SSM - Population Health 17 (2022) 101061

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: www.elsevier.com/locate/ssmph

Trajectories of health-related quality of life by change pattern of objective and subjective social status

Eunah Kim [a], Sung-il Cho [a,b,*]

[a] Department of Public Health Science, Graduate School of Public Health, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, 08826, Republic of Korea
[b] Institute of Health and Environment, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, 08826, Republic of Korea

ARTICLE INFO

Keywords:
Social inequality
Health status disparity
Health related quality of life
Latent class model

ABSTRACT

Long-term and cumulative social experiences influence an individual's objective and subjective social status. Social determinants of health are more effectively investigated by longitudinal rather than cross-sectional studies. The primary focus of this study was the prospective effect of socioeconomic transition on health-related quality of life trajectories. The study population were adults over 18 years of age who responded in all nine waves of the Korea Health Panel (2009–2017). Data were analyzed by group-based trajectory modeling to identify health trajectories, and group-based multi-trajectory modeling to investigate combined change patterns of objective and subjective social status (i.e., multi-SES trajectories). To predict the effects of underlying socioeconomic measures on health trajectory group membership, we included these time-stable covariates in trajectory modeling and estimated the risk of belonging to each trajectory based on the measures. The health-related quality of life trajectories showed three patterns during the period 2013 to 2017; 13.7% of individuals had a low and declining health trajectory and the others had a higher stable health trajectory. Four types of multi-SES trajectory were derived during the period 2009 to 2013; the richer had a steeper income slope while there were slight changes in subjective social status among all groups. These combined longitudinal SES patterns in 2009–2013 were strong predictors of subsequent health trajectory group membership in 2013–2017. These findings indicate that rich countries, such as South Korea, may encounter growing income inequality, where individuals become entrenched in income disparity that pins down their perceptions of social position. Over time this rigid social structure will widen the gap in health-related quality of life.

1. Introduction

Social inequality and its consequences are a persistent concern. Because most countries have reached at least a reasonable life expectancy, even developing countries, the quality of life has been a focus rather than merely prolonging life (Roser & Ortiz-Ospina, 2016). However, population health or quality of life rises substantially only in the early stages of economic growth, and additional economic growth adds nothing further to health in developed countries. Instead, inequality within a society explains differences in health (Wilkinson & Pickett, 2010). Regarding these social gradients in health, we need to consider to whom, in what way, and which consequences have occurred and will occur in the future.

The strength of the association between social position and health disparities varies depending on which conceptual basis or definition is applied in terms of social position (Bartley et al., 1999). Here, we begin our discussion by briefly distinguishing among the notions of social class-based measures. *Social class* arises from interdependent economic and legal relationships among people within a society's economic structure. Classes are forged by one another and exist only within these relationships, which are determined by the possession of property, ownership, and labor (Krieger et al., 1997). *Socioeconomic position* (i.e., *SEP*) is a combined concept with resource-based and prestige- or rank-based characteristics. This refers to whether material resources are sufficient to survive (Krieger et al., 1997) and to how groups stand in relation to each other (i.e., relative position in social hierarchies) (Glymour et al., 2014). *Socioeconomic status* (i.e., *SES*) is typically characterized by three dimensions—education, employment, and money—and is defined as "differences in the possession of resources" (Glymour et al., 2014) or as "differential access to desired resources" (Oakes & Rossi,

* Corresponding author. Graduate School of Public Health, and Institute of Health and Environment, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, 08826, Republic of Korea.
E-mail addresses: eunah.neema@gmail.com (E. Kim), persontime@hotmail.com (S.-i. Cho).

https://doi.org/10.1016/j.ssmph.2022.101061
Received 11 October 2021; Received in revised form 19 February 2022; Accepted 1 March 2022
Available online 8 March 2022

2003). Unlike social class, people do not share a specific group consciousness within the SES framework. This is the case even for those in similar economic positions because SES is a temporary position that can change (Liu et al., 2004). Finally, *Subjective social status* (i.e., *SSS*) indicates an individual's sense of his/her relative position in the social hierarchy (Adler & Stewart, 2007). SSS encompasses nuanced judgments on prestigious achievements, future life chances, and accumulated class-based experiences that have limitations when measured using SES or SEP indicators (Singh-Manoux et al., 2005).

