULTS

Characteristics of the sample for the telephone survey were summarized by gender in **Table 1**. The average age of male and female subjects was the same because we sampled the subjects by age and gender. Male respondents were more inclined to be married, to be current smokers and alcohol users, and to have lower BMI than female respondents. Elderly Chinese men were more likely to have a higher educational level, live in a self-owned house, have a lower monthly income and a higher monthly expenditure, report less economic hardship, and have a higher level of occupation than similarly aged women. For the outcomes of HRQOL, men were more likely to report better SRH than women in this study. Both physical and mental component SF12 scores were higher in men than in women in this sample.

Table 2 showed the results of adjusted ordinal logistic regression for SRH and each SES indicator. Subjects with higher educational levels reported better SRH than those with lower educational levels, especially for men with post-secondary and secondary level education. Elderly people living in their own houses were more likely to report better SRH than those living in rented or public housing. Compared to the lowest income group, men with 6,000-9,999 HK$ monthly income reported better SRH; however, no difference was found between other groups. Male professional or technical workers and female professional or unemployed workers were more likely to report better SRH than elementary workers. Economic hardship showed the strongest relationship with SRH among all the SES indicators. For men, current smoking, hospitalization in past 12 months, and diagnosis of chronic diseases were associated with worse SRH. For women, only hospitalization and diagnosis of chronic diseases were associated with worse SRH.

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The results on associations between SES indicators and PCS12 as well as MCS12 scores were presented in **Table 3** and **Table 4**, respectively. For men, a significant association was found between PCS12 score and SES for all SES indicators except housing tenure, which indicated that men with higher SES were more likely to report a higher PCS12 score. Only education and economic hardship were found to be related with PCS12 scores for elderly women. Significant associations were found for education (post-secondary vs illiterate), occupation (professional and technical vs elementary for men, professional vs elementary for women), and economic hardship with MCS12. Economic hardship was identified as the strongest predictor for both mental and physical SF12 score among six SES indicators. For the covariates, elderly Chinese with older age, hospitalization in past months and diagnosis of chronic diseases experienced lower PCS12 score. Exercise was positively associated with MCS12, but BMI was negatively associated with MCS12 in men. Women with younger age, ex-married marriage status, hospitalization, and diagnosis of chronic diseases experienced lower MCS12.

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DISCUSSION

Most elderly people reported SRH not worse than their peers. The average PCS12 score was 40.3 and MCS12 score was 51.5 among this elderly Chinese sample. Men tended to report better HRQOL than women. Educational level and occupation were positively associated with HRQOL. Housing tenure was significantly associated with SRH only. Economic SES indicators (monthly income and expenditure) only showed a weak association with physical SF12 scores in men. Economic hardship showed the strongest association with HRQOL among all SES indicators in both men and women.

Using SRH and SF12 as measurements of HRQOL, our results confirmed the association between HRQOL and education[5, 37-42] and occupation among a Chinese sample.[6, 43, 44] Housing tenure was only found to be related with SRH for both men and women. This result confirmed the findings in Dunn's study that the people living in rented houses were approximately 3 times as likely to report worse SRH than those living in self-owned houses.[4] In this study, we present results similar to previous studies which showed that HRQOL inequalities by SES are larger in the physical domain than in the mental domain of HRQOL.[22, 23]

Objective economic SES indicators (monthly income and expenditure) showed only a weak association with the physical domain of HRQOL in the present study, which conflicts with findings from several previous studies.[7, 42] However subjective economic SES indicators of economic hardship showed strong associations with all HRQOL measurements in both men and women. The findings of non-significant associations between HRQOL and economic SES indicators might be because many of our poorer elderly subjects received a welfare payment from the Hong Kong Government. Because income was not a good indicator for people after retirement, we included monthly expenditure in our telephone survey. However, expenditure

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showed no associations with any HRQOL measures. Because many elderly Chinese live with their children or other family members, we cannot tell if the expenditure was for the whole family or themselves. Economic hardship showed the strongest association with HRQOL in the present study. Economic hardship was identified much stronger association with SRH than educational level by Cheng et al;[31] however, few studies contained both economic hardship and other SES indicators. With respect to this strong association, there were some possible explanations. At first, obviously, economic hardship was more meaningful than income. Higher income does not mean more available money, if compared with higher expenditure, but economic hardship does. In addition, people with larger economic hardship endured much more pressures and depressions which in turn affected health. In this study, economic hardship was found to be more strongly related to mental than physical HRQOL. This was mainly due to the subjectivity character of economic hardship (MCS was more subjective than PCS). According to the outcomes in present study, economic hardship showed a stronger positively association in female than in male, contrast to other SES indicators. This indicator may truly reflect the difference between these two sexes that women were more likely to care about their available money and avoid the occurrence of economic hardship than men. This potential explanation coincided with the different perceptions toward money management between two sexes in Chinese.

Men were more likely to report better HRQOL than women in the present study, which confirmed findings based on western populations in previous studies.[18, 21] For objective SES indicators (education, housing tenure, occupation and income), men showed stronger associations with HRQOL than women. However for subjective SES indicators of economic hardship, the association with HRQOL was a little stronger in women than in men. The

difference by sex can be ascribed to different structure of educational level and occupation between males and females. For instance, compared to males, 80% female elderly Chinese had primary or lower education. This concentration attenuated the difference of HRQOL with baseline group in females, which resulted in the different association between sexes. The difference between men and women for the relationship between HRQOL and economic SES indicators might be contributed to by the fact that the income of the whole family is often managed by the wife in Chinese families.