The mechanism of evolving health inequalities varies according to the properties of each class-based measure (Bartley et al., 1999). Social class is logically prior to the existence of income or social status distribution, hence generating and facilitating the persistence of inequalities in income, wealth, and health (Krieger et al., 1997). Low-SES individuals are more likely to be exposed to risk factors related to diseases. By contrast, high-SES individuals, who possess and have access to abundant resources (e.g., knowledge, money, and/or social networks), can avoid risks using resources in multiple ways (Link & Phelan, 1995). When understanding health inequalities one step further, the problem exists beyond the lack of medical use for the poor. The relative position in the social hierarchy determines autonomy and full social participation, and eventually better health (Marmot, 2006). Regarding SSS, the everyday experience of social class influences chronic perceptions of relative standing and how to evaluate the self (Kraus & Park, 2014). Therefore, low SSS correlates with chronic stress (Adler et al., 2000) and negative emotion (Operario et al., 2004) as well as a low level of material resources. The SSS affects health beyond conventional SES measures via sociological, psychological, and biological pathways (Hoebel & Lampert, 2020).

These social determinants of health tend to be long-term and cumulative in formation and in terms of their health effect. Early exposures may reinforce or prevent vulnerability to exposures in later life, which is linked to disease outcomes (Berkman, 2009). Furthermore, the effects of chronic exposure to socio-environmental stressors on health can manifest over decades through a complex and long causal pathway (Braveman & Gottlieb, 2014). Therefore, the longitudinal effects of life-course socioeconomic position on the quality of life vary depending on which life-course model is used in the analysis (Niedzwiedz et al., 2012). A group-based trajectory modeling can identify developmental trajectories of the variables of interest over time (Nagin & Odgers, 2010). This method highlights the life-course perspectives in health or etiology and can provide longitudinal evidence for causal inferences among SSS, SES, and health.

Furthermore, because social determinants of health interact, an innovative approach is needed to model complicated relationships (Braveman & Gottlieb, 2014). Objective and subjective status cannot be divided because SES is a determinant of SSS (Singh-Manoux et al., 2003) and SSS can be used as an indicator variable of SES (Oakes & Rossi, 2003). SSS and SES indicators were formerly entered simultaneously into a multiple regression model regarding health outcome as the independent variable or covariate to account for their interaction (Adler et al., 2000; Demakakos et al., 2008; Goodman et al., 2003; Operario et al., 2004; Singh-Manoux et al., 2003, 2005). Class discrepancy or status inconsistency can be applied to examine how a combination of factors influence health. A prior work compared the subjective class identification (e.g., which class people think they belong to [lower, working, middle, or upper class]) to the actual SES (Hodge & Treiman, 1968; Hout, 2008). Macleod et al. (2005) investigated contradictory class locations and how they affect mortality and morbidity (Macleod et al., 2005). Recently, status inconsistency using a scale of self-anchoring at the 10-rung social ladder, rather than class identification, has been applied in health research (Zang & Bardo, 2019).

However, these approaches have been criticized for ambiguity and ambivalence. Unlike those of very high or low SES, status inconsistency often appears in the middle class, who objectively have mixed and complicated attributes. Depending the attribute on which a survey question is focused, people are forced to answer that they are in the middle class or working class. Those with income, education, and occupation near class borders have an ambiguous subjective class (Hout, 2008). Classifying these mixed characteristics is important in social class research.

As a method of modeling individual-level heterogeneity, group-based trajectory modeling can classify the population by detecting unobserved heterogeneity between groups (Nagin, 2009). Furthermore, group-based multi-trajectory modeling can identify trajectory groups across multiple indicators and detect interrelationships of relevant indicators, revealing combined change patterns (Nagin et al., 2018).

To the best of our knowledge, few studies have evaluated the longitudinal effects of combined objective and subjective social status on health inequalities. Therefore, we investigated the longitudinal relationship between changes in multiple social status indicators and changes in health-related quality of life (HRQoL). The research hypotheses were as follows.

(1) The change pattern of HRQoL over time can be identified as distinct trajectories, which have significantly different characteristics at baseline.
(2) New socioeconomic groups can be identified by tracing the combination of objective and subjective social status over time.
(3) The underlying socioeconomic characteristics determine the probability of subsequent HRQoL trajectory group membership.

2. Materials and methods

2.1. Data and study population

We used the Korea Health Panel Survey (KHPS) data version 1.6 from 2009 to 2017, which is conducted annually by the Korea Institute for Health and Social Affairs (KIHASA) and the National Health Insurance Service (NHIS) consortium. This survey is nationally representative of South Korea, being based on Population and Housing Census data from 16 districts nationwide. The first-period panel (i.e., original panel) started in 2008. After 2014, to compensate for attrition, approximately 2500 households were added as the second-period panel. KHPS investigates medical usage, health behaviors, outcomes, and socioeconomic characteristics. Trained surveyors collect the data during a home visit (KIHASA & NHIS). The raw data are accessible to all and may be obtained by submitting a requisition form via the official KHPS website (www.khp.re.kr:444/).

We merged nine waves of the KHPS (2009–2017) by individual identification key variable. We excluded the data of the underage respondents because they did not answer health-related domains. Moreover, we set eligibility as the respondents from the first-period original panel because one of the primary interest variables—subjective social status—was included only in the 2009, 2011, 2012, and 2013 KHPS. A total of 26,507 respondents joined the survey during 2009–2017, including the underage or those from the second panel. There were 21,204 adults over 18 years of age. Among them, 13,821 adults were from the original panel (starting in 2009). Within the original panel, 7642 individuals responded to the nine waves of the survey (i.e., balanced panel) and 6179 individuals showed intermittent responses or withdrawals.

We tested the bias of panel attrition (i.e., whole-wave missing) and randomness on missing data (i.e., within-wave missing). To detect panel attrition bias in the unbalanced panel, we estimated a fixed-effect model and tested for the significance of a term indicating 'the period just before attrition for each individual' (Wooldridge, 2010). We performed Little's MCAR test for each wave to test the assumption of missing completely at random (MCAR) (Little, 1995). If each panel wave was not MCAR, covariate-dependent missingness (CDM) assumption was tested to ascertain missing at random (MAR) (Fitzmaurice et al., 2008; Li, 2013). The results showed no specific pattern of panel attrition, indicating

MCAR, and each wave can be considered, at least, as MAR. Therefore, we created a balanced panel dataset, guaranteeing unbiased results. A total of 7642 individuals (3324 [43.5%] males and 4318 females [56.5%]) were included in the analysis.

2.2. Measures

2.2.1. Health outcome: HRQoL

To assess HRQoL, we used the Euro-QoL-5 Dimension (i.e., EQ-5D) indicators. The EQ-5D questionnaire comprises five health dimensions—mobility, ability to self-care, ability to undertake usual activities, pain and discomfort, and anxiety and depression. Each response had three levels—no problem, some problems, and extreme problems. The EQ-5D indicators were summarized and scored using weights based on South Korean studies. The estimation equation is described elsewhere (Lee et al., 2009).

2.2.2. Socioeconomic indicators

In this paper, equivalized household income is used to represent the SES. Household income was the sum of the labor income of all household members and capital income for the last year and was equivalized by the square root of the number of household members (OECD, 2012). This equivalent income had several extremes, up to more than sevenfold the interquartile range. These values showed substantial decreases or increases compared to the next year in repeated observations. We, therefore, regard these extremes (30 households) as reporting errors and treated them as missing values.

To define relative income, we sorted equivalized income of a household unit in order and computed its rank using the Weibull formula. This income rank, calculated at the household level, was assigned to each household member.

To measure subjective social status (i.e., SSS), the survey uses the same image as the youth version of the MacArthur scale. It depicts a 10-rung ladder picture of the structure of society, i.e., best off at the top and worst off at the bottom. Participants are asked where they think their family would be on the ladder (Goodman et al., 2001). The comparison reference is overall society, and the evaluated target is the familial situation rather than their own as individuals.

We composed measures of status inconsistency using objective status of household income and the SSS. Household income and SSS were divided into five deciles and we defined the lower 40% as low status, 40–80% as middle, and upper 20% as high status. By comparing each category, we identified groups with a consistent status (i.e., SSS = income) and inconsistent status (i.e., SSS > income or SSS < income).

2.2.3. Covariates

The baseline covariates were those in 2009. Individual factors included sex, age, years of education, and employment status. Household environment consisted of family role, household composition, marital status, house type, and homeownership. Health behaviors consisted of smoking, risky drinking, sleeping time, and obesity (18.5 BMI $\leq$ normal weight <23.0 BMI; according to the Asia-Pacific standards of the World Health Organization (2000) guidelines). We considered comorbid conditions by calculating the Charlson Comorbidity Index (CCI) according to Quan's ICD-10 classification with updated weights (Quan et al., 2011).

2.3. Statistical analyses

To identify clusters of trajectories, we applied group-based trajectory modeling (i.e., GBTM) (Nagin & Odgers, 2010). Change patterns in HRQoL were analyzed for the periods 2009 to 2017 and 2013 to 2017 using GBTM. The combined change patterns of SES (household income) and SSS from 2009 to 2013 (i.e., multi-SES trajectories) were evaluated by group-based multi-trajectory modeling (i.e., the multi-GBTM method) (Nagin et al., 2018). A censored normal distribution was assumed for each analysis. We allowed different standard deviations for the trajectory groups. The criteria for the optimal number of groups and polynomial degree for each group were based on entropy, the Bayesian information criterion, and others (Nagin, 2009; Van Der Nest et al., 2020), as detailed in Appendix A.