Several limitations need to be considered. First, as mentioned in many SES and health studies, the cross-sectional design was the most important limitation in this study. Even though we have baseline data and a follow-up telephone survey, our design was still cross-sectional because no longitudinal data were collected and used. Second, the baseline elderly sample may not represent the whole elderly population in Hong Kong. Because the subjects recruited in the baseline were all volunteers, they may be much healthier and more careful with their health. In addition, we sampled the subjects stratified by age and sex for the telephone survey, thus we included more older and male people in the telephone sample. We also excluded the aged with speaking and listening disabilities from the sample during the telephone survey. Thus, the results may not be generalized to whole Hong Kong elderly population. Third, survival bias may exist because the attendance which gave rise to enrollment and the baseline survey was voluntary and we excluded all those who had died in the telephone survey. Fourth, there were some flaws in the SES indicators. A large number of elderly Chinese in Hong Kong receive a welfare payment from the Hong Kong government and they may report this as their monthly income. We grouped housing tenure into self-owned house and others, so we did not know the size and quality of the

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houses. In the end, there may be floor or ceiling effects for SRH because we only have three categories for SRH.

There were several advantages in this study. At first, this may be the first study to identify the association between all individual SES indicators and HRQOL based on SRH and SF-12 among healthy elderly Chinese population. In addition, six individual-level SES indicators were contained in present study, including expenditure and economic hardship, which scarcely occurred in these kinds of studies. Together with demographic, lifestyle, and chronic disease factors, these SES indicators were also adjusted in multivariate models. Moreover, this study was conducted in a large sample and the response rate was good comparing with other similar designs. At meantime, disease factors, which may play a big role on HRQOL in the elderly, were controlled in this study.

In conclusion, elderly Chinese men reported better HRQOL than women. Economic hardship, education, housing tenure, and occupation were identified to be associated with HRQOL among elderly Chinese. Subjective SES indicators might impact more on HRQOL among elderly people than more traditional objective measures. Future research is needed to interpret the strong association between subjective SES indicator and HRQOL among elderly Chinese. Only individual level measures of SES were included in present study, thus SES at community and neighborhood levels were needed. Considering the positive association between SES and HRQOL, improving SES level seems the most direct way to gain HRQOL benefits among elderly Chinese.

Conflict of interest: None.

Ethics approval: The study was approved by the Ethics Committees of the University of Hong Kong and of the Department of Health.

Data sharing statement: No additional data are available.

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Table 1. Characteristics of the sample for telephone survey by gender

	Male		Female		P Value
	N	**%**	**N**	**%**	
Sample Size	1,201	51.2	1,146	48.8	
Age (Years, Mean, SD)	77.3	6.6	77.3	6.6	0.959
Marital Status					<0.001
Ex-married	194	16.2	734	64.0	
Single	31	2.6	22	1.9	
Married	974	81.2	389	34.0	
Smoking History					<0.001
Never	375	31.2	498	43.5	
Current	606	50.5	437	38.1	
Quit	220	18.3	211	18.4	
Alcohol Use	410	34.1	199	17.4	<0.001
Exercise (Times/week, Mean, SD)	5.6	2.6	5.4	2.7	0.068
BMI (Kg/m^2, Mean, SD)	23.7	3.1	24.1	3.9	<0.01
Hospitalization	218	18.2	219	19.1	0.560
Self-Rated Health					<0.001
Better	452	37.6	302	26.4	
Normal	632	52.6	643	56.1	
Worse	117	9.7	201	17.5	
PCS12 score (Mean, SD)	42.9	10.8	37.6	11.1	<0.001
MCS12 score (Mean, SD)	52.8	9.0	50.2	10.8	<0.001

Table 1. Characteristics of the sample for telephone survey by gender (cont.)

	Male		Female		P Value
	N	%	N	%	
Education Level					<0.001
Post-secondary	105	8.7	19	1.7	
Secondary	300	25.0	101	8.8	
Primary	610	50.8	355	31.0	
Uneducated	127	10.6	242	21.1	
Illiterate	59	4.9	429	37.4	
House Tenure					<0.001
Self-owned	627	52.2	500	43.6	
Non-self-owned	574	47.8	646	56.4	
Income					<0.001
>10,000	46	3.8	25	2.2	
6,000-9,999	102	8.5	97	8.5	
3,000-5,999	321	26.7	421	36.7	
2,000-2,999	295	24.6	339	29.6	
1,000-1,999	260	21.7	150	13.1	
<1,000	177	14.7	114	10.0	
Expenditure					<0.001
>10,000	21	1.8	21	1.8	
6,000-9,999	196	16.3	135	11.8	
3,000-5,999	434	36.1	467	40.8	
2,000-2,999	410	34.1	345	30.1	
<2,000	140	11.7	178	15.5	
Economic Hardship					<0.001
More than enough	85	7.1	39	3.4	
Enough	551	45.9	447	39.0	
Just right	372	31.0	440	38.4	
Insufficient	193	16.1	220	19.2	
Occupation					<0.001
Professional	261	21.7	79	6.9	
Workers	747	62.2	436	38.1	
Elementary	185	15.4	466	40.7	
Unemployed	8	0.7	165	14.4	

Table 2. Results of adjusted ordinal logistic regression models for SRH and SES indicators

	Male (OR, 95% CI)	Female (OR, 95% CI)
Education		
Post-secondary	3.26 (1.68, 6.33)**	1.32 (0.53, 3.32)
Secondary	2.43 (1.37, 4.28)**	1.67 (1.07, 2.61)*
Primary	1.55 (0.91, 2.65)	1.49 (1.12, 1.99)**
Uneducated	1.67 (0.90, 3.10)	0.98 (0.72, 1.35)
Illiterate	1.00	1.00
House Tenure		
Self-owned	1.34 (1.06, 1.70)*	1.27 (1.00, 1.61)*
Non-self-owned	1.00	1.00
Income		
>10,000	1.95 (0.99, 3.85)	0.99 (0.41, 2.37)
6,000~9,999	1.96 (1.19, 3.22)**	1.49 (0.86, 2.60)
3,000~5,999	1.11 (0.77, 1.61)	1.10 (0.72, 1.67)
2,000~2,999	1.41 (0.97, 2.04)	1.03 (0.67, 1.57)
1,000~1,999	1.40 (0.96, 2.05)	1.06 (0.65, 1.73)
<1,000	1.00	1.00
Expenditure		
>10,000	1.05 (0.42, 2.65)	0.50 (0.20, 1.25)
6,000~9,999	1.57 (1.01, 2.43)	1.07 (0.68, 1.67)
3,000~5,999	1.28 (0.88, 1.88)	0.94 (0.66, 1.32)
2,000~2,999	1.41 (0.96, 2.07)	0.92 (0.64, 1.32)
<2,000	1.00	1.00
Occupation		
Professionals	1.91 (1.30, 2.82)**	2.28 (1.40, 3.71)**
Technical Workers	1.50 (1.09, 2.07)*	1.16 (0.89, 1.51)
Unemployed	--	1.51 (1.05, 2.16)*
Elementary Workers	1.00	1.00
Economic Hardship		
More than enough	4.61 (2.54, 8.37)**	4.70 (2.26, 9.77)**
Enough	2.06 (1.46, 2.91)**	2.12 (1.52, 2.97)**
Just right	1.72 (1.20, 2.46)**	1.57 (1.13, 2.18)**
Insufficient	1.00	1.00

a. *p<0.05, **p<0.01.

b. OR=odds ratio; 95% CI=95% confidence interval.

c. Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

Table 3. Results of adjusted general linear model for PCS12 and SES indicators

	Male (β, 95% CI)	Female (β, 95% CI)
Education		
Post-secondary	4.96 (1.87, 8.05)**	-0.95 (-5.64, 3.74)
Secondary	3.10 (0.45, 5.76)*	1.55 (-0.71, 3.81)
Primary	2.73 (0.21, 5.24)*	2.52 (1.06, 3.98)**
Uneducated	2.87 (-0.04, 5.79)	1.10 (-0.50, 2.70)
Illiterate	0.00	0.00
House Tenure		
Self-owned	0.74 (-0.37, 1.86)	0.29 (-0.92, 1.49)
Non-self-owned	0.00	0.00
Income		
>10,000	5.42 (2.27, 8.57)**	1.90 (-2.57, 6.37)
6,000~9,999	3.75 (1.42, 6.08)**	1.28 (-1.54, 4.10)
3,000~5,999	3.11 (1.37, 4.86)**	1.48 (-0.65, 3.61)
2,000~2,999	2.94 (1.18, 4.69)**	0.87 (-1.30, 3.04)
1,000~1,999	3.15 (1.34, 4.95)**	1.17 (-1.31, 3.65)
<1,000	0.00	0.00
Expenditure		
>10,000	4.62 (0.25, 9.00)*	-2.06 (-6.73, 2.61)
6,000~9,999	3.40 (1.33, 5.47)**	0.42 (-1.85, 2.69)
3,000~5,999	3.02 (1.21, 4.82)**	-0.88 (-2.63, 0.87)
2,000~2,999	2.91 (1.10, 4.73)**	-0.86 (-2.70, 0.98)
<2,000	0.00	0.00
Occupation		
Professionals	2.63 (0.82, 4.45)**	0.75 (-1.73, 3.23)
Technical Workers	0.96 (-0.55, 2.46)	1.31 (-0.02, 2.65)
Unemployed	--	1.53 (-0.29, 3.36)
Elementary Workers	0.00	0.00
Economic Hardship		
More than enough	5.60 (2.95, 8.24)**	5.95 (2.33, 9.56)**
Enough	3.61 (2.02, 5.20)**	4.39 (2.73, 6.05)**
Just right	2.56 (0.90, 4.22)**	2.73 (1.09, 4.36)**
Insufficient	0.00	0.00

a. *p<0.05, **p<0.01.

b. OR=odds ratio; 95% CI=95% confidence interval.

c. Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

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Table 4. Results of adjusted general linear model for MCS12 and SES indicators

	Male (β, 95% CI)	Female (β, 95% CI)
Education		
Post-secondary	3.00 (0.09, 5.91)*	6.58 (1.69, 11.47)**
Secondary	0.46 (-2.04, 2.96)	0.51 (-1.83, 2.87)
Primary	0.03 (-2.34, 2.41)	0.27 (-1.25, 1.79)
Uneducated	-0.63 (-3.36, 2.11)	0.44 (-1.23, 2.11)
Illiterate	0.00	0.00
House Tenure		
Self-owned	0.63 (-0.41, 1.68)	1.01 (-0.26, 2.27)
Non-self-owned	0.00	0.00
Income		
>10,000	-0.60 (-3.55, 2.35)	1.56 (-3.10, 6.22)
6,000~9,999	-0.70 (-2.89, 1.49)	1.51 (-1.43, 4.45)
3,000~5,999	0.27 (-1.37, 1.90)	1.32 (-0.90, 3.53)
2,000~2,999	0.29 (-1.36, 1.94)	0.92 (-1.35, 3.18)
1,000~1,999	0.49 (-1.20, 2.19)	0.09 (-2.50, 2.67)
<1,000	0.00	0.00
Expenditure		
>10,000	-2.97 (-7.06, 1.12)	-2.35 (-7.22, 2.52)
6,000~9,999	-1.32 (-3.26, 0.61)	-2.31 (-4.68, 0.06)
3,000~5,999	-1.17 (-2.86, 0.53)	-0.92 (-2.74, 0.91)
2,000~2,999	-0.91 (-2.61, 0.79)	-0.98 (-2.90, 0.94)
<2,000	0.00	0.00
Occupation		
Professionals	3.39 (1.69, 5.10)**	3.65 (1.08, 6.22)**
Technical Workers	2.00 (0.59, 3.42)**	1.20 (-0.19, 2.58)
Unemployed	--	0.74 (-1.16, 2.63)
Elementary Workers	0.00	0.00
Economic Hardship		
More than enough	9.57 (7.17, 11.97)**	10.26 (6.56, 13.96)**
Enough	7.03 (5.58, 8.48)**	6.98 (5.28, 8.68)**
Just right	4.38 (2.87, 5.88)**	3.93 (2.25, 5.60)**
Insufficient	0.00	0.00

a. *p<0.05, **p<0.01.