To describe the income inequalities between multi-SES trajectories over time, we computed several income inequality measures (see Appendix B) including the Generalized Entropy Class of Inequality Index, which was assigned a parameter (α) of 2 (i.e., GE[2]). This is decomposable to within- and between-group inequality (Atkinson & Bourguignon, 2014).

Finally, to predict the impact of socioeconomic measures on HRQoL trajectory group membership, we introduced the time-stable covariates into trajectory modeling simultaneously (Jones & Nagin, 2012). This method can account for uncertainty about an individual's group assignment, thus yielding unbiased results (Jones et al., 2001). We included the socioeconomic measures for 2009 and multi-SES trajectories for 2009–2013 as predictors; the HRQoL trajectory for 2013–2017 was the dependent variable. The effects of predictors on the probabilities of group membership were provided in the form of a multinomial logit model.

Data were analyzed using STATA version 15.1 and used STATA plugin 'traj' for GBTM and the multi-GBTM method.

3. Results

Health status as assessed by the five dimensions of the EQ-5D decreased slightly over time. The EQ-5D summation index (i.e., HRQoL) remained high, being 0.944 points in 2009 and 0.934 points in 2017, however, since 2012, HRQoL decreased below the lower bound of the 95% confidence interval (CI) of 2009 (Table 1).

Fig. 1 shows the HRQoL trajectories from 2009 to 2017 and 2013–2017. The criteria for optimal model selection are provided in Appendix A Three health trajectories composed of intercept and linear terms were selected as the final model. The trajectory patterns were of similar shapes but had different group membership rates. From 2009 to 2017, the majority (58.7%) were classified as near maximum and stable, 32.3% were moderate (>0.9 points), and 9.0% had a low status in 2009 that decreased over time. From 2013 to 2017, more participants (13.7%) were classified as having a low-declining health trajectory than during 2009–2017.

The baseline characteristics of 2009 according to the 2009–2017 HRQoL trajectories are presented in Table 2. The low-declining group was predominantly females (75.0% of the sample) and more likely to be older (67.2 years) and less-educated (7.7 years) at baseline than the other health trajectory groups. The proportion of people who were not in employment was twofold higher in the low-declining group than the high-stable group (64.7% vs. 31.7%). Marital status of divorce or bereavement differed significantly between groups (38.5% in the low-declining group, 17.1% in the moderate-stable group, and 5.4% in the high-stable group, $p < 0.001$). The proportion of young dependents (e.g., children) was high in the high-stable group, and that of elder dependents (e.g., grandparents) was high in the low-declining group. The high-stable group was more likely to live in an apartment or owner-occupied home.

The high proportion of smoking and drinking in the high-stable group may result from confounding effects due to unadjusted description. In addition, abnormal body weight, lack of sleeping time, and prevalence of chronic diseases presented as CCI at baseline were risk factors for membership of the low-declining group.

Regarding socioeconomic characteristics of, the median household income in 2009 differed significantly among the trajectory groups (468, 848, and 1198 dollars per month in order). SSS at baseline differed from 3.0 points to 4.3 points across trajectory groups. The proportion of people with a higher income than SSS was 33.9% in the high-stable group, 27.8% in the middle-stable group, and 15.8% in the low-

Table 1
Distribution of health-related quality of life from 2009 to 2017.

Year	N (Total = 7642)	EQ-5D indicators (%)					EQ-5D index
		Mobility	Self-Care	Usual Activities	Pain & Discomfort	Anxiety & Depression	Mean (95% CI)
2009	7166	87.7	98.4	92.9	68.4	86.8	0.944 (0.942, 0.946)
2010	7323	88.9	97.6	92.3	66.9	83.6	0.939 (0.937, 0.941)
2011	7311	88.3	97.4	93.2	69.3	84.5	0.943 (0.941, 0.945)
2012	7325	87.7	96.2	92.2	68.0	85.1	0.940 (0.938, 0.942)
2013	7335	85.9	95.3	90.6	66.6	85.3	0.936 (0.934, 0.938)
2015	7453	85.6	95.1	90.6	67.5	86.1	0.937 (0.934, 0.939)
2016	7441	85.7	95.0	90.2	67.8	84.0	0.935 (0.932, 0.937)
2017	7456	85.1	94.5	89.6	66.4	87.5	0.934 (0.932, 0.937)

Notes: Possible responses were No problem, some problems, and extreme problems. Values are the proportions of 'No problem' responses. The EQ-5D questionnaires were excluded in the 2014 survey.