b. OR=odds ratio; 95% CI=95% confidence interval.

c. Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

A Cross-sectional Study on Socioeconomic Status and Health-Related Quality of Life among Elderly Chinese

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Article focus

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- The effect of socioeconomic status on health-related quality of life among elderly Chinese population

Key messages

- Most indicators of socioeconomic status were associated with health-related quality of life among elderly Chinese
- Subjective socioeconomic status indicator showed much stronger association with health-related quality of life than objective indicators
- Educational level, occupational level and economic indicators such as income and expenditure tended to associate with physical dimension of health-related quality of life only among elderly Chinese men.

Strengths and limitations of this study

- This is the first study to examine socioeconomic status and health-related quality of life among elderly Chinese
- Survival bias may exist because the baseline survey was voluntary and we excluded all those who had died in the telephone survey
- A large number of elderly Chinese in Hong Kong receive a welfare payment from the Hong Kong government and they may report this as their monthly income
- There may be floor or ceiling effects for self-reported health because we only have three categories for this variable

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ABSTRACT

Objectives: To examine the association between socioeconomic status (SES) and health-related quality of life (HRQOL) in a sample of elderly Chinese people in Hong Kong.

Study Design: Cross-sectional study.

Setting: 18 Elderly Health Centers in Hong Kong.

Participants: This study was based on a cohort aged 65 years or above who were enrolled in the Elderly Health Services from 1998 to 2005 in Hong Kong. Initially 3,324 subjects were randomly sampled from the baseline database. In the end, 2,441 successful cases were obtained for the telephone survey. After excluding cases with missing SES or HRQOL information and the cases whose questionnaires were answered by their family members, 2,347 subjects were included in the final analysis.

Results: Elderly Chinese with less subjective economic hardship reported much better self-rated health (SRH) (Odds Ratio (OR) 1.57-4.70, all p<0.01) and higher SF12 scores (β 2.56-10.26, all p<0.01) than those with economic hardship. Male subjects in the highest education and occupation subgroup reported better HRQOL comparing with the baseline subgroup (OR for SRH 1.91-3.26, p<0.01; β 2.63-4.96, p<0.05). Two economic indicators, income and expenditure, only showed significant positive associations with physical SF12 scores for men (β 2.91-5.42, all p<0.05). Housing tenure was associated with SRH (OR 1.34 for men and 1.27 for women, p<0.05) but not SF12 scores.

Conclusions: Economic hardship showed the strongest association with HRQOL among all SES indicators. Educational level, occupational level and economic indicators tended to associate with physical HRQOL only among elderly Chinese men. More attention should be placed on subjective SES indicators when investigating influences on HRQOL among elderly Chinese people.

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BACKGROUND

There is a well-established inverse relationship between socioeconomic status (SES) and health according to which people with higher SES experience fewer health problems compared with people with lower SES.[1-3] This association has been identified in both individual-[4-7] and neighborhood-level SES indicators,[8, 9] for almost all health outcomes including mortality,[10-12] morbidity[13, 14] and disability.[13-16]

With aging populations and increasing burden of chronic diseases, health-related quality of life (HRQOL) has been paid more attention. SES has been linked to several measures of HRQOL in previous studies, including self-rated health (SRH),[17-19] the Medical Outcomes Study short form (SF) 36/20/12,[20-25] and other measures.[26, 27] People with higher SES are more likely to report better HRQOL than those with lower SES. Using the most validated instrument of HRQOL, Thumboo et al. found that there were 0.5-0.6 points increase in SF-36 score per year's increase in education and 3.5-4.0 points increase in score with a better housing type.[23] In a Norwegian study using SF12, researchers found that both physical and mental dimensions of HRQOL were correlated with education and occupation.[28]

Although consistent results were reported in previous studies about SES and HRQOL, the evidence was still limited among Chinese populations, especially among elderly people. Lam et al. examined the effect of HRQOL on health service utilities and validated the SF12 in a Chinese sample; however, no studies were conducted on SES by them.[29, 30] Cheng et al. used a subjective SES indicator (economic hardship) and found that Chinese who reported economic hardship were more likely to rate lower SRH.[31] Several recent studies examined SES and HRQOL among Chinese, however, all focused on special populations such as elderly living alone,[32] elderly with

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hearing impairment[33] or patients with some diseases.[34] To date, no studies have investigated the association between SES and HRQOL among healthy elderly Chinese.

This study was designed to measure SES and HRQOL in a representative sample of elderly Chinese people in Hong Kong, and to identify the potential relationship between SES indicators and HRQOL. Finding from present study will enhance our understanding on the effect of SES on HRQOL, and provide recommendations on improvement of HRQOL among elderly Chinese.

METHODS

Study Design and Study Population

This was a cross-sectional study with combination of baseline data and a subsequent telephone survey several years later. The subjects in the baseline database were recruited by the Elderly Health Services (EHS) of the Department of Health, Hong Kong Government, in their Elderly Health Centers (EHC), from May 1998 to December 2005. The subjects were ambulatory, aged at least 65 at enrollment and likely to be representative of the healthy elderly Chinese in Hong Kong. When the participants first registered, a detailed face-to-face interview was performed by trained nurses of EHC using a standardized questionnaire developed by EHS comprising information on demographic (age, sex, marital status, height, weight), lifestyle (smoking, alcohol use, exercise), socioeconomic (educational level, living alone or not, social contact and finance), health-related, and disease-related information (hospitalization, active diseases, number of falls, medication, self-rated health, family history of chronic diseases). In order to collect information about SES and HRQOL, a telephone survey was performed aimed at 3,324 subjects randomly sampled from the baseline database after stratification by age and gender from October 2006 to January 2007. The mean time of gap from baseline interview to telephone survey was 1985±765 days (ranged from 302 to 3137 days). In order to obtain most update data, information on marriage, smoking, alcohol use, exercise, hospitalization and living alone or not was also collected during the telephone interview even though we had such information from the baseline survey. In the end, 2,441 successful cases were obtained for the telephone survey with a crude response rate 67.4% (2,441/3,324) and an adjusted response rate 92.6% (2,441/(2,441+49 refused+147 unreached)). After excluding cases with missing SES or HRQOL information (N=78) and the cases whose questionnaires were answered by their family

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members (N=16), 2,347 subjects were included into the final analysis. The telephone interview

was performed in Cantonese. The study was approved by the Ethics Committees of the

University of Hong Kong and of the Department of Health.

Measures

Six SES indicators were included in this study: education, housing tenure, previous

occupation, monthly income, monthly expenditure, and economic hardship. Education was coded

into five categories from the highest post-secondary, through secondary, primary, uneducated but

can read and write, to the lowest, illiterate. Housing tenure was defined as self-owned or non-

self-owned. Since most subjects were now retired from work, the question about occupation

sought information on the job with the longest duration in the past. For occupation, three

categories for men (professional, technical and elementary workers) and four categories for

women (professional, technical, unemployed, and elementary workers) were coded, because only

a few men were unemployed for long periods. Monthly income was coded into six categories,

<1,000, 1,000-1,999, 2,000-2,999, 3,000-5,999, 6,000-9,999, and ≥10,000 HK dollars and

monthly expenditure was coded into five categories, <2,000, 2,000-2,999, 3,000-5,999, 6,000-

9,999, and ≥10,000 HK dollars. A simple question was used to evaluate self-rated economic

hardship, "Do you think you have sufficient money to cover your daily expenses?", and the

answers were "more than enough", "enough", "just right" and "insufficient".[31]

HRQOL information was collected in the telephone survey based on SRH and SF12. SRH

was measured by a simple question in which subjects were asked to rate their health status

compared to their peers, and the possible answers were "better", "normal", or "worse". The SF12,

an abbreviated version of the SF-36 health questionnaire, covers 8 domains with 12 items and

measures HRQOL in a physical component score (PCS12) and a mental component score (MCS12).[35] The instrument has been validated in Hong Kong and, by using the same scoring system as the standard SF12 but weighting using the Chinese (HK) specific PCS and MCS regression coefficients for each item response,[36] the PCS12 and MCS12 scores could range from 0 to 100. A higher score indicated a better HRQOL and vice versa.[29-30]

Covariates in this study included age, marriage (married, single, ex-married including widowed and divorced), living alone or not (yes, no), smoking history (never smoking, current smoking, quit smoking), alcohol use (drink at least one day per week in the past one month or not), exercise (times/week), BMI, hospitalization (yes, no), diagnosis of hypertension, diabetes mellitus, heart diseases, musculoskeletal disease, chronic pulmonary disease and hearing loss (yes, no).

Statistical Analysis

The sample size calculation was based on being able to identify a difference of ± 0.1 in the weight measure which ranged from 0 to 1.0. With an alpha of 5%, power of 90% and a 2-sided test, a minimum of 1,680 subjects was needed. The calculation was conducted by G-power software. To allow for incomplete and inconsistent data, we planned to aim for 2,400 subjects to be interviewed. In addition, considering the dead cases, missing cases and non-response cases during interview, according to the experiences of former studies based on this EHS database (response rate was about 71.1%) and the outcome of a pilot study (response rate was 88.5%), 3,400 cases were initially be sampled to meet the target 2400 cases. The data were entered into Excel (Microsoft) and, by matching subjects' unique Hong Kong ID numbers the data from the telephone survey were merged with the baseline database. Means and proportions were

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compared between men and women for continuous and categorical variables by T-test or Chi-square test, respectively. Because significant difference was found among most of the variables between two genders, all the multivariate analyses were performed with stratification on gender. Ordinal Logistic regression models were used to examine the effect of SES on SRH, since there were three ordered scales for SRH. General Linear Models (GLM) were used to identify the association between SF12 score (PCS12 and MCS12) and SES. Colinearity and interactions were examined in all models. Only one variable was kept in the model if colinearity was detected between the variables. Significant interaction terms were included in the models if detected. All covariates above were included in the models unless colinearity was found. When examining the association between an SES indicator with HRQOL outcomes, all other SES indicators were included in the adjusted models as covariates. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the adjusted models. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two. The level of statistical significance was set at p<0.05. All statistical analyses were performed using SAS 9.2 (Cary, NC, USA).

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RESULTS

Characteristics of the sample for the telephone survey were summarized by gender in **Table 1**. The average age of male and female subjects was the same because we sampled the subjects by age and gender. Male respondents were more inclined to be married, to be current smokers and alcohol users, and to have lower BMI than female respondents. Elderly Chinese men were more likely to have a higher educational level, live in a self-owned house, have a lower monthly income and a higher monthly expenditure, report less economic hardship, and have a higher level of occupation than similarly aged women. For the outcomes of HRQOL, men were more likely to report better SRH than women in this study. Both physical and mental component SF12 scores were higher in men than in women in this sample.

Table 2 showed the results of adjusted ordinal logistic regression for SRH and each SES indicator. Subjects with higher educational levels reported better SRH than those with lower educational levels, especially for men with post-secondary and secondary level education. Elderly people living in their own houses were more likely to report better SRH than those living in rented or public housing. Compared to the lowest income group, men with 6,000-9,999 HK$ monthly income reported better SRH; however, no difference was found between other groups. Male professional or technical workers and female professional or unemployed workers were more likely to report better SRH than elementary workers. Economic hardship showed the strongest relationship with SRH among all the SES indicators. For men, current smoking, hospitalization in past 12 months, and diagnosis of chronic diseases were associated with worse SRH. For women, only hospitalization and diagnosis of chronic diseases were associated with worse SRH.