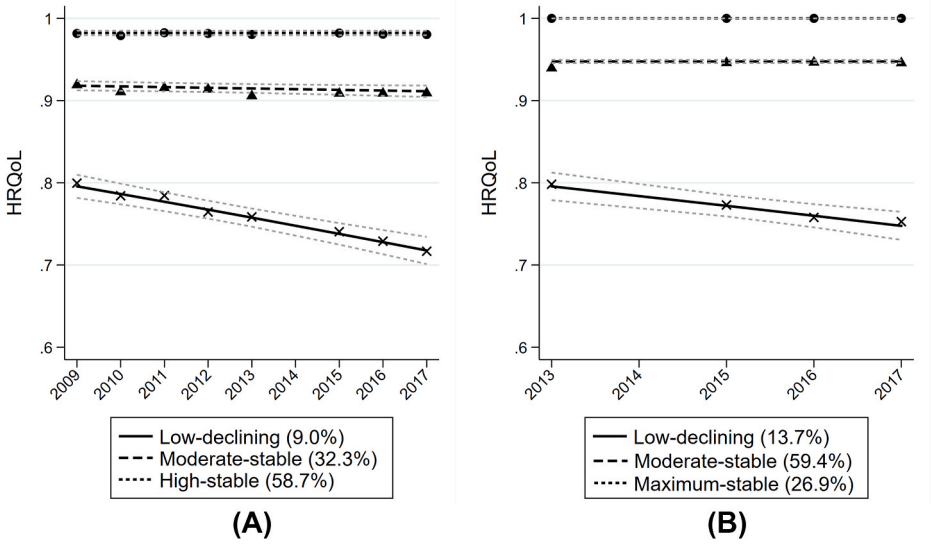

Fig. 1. Trajectories of health-related quality of life from 2009 to 2017 (A) and 2013 to 2017 (B).
Notes: Observed group means for each year (symbol), estimated trajectories (lines), and estimated group percentages (%) are presented. EQ-5D indicators were not collected in the 2014 survey. We used a balanced panel for 2009–2017 containing 7642 individuals. Nine observations were excluded in the trajectory model because they had no trajectory data.

declining group. By contrast, the proportion of consistency (income = SSS) increased with decreasing health trajectory group.

Fig. 2 depicts the combined change pattern of objective and subjective social status from 2009 to 2013. The information used to select the optimal number of groups and the polynomial type of the trajectory is provided in Appendix A. Four multi-SES trajectories were derived. Each trajectory group was named on the basis of its shape: subsistence level (i.e., low SSS and the lowest income; 16.4%), relative deprivation (i.e., moderate SSS and low-stable income; 30.4%), upper-middle (i.e., moderate SSS and moderate-increasing income; 35.7%), and privileged (i.e., high SSS and high-increasing income; 17.5%). SSS was stratified in each trajectory and maintained with little variation over time. In addition, household income tended to increase but had an uneven slope according to baseline income level. The higher the household income in 2009, the steeper the slope of income growth. The results of the income inequality measure (*see* Appendix B) also showed that inequality between multi-SES trajectory groups became greater over time. More information on income inequality in the total study population and across multi-SES trajectories is presented in Appendix B.

Table 3 shows the group membership probabilities of multi-SES trajectories from 2009 to 2013 and health trajectories from 2013 to 2017. Individuals of subsistence level multi-SES were more likely to have a low-declining (0.390 probability) or moderate-stable (0.526 probability) health trajectory. Among those of relative-deprivation multi-SES, the majority (63.4%) had a moderate-stable health trajectory. The probability of a maximum-stable health trajectory increased with multi-SES status. The probability distribution was similar for individuals of upper-middle and privileged multi-SES.

Table 4 shows the effects of socioeconomic predictors at baseline for the probability of belonging to each HRQoL trajectory group in 2013–2017. We set the maximum-stable HRQoL trajectory as the referent and compared the relative risk of decreasing health trajectory according to type of socioeconomic measure.

The model including objective household income (Model 1) or income rank (Model 2) of 2009 on trajectory group membership had similar model fitness (BIC = −5187 and −5190, respectively), indicating that an increase in income reduced the risk of being in the lower HRQoL trajectory groups relative to the maximum-stable group. The effects of SSS in 2009 on trajectory group membership remained significantly high after accounting for household income (Model 3 vs. 4). As one unit of SSS increased, the risk of being in the low-declining or moderate-stable group vs. the maximum-stable group fell by about 31% (i.e., 0.69-fold of RRR) and about 13% (i.e., 0.87-fold of RRR) respectively (Model 4). That is, a higher SSS increased the likelihood of being in the maximum-stable trajectory group and had a protective effect on longitudinal health.

The status inconsistency (Model 5) measure did not show statistical significance on moderate-stable vs. maximum-stable group membership. By contrast, a status of inconsistency (income > SSS or income < SSS) relative to consistency (income = SSS) decreased the risk of being in the lower-declining vs. maximum-stable group by about 35%. That is, even one-side high had a protective effect on the low-decreasing health trajectory.