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The results on associations between SES indicators and PCS12 as well as MCS12 scores were presented in **Table 3** and **Table 4**, respectively. For men, a significant association was found between PCS12 score and SES for all SES indicators except housing tenure, which indicated that men with higher SES were more likely to report a higher PCS12 score. Only education and economic hardship were found to be related with PCS12 scores for elderly women. Significant associations were found for education (post-secondary vs illiterate), occupation (professional and technical vs elementary for men, professional vs elementary for women), and economic hardship with MCS12. Economic hardship was identified as the strongest predictor for both mental and physical SF12 score among six SES indicators. For the covariates, elderly Chinese with older age, hospitalization in past months and diagnosis of chronic diseases experienced lower PCS12 score. Exercise was positively associated with MCS12, but BMI was negatively associated with MCS12 in men. Women with younger age, ex-married marriage status, hospitalization, and diagnosis of chronic diseases experienced lower MCS12.

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DISCUSSION

Most elderly people reported SRH not worse than their peers. The average PCS12 score was 40.3 and MCS12 score was 51.5 among this elderly Chinese sample. Men tended to report better HRQOL than women. Educational level and occupation were positively associated with HRQOL. Housing tenure was significantly associated with SRH only. Economic SES indicators (monthly income and expenditure) only showed a weak association with physical SF12 scores in men. Economic hardship showed the strongest association with HRQOL among all SES indicators in both men and women.

Using SRH and SF12 as measurements of HRQOL, our results confirmed the association between HRQOL and education[5, 37-42] and occupation among a Chinese sample.[6, 43, 44] Housing tenure was only found to be related with SRH for both men and women. This result confirmed the findings in Dunn's study that the people living in rented houses were approximately 3 times as likely to report worse SRH than those living in self-owned houses.[4] In this study, we present results similar to previous studies which showed that HRQOL inequalities by SES are larger in the physical domain than in the mental domain of HRQOL.[22, 23]

Objective economic SES indicators (monthly income and expenditure) showed only a weak association with the physical domain of HRQOL in the present study, which conflicts with findings from several previous studies.[7, 42] However subjective economic SES indicators of economic hardship showed strong associations with all HRQOL measurements in both men and women. The findings of non-significant associations between HRQOL and economic SES indicators might be because many of our poorer elderly subjects received a welfare payment from the Hong Kong Government. Because income was not a good indicator for people after retirement, we included monthly expenditure in our telephone survey. However, expenditure

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showed no associations with any HRQOL measures. Because many elderly Chinese live with their children or other family members, we cannot tell if the expenditure was for the whole family or themselves. Economic hardship showed the strongest association with HRQOL in the present study. Economic hardship was identified much stronger association with SRH than educational level by Cheng et al;[31] however, few studies contained both economic hardship and other SES indicators. With respect to this strong association, there were some possible explanations. At first, obviously, economic hardship was more meaningful than income. Higher income does not mean more available money, if compared with higher expenditure, but economic hardship does. In addition, people with larger economic hardship endured much more pressures and depressions which in turn affected health. In this study, economic hardship was found to be more strongly related to mental than physical HRQOL. This was mainly due to the subjectivity character of economic hardship (MCS was more subjective than PCS). According to the outcomes in present study, economic hardship showed a stronger positively association in female than in male, contrast to other SES indicators. This indicator may truly reflect the difference between these two sexes that women were more likely to care about their available money and avoid the occurrence of economic hardship than men. This potential explanation coincided with the different perceptions toward money management between two sexes in Chinese.

Men were more likely to report better HRQOL than women in the present study, which confirmed findings based on western populations in previous studies.[18, 21] For objective SES indicators (education, housing tenure, occupation and income), men showed stronger associations with HRQOL than women. However for subjective SES indicators of economic hardship, the association with HRQOL was a little stronger in women than in men. The

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difference by sex can be ascribed to different structure of educational level and occupation between males and females. For instance, compared to males, 80% female elderly Chinese had primary or lower education. This concentration attenuated the difference of HRQOL with baseline group in females, which resulted in the different association between sexes. The difference between men and women for the relationship between HRQOL and economic SES indicators might be contributed to by the fact that the income of the whole family is often managed by the wife in Chinese families.

Several limitations need to be considered. First, as mentioned in many SES and health studies, the cross-sectional design was the most important limitation in this study. Even though we have baseline data and a follow-up telephone survey, our design was still cross-sectional because no longitudinal data were collected and used. Second, the baseline elderly sample may not represent the whole elderly population in Hong Kong. Because the subjects recruited in the baseline were all volunteers, they may be much healthier and more careful with their health. In addition, we sampled the subjects stratified by age and sex for the telephone survey, thus we included more older and male people in the telephone sample. We also excluded the aged with speaking and listening disabilities from the sample during the telephone survey. Thus, the results may not be generalized to whole Hong Kong elderly population. Third, survival bias may exist because the attendance which gave rise to enrollment and the baseline survey was voluntary and we excluded all those who had died in the telephone survey. Fourth, there were some flaws in the SES indicators. A large number of elderly Chinese in Hong Kong receive a welfare payment from the Hong Kong government and they may report this as their monthly income. We grouped housing tenure into self-owned house and others, so we did not know the size and quality of the

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houses. In the end, there may be floor or ceiling effects for SRH because we only have three categories for SRH.

There were several advantages in this study. At first, this may be the first study to identify the association between all individual SES indicators and HRQOL based on SRH and SF-12 among healthy elderly Chinese population. In addition, six individual-level SES indicators were contained in present study, including expenditure and economic hardship, which scarcely occurred in these kinds of studies. Together with demographic, lifestyle, and chronic disease factors, these SES indicators were also adjusted in multivariate models. Moreover, this study was conducted in a large sample and the response rate was good comparing with other similar designs. At meantime, disease factors, which may play a big role on HRQOL in the elderly, were controlled in this study.

In conclusion, elderly Chinese men reported better HRQOL than women. Economic hardship, education, housing tenure, and occupation were identified to be associated with HRQOL among elderly Chinese. Subjective SES indicators might impact more on HRQOL among elderly people than more traditional objective measures. Future research is needed to interpret the strong association between subjective SES indicator and HRQOL among elderly Chinese. Only individual level measures of SES were included in present study, thus SES at community and neighborhood levels were needed. Considering the positive association between SES and HRQOL, improving SES level seems the most direct way to gain HRQOL benefits among elderly Chinese.

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Data sharing statement: No additional data are available.

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Table 1. Characteristics of the sample for telephone survey by gender

	Male		Female		P Value
	N	**%**	**N**	**%**	
Sample Size	1,201	51.2	1,146	48.8	
Age (Years, Mean, SD)	77.3	6.6	77.3	6.6	0.959
Marital Status					
Ex-married	194	16.2	734	64.0	<0.001
Single	31	2.6	22	1.9	
Married	974	81.2	389	34.0	
Smoking History					<0.001
Never	375	31.2	498	43.5	
Current	606	50.5	437	38.1	
Quit	220	18.3	211	18.4	
Alcohol Use	410	34.1	199	17.4	<0.001
Exercise (Times/week, Mean, SD)	5.6	2.6	5.4	2.7	0.068
BMI (Kg/m^2, Mean, SD)	23.7	3.1	24.1	3.9	<0.01
Hospitalization	218	18.2	219	19.1	0.560
Self-Rated Health					<0.001
Better	452	37.6	302	26.4	
Normal	632	52.6	643	56.1	
Worse	117	9.7	201	17.5	
PCS12 score (Mean, SD)	42.9	10.8	37.6	11.1	<0.001
MCS12 score (Mean, SD)	52.8	9.0	50.2	10.8	<0.001

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Table 1. Characteristics of the sample for telephone survey by gender (cont.)

	Male		Female		P Value
	N	**%**	**N**	**%**	
Education Level					<0.001
Post-secondary	105	8.7	19	1.7	
Secondary	300	25.0	101	8.8	
Primary	610	50.8	355	31.0	
Uneducated	127	10.6	242	21.1	
Illiterate	59	4.9	429	37.4	
House Tenure					<0.001
Self-owned	627	52.2	500	43.6	
Non-self-owned	574	47.8	646	56.4	
Income					<0.001
>10,000	46	3.8	25	2.2	
6,000-9,999	102	8.5	97	8.5	
3,000-5,999	321	26.7	421	36.7	
2,000-2,999	295	24.6	339	29.6	
1,000-1,999	260	21.7	150	13.1	
<1,000	177	14.7	114	10.0	
Expenditure					<0.001
>10,000	21	1.8	21	1.8	
6,000-9,999	196	16.3	135	11.8	
3,000-5,999	434	36.1	467	40.8	
2,000-2,999	410	34.1	345	30.1	
<2,000	140	11.7	178	15.5	
Economic Hardship					<0.001
More than enough	85	7.1	39	3.4	
Enough	551	45.9	447	39.0	
Just right	372	31.0	440	38.4	
Insufficient	193	16.1	220	19.2	
Occupation					<0.001
Professional	261	21.7	79	6.9	
Workers	747	62.2	436	38.1	
Elementary	185	15.4	466	40.7	
Unemployed	8	0.7	165	14.4	

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Table 2. Results of adjusted ordinal logistic regression models for SRH and SES indicators

	Male (OR, 95% CI)	Female (OR, 95% CI)
Education		
Post-secondary	3.26 (1.68, 6.33)**	1.32 (0.53, 3.32)
Secondary	2.43 (1.37, 4.28)**	1.67 (1.07, 2.61)*
Primary	1.55 (0.91, 2.65)	1.49 (1.12, 1.99)**
Uneducated	1.67 (0.90, 3.10)	0.98 (0.72, 1.35)
Illiterate	1.00	1.00
House Tenure		
Self-owned	1.34 (1.06, 1.70)*	1.27 (1.00, 1.61)*
Non-self-owned	1.00	1.00
Income		
>10,000	1.95 (0.99, 3.85)	0.99 (0.41, 2.37)
6,000~9,999	1.96 (1.19, 3.22)**	1.49 (0.86, 2.60)
3,000~5,999	1.11 (0.77, 1.61)	1.10 (0.72, 1.67)
2,000~2,999	1.41 (0.97, 2.04)	1.03 (0.67, 1.57)
1,000~1,999	1.40 (0.96, 2.05)	1.06 (0.65, 1.73)
<1,000	1.00	1.00
Expenditure		
>10,000	1.05 (0.42, 2.65)	0.50 (0.20, 1.25)
6,000~9,999	1.57 (1.01, 2.43)	1.07 (0.68, 1.67)
3,000~5,999	1.28 (0.88, 1.88)	0.94 (0.66, 1.32)
2,000~2,999	1.41 (0.96, 2.07)	0.92 (0.64, 1.32)
<2,000	1.00	1.00
Occupation		
Professionals	1.91 (1.30, 2.82)**	2.28 (1.40, 3.71)**
Technical Workers	1.50 (1.09, 2.07)*	1.16 (0.89, 1.51)
Unemployed	--	1.51 (1.05, 2.16)*
Elementary Workers	1.00	1.00
Economic Hardship		
More than enough	4.61 (2.54, 8.37)**	4.70 (2.26, 9.77)**
Enough	2.06 (1.46, 2.91)**	2.12 (1.52, 2.97)**
Just right	1.72 (1.20, 2.46)**	1.57 (1.13, 2.18)**
Insufficient	1.00	1.00

a. *p<0.05, **p<0.01.
b. OR=odds ratio; 95% CI=95% confidence interval.
c. Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