Considering multi-SES trajectories (Model 6; the combined change patterns of income and SSS in 2009–2013), the risk of being in the low-declining vs. maximum-stable group was about 73% lower for the upper-

Table 2
Sociodemographic characteristics at baseline (in 2009) across health-related quality of life trajectory groups (in 2009–2017).

	N (total = 7642)	Low-declining (N = 655)[a]	Moderate-stable (N = 2360)[a]	High-stable (N = 4627)[a]	*p*-value[b]
Individual factors					
Sex, Female (%)	(N = 7642)	75.0	65.1	49.4	<0.001
Age (Mean ± SD)	(N = 7642)	67.2 ± 9.9	57.1 ± 12.9	45.0 ± 12.9	<0.001
Education year (Mean ± SD)	(N = 7642)	7.7 ± 5.4	9.8 ± 4.5	12.6 ± 3.4	<0.001
Employment status (%)	(N = 7631)				<0.001
Employer/Self-employed/Regular worker		15.0	24.5	32.7	
Temporary worker		20.3	35.1	35.6	
Not in employment		64.7	40.4	31.7	
Household environments					
Marital status (%)	(N = 7642)				<0.001
Currently Married		58.9	77.4	80.1	
Formerly Married		38.5	17.1	5.4	
Never Married		2.6	5.5	14.5	
Family role (%)	(N = 7607)				<0.001
Head of household (HH)		50.8	45.3	47.4	
Spouse of HH		37.4	46.3	38.3	
Children of HH		1.5	4.4	13.6	
Parents of HH		10.3	4.1	0.7	
Type of house (%)	(N = 7642)				<0.001
House		74.4	65.6	49.1	
Apartment		20.5	30.5	47.9	
Others		5.2	3.9	3.1	
Homeownership (%)	(N = 7642)				<0.001
Owner occupied		69.9	76.0	72.6	
Chartered/Monthly rent/Free-offered		30.1	24.0	27.4	
Health-related conditions					
Smoking prevalence, yes (%)	(N = 7545)	13.7	17.8	25.5	<0.001
Risky drinking, yes (%)	(N = 7641)	4.0	8.4	12.6	<0.001
Obesity (%)	(N = 7621)				<0.001
Underweight (BMI <18.5)		6.1	4.0	4.1	
Normal weight (18.5≤ BMI <23)		38.6	39.6	47.6	
Overweight/obesity (23≤ BMI)		55.3	56.5	48.3	
Sleeping time (Mean ± SD)	(N = 7166)	6.3 ± 1.6	6.6 ± 1.3	6.9 ± 1.2	<0.001
Charlson Comorbidity Index, more than 1 (%)	(N = 7642)	39.1	20.2	7.7	<0.001
Socioeconomic indicators					
Household income (Median, IQR)	(N = 7557)	467.6 (321.3–813.1)	847.9 (500.6–1334.2)	1197.8 (813.1–1738.1)	<0.001
Income rank (Median, IQR)	(N = 7557)	0.2 (0.1–0.4)	0.4 (0.2–0.7)	0.6 (0.4–0.8)	<0.001
SSS (Mean ± SD)	(N = 7165)	3.0 ± 1.5	3.6 ± 1.5	4.3 ± 1.5	<0.001
Status inconsistency (%)	(N = 7091)				<0.001
Household income > SSS		15.8	27.8	33.9	
Household income < SSS		22.4	19.1	17.4	
Household income = SSS		61.8	53.1	48.7	

Abbreviations: Standard deviation (SD); head of household (HH); interquartile range (IQR); body mass index (BMI); subjective social status (SSS).
Notes.
[a] The number of individuals within each group is based on the most-likely trajectory group assignment (i.e., individuals classified based on the highest posterior probability).
[b] Categorical variables were compared using Pearson's chi-square test. Normally distributed continuous variables (i.e., age, education years, sleeping time, SSS) were compared by ANOVA; continuous, neither log normally or normally distributed variables (i.e., household income, income rank) were compared by Kruskal-Wallis rank test.

middle or privileged group relative to the subsistence or relative deprivation group. Similarly, the risk of being in the moderate-stable vs. maximum-stable group was about 35% lower for the upper multi-SES groups relative to the lower multi-SES groups.

4. Discussion

We found that growing income inequality exacerbates health disparities, leading to better health for the better off. We identified a prolonged HRQoL pattern of low and declining over time. By tracing the combined objective and subjective social status longitudinally, four multi-SES trajectories were derived, describing broaden between-group income inequality with static SSS. A high underlying SES had a protective effect against belonging to the low-declining HRQoL trajectory group. In particular, the multi-SES trajectories had significant utility for explaining changes in health over time.

The results show that 13.7% of individuals showed a deterioration of HRQoL during the period 2013 to 2017, whereas that of the majority was unchanged and high. Although South Korea, where the study sample was derived, was recently classified as a developed country (UNCTAD, 2021), the pattern of low and declining HRQoL over time suggests that the underprivileged are still excluded from economic development. Therefore, those with a longitudinally declining HRQoL trajectory should be targeted by health policies.

The multi group-based trajectory model of objective and subjective social status in the period 2009 to 2013 indicated interactions between the two characteristics. The rich earn more money, but irrespective of income growth, people have a fixed perception of their social position over time; this has several possible interpretations.

SSS is a valid and reliable indicator of cumulative socioeconomic circumstances. In previous studies of test-retest reliability, SSS showed good reliability within an interval of 14 days (Giatti et al., 2012) and adequate reliability for 6 months (Operario et al., 2004). Furthermore, the developmental trajectories of SSS are consistent during the transition from adolescence to adulthood (Goodman et al., 2015). This reproducibility may be because SSS is a cognitive averaging of the standard markers of SES (Singh-Manoux et al., 2003). In particular, from the life-course perspective, SSS adequately summarizes the socioeconomic circumstances in different periods of life (Singh-Manoux et al., 2005). SSS provides an aggregate estimate of one's social experiences

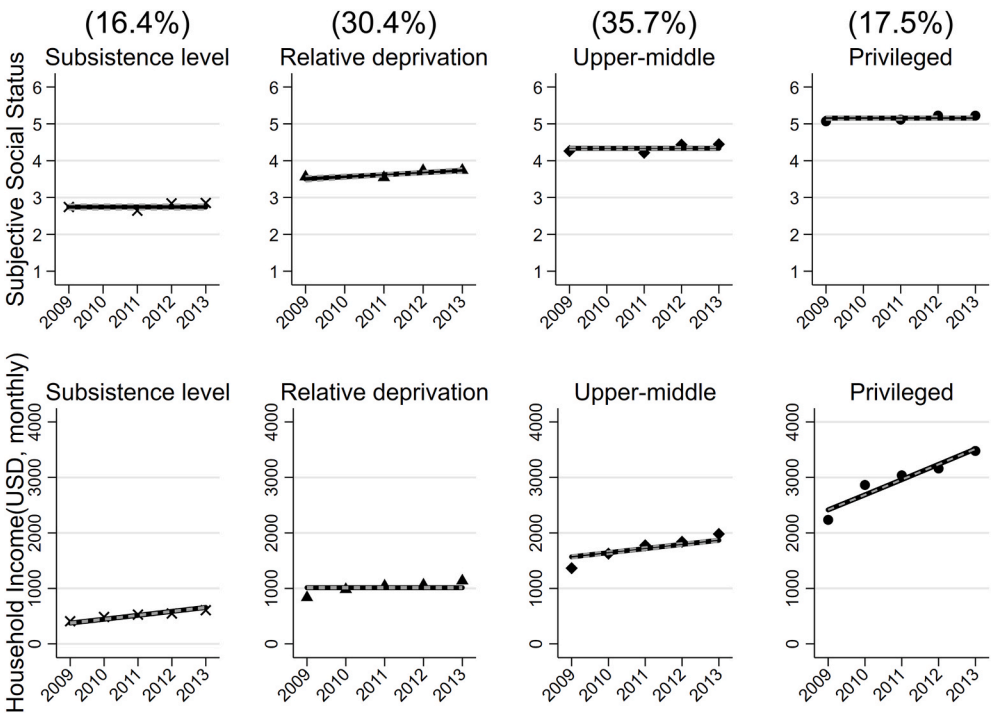

Fig. 2. Group-based multi-trajectory modeling of longitudinal household income and subjective social status.
Notes: Observed group means at each year (symbol), estimated trajectories (solid lines), and estimated group percentages (%) are presented. The degree of a polynomial for SSS was 0 (intercept), 1 (linear), 0 (intercept), and 0 (intercept) in order, and all parameters were significant. The degree of a polynomial for household income was 1 (linear), 0 (intercept), 1 (linear), and 2 (quadratic) in order, and each was significant except the last term of a quadratic function.

Table 3
Average posterior probabilities of HRQoL and multi-SES trajectory group membership.