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Table 3. Results of adjusted general linear model for PCS12 and SES indicators

	Male (β, 95% CI)	Female (β, 95% CI)
Education		
Post-secondary	4.96 (1.87, 8.05)**	-0.95 (-5.64, 3.74)
Secondary	3.10 (0.45, 5.76)*	1.55 (-0.71, 3.81)
Primary	2.73 (0.21, 5.24)*	2.52 (1.06, 3.98)**
Uneducated	2.87 (-0.04, 5.79)	1.10 (-0.50, 2.70)
Illiterate	0.00	0.00
House Tenure		
Self-owned	0.74 (-0.37, 1.86)	0.29 (-0.92, 1.49)
Non-self-owned	0.00	0.00
Income		
>10,000	5.42 (2.27, 8.57)**	1.90 (-2.57, 6.37)
6,000~9,999	3.75 (1.42, 6.08)**	1.28 (-1.54, 4.10)
3,000~5,999	3.11 (1.37, 4.86)**	1.48 (-0.65, 3.61)
2,000~2,999	2.94 (1.18, 4.69)**	0.87 (-1.30, 3.04)
1,000~1,999	3.15 (1.34, 4.95)**	1.17 (-1.31, 3.65)
<1,000	0.00	0.00
Expenditure		
>10,000	4.62 (0.25, 9.00)*	-2.06 (-6.73, 2.61)
6,000~9,999	3.40 (1.33, 5.47)**	0.42 (-1.85, 2.69)
3,000~5,999	3.02 (1.21, 4.82)**	-0.88 (-2.63, 0.87)
2,000~2,999	2.91 (1.10, 4.73)**	-0.86 (-2.70, 0.98)
<2,000	0.00	0.00
Occupation		
Professionals	2.63 (0.82, 4.45)**	0.75 (-1.73, 3.23)
Technical Workers	0.96 (-0.55, 2.46)	1.31 (-0.02, 2.65)
Unemployed	--	1.53 (-0.29, 3.36)
Elementary Workers	0.00	0.00
Economic Hardship		
More than enough	5.60 (2.95, 8.24)**	5.95 (2.33, 9.56)**
Enough	3.61 (2.02, 5.20)**	4.39 (2.73, 6.05)**
Just right	2.56 (0.90, 4.22)**	2.73 (1.09, 4.36)**
Insufficient	0.00	0.00

a. *p<0.05, **p<0.01.

b. OR=odds ratio; 95% CI=95% confidence interval.

c. Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

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Table 4. Results of adjusted general linear model for MCS12 and SES indicators

	Male (β, 95% CI)	Female (β, 95% CI)
Education		
Post-secondary	3.00 (0.09, 5.91)*	6.58 (1.69, 11.47)**
Secondary	0.46 (-2.04, 2.96)	0.51 (-1.83, 2.87)
Primary	0.03 (-2.34, 2.41)	0.27 (-1.25, 1.79)
Uneducated	-0.63 (-3.36, 2.11)	0.44 (-1.23, 2.11)
Illiterate	0.00	0.00
House Tenure		
Self-owned	0.63 (-0.41, 1.68)	1.01 (-0.26, 2.27)
Non-self-owned	0.00	0.00
Income		
>10,000	-0.60 (-3.55, 2.35)	1.56 (-3.10, 6.22)
6,000~9,999	-0.70 (-2.89, 1.49)	1.51 (-1.43, 4.45)
3,000~5,999	0.27 (-1.37, 1.90)	1.32 (-0.90, 3.53)
2,000~2,999	0.29 (-1.36, 1.94)	0.92 (-1.35, 3.18)
1,000~1,999	0.49 (-1.20, 2.19)	0.09 (-2.50, 2.67)
<1,000	0.00	0.00
Expenditure		
>10,000	-2.97 (-7.06, 1.12)	-2.35 (-7.22, 2.52)
6,000~9,999	-1.32 (-3.26, 0.61)	-2.31 (-4.68, 0.06)
3,000~5,999	-1.17 (-2.86, 0.53)	-0.92 (-2.74, 0.91)
2,000~2,999	-0.91 (-2.61, 0.79)	-0.98 (-2.90, 0.94)
<2,000	0.00	0.00
Occupation		
Professionals	3.39 (1.69, 5.10)**	3.65 (1.08, 6.22)**
Technical Workers	2.00 (0.59, 3.42)**	1.20 (-0.19, 2.58)
Unemployed	--	0.74 (-1.16, 2.63)
Elementary Workers	0.00	0.00
Economic Hardship		
More than enough	9.57 (7.17, 11.97)**	10.26 (6.56, 13.96)**
Enough	7.03 (5.58, 8.48)**	6.98 (5.28, 8.68)**
Just right	4.38 (2.87, 5.88)**	3.93 (2.25, 5.60)**
Insufficient	0.00	0.00

a. *p<0.05, **p<0.01.
b. OR=odds ratio; 95% CI=95% confidence interval.
c. Covariates included age, marriage, BMI, smoking, alcohol use, exercise, live alone or not, hospitalization, diagnosis of heart disease, diabetes, hypertension, chronic pulmonary disease, hearing loss, or musculoskeletal, other SES indicators. Because correlation was found between education and occupation, income and expenditure, only one indicator of each pair was included in the model. For example, if education was the independent variable in the model, occupation was excluded due to the correlation with education, and income but not expenditure was included in the model due to the correlation between the two; If expenditure was the independent variable, income was excluded due to the correlation with occupation, and education but not occupation was included in the model due to the correlation between the two.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	*8*
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6,8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10-11
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	22-23
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-11, 22-25
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-11
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.