		HRQoL trajectory (2013–2017)		
		Low-declining	Moderate-stable	Maximum-stable
		(N = 939)	(N = 4249)	(N = 2454)
Multi-SES trajectory of SSS & Income (2009–2013)				
Subsistence-level	(N = 1275)	0.390	0.526	0.083
Relative deprivation	(N = 2307)	0.142	0.634	0.224
Upper-middle	(N = 2755)	0.059	0.602	0.339
Privileged	(N = 1305)	0.045	0.575	0.380
Total	(N = 7642)	0.137	0.594	0.269

Notes: Values are probabilities of membership of four multi-SES trajectories (shown in Fig. 2) by three HRQoL trajectories (shown in Fig. 1-B). The number of individuals (N) within each group is derived from the most-likely group membership (i.e., individuals classified based on the highest posterior probability).

over a lifetime, which is problematic using conventional SES indicators (Wright & Steptoe, 2005). That is, the comprehensive and summative nature of SSS could render the pattern of SSS trajectories consistent and stable when the income patterns tend to increase.

An alternative explanation is based on the psychological mechanism by which people perceive their status in the social hierarchy. The formation of SSS follows social comparison processes (Kraus et al., 2011; Mcleod, 2013). People set themselves on the social ladder by comparison with others—within society overall or a group to whom they feel they belong. Therefore, the reference group set is crucial for determining SSS (Wolff et al., 2010). Growing income inequality between groups may reduce the opportunity for economic mobility, leading to a fragmented society. Such a rigid society is likely to have consistent comparison standards and little variation within and between reference groups.

A further assumption is that SSS is more likely to reflect unchanging social classes rather than a volatile socioeconomic position or status. Although we used two types of SES measures, our results may demonstrate distinctive stratified social classes embedded within a society, which reinforce wealth and income inequality. Indeed, SSS is more strongly associated with wealth than with education or occupation type (Adler & Stewart, 2007; Demakakos et al., 2008). In developed countries in the 21st Century, wealth is highly concentrated in a few top wealth holders. The higher rate of return on capital than the economic growth rate has amplified wealth inequalities (Piketty, 2015). Furthermore, social prestige, power, or habitus are produced by social conditioning and contribute to sustaining existing structures and class-based inequalities (Bourdieu, 1998; Doob, 2019). These attributes of wealth inequalities in the 21st Century may contribute to the shape of the combined SSS and income trajectories. In sum, the social structure pins down the SSS levels, restricting economic benefit largely to the privileged. Socioeconomic grouping depicts how an unequal society determines an individual's objective and subjective social status.

We examined the association between underlying SES and health trajectory according to several types of analysis. Consequently, three consistent results of this study illustrate that one's underlying SES—whether objective or subjective—is a significant risk factor for declining health trajectory, damaging health equity. First, we demonstrated the underlying characteristics across HRQoL trajectories. People with a low-declining health trajectory tended to have low levels of underlying SES (e.g., low income, low SSS, less-educated, not in employment, divorced or bereaved, or living in a monthly rent home).

Second, we estimated the average probabilities of multi-SES trajectories (2009–2013) by temporally distinct HRQoL trajectories (2013–2017). The increased income inequalities during the period 2009 to 2013 were associated with health trajectories during 2013–2017. This means that low and declining HRQoL may be a byproduct of stagnant inequalities and perception of a low social position. This result is in contrast to that of Nobles et al. (2013), who reported that declines in health induce declines in SSS, and there are bi-directional effects on health and SSS (Nobles et al., 2013). Given that they used data in 2000 and 2007 from a developing country (Indonesia), this indicates the importance of cultural and economic differences between developed and

Table 4
Effects of socioeconomic predictors on HRQoL trajectory group membership.

	Health-related quality of life trajectories in 2013–2017						Model fit statistics
	Low-declining vs. Maximum-stable HRQoL[a]			Moderate-stable vs. Maximum-stable HRQoL[a]			
	RRR[b]	**(95% CI)**	***p*-value**	**RRR**[b]	**(95% CI)**	***p*-value**	
Model 1[c]							
Ln(Household income) in 2009	0.45	(0.38–0.54)	<0.001	0.75	(0.65–0.86)	<0.001	(N = 6976) BIC = −5187 AIC = −5063
Model 2[c]							
Income rank in 2009	0.09	(0.05–0.15)	<0.001	0.50	(0.37–0.69)	<0.001	(N = 6983) BIC = −5190 AIC = −5066
Model 3[c]							
Subjective social status in 2009	0.64	(0.59–0.70)	<0.001	0.86	(0.81–0.90)	<0.001	(N = 7053) BIC = −5236 AIC = −5113
Model 4[c]							
Ln(Household income) in 2009	0.56	(0.46–0.67)	<0.001	0.84	(0.73–0.96)	0.013	(N = 6975)
Subjective social status in 2009	0.69	(0.63–0.76)	<0.001	0.87	(0.83–0.92)	<0.001	BIC = −5162 AIC = −5031
Model 5[c]							
Status inconsistency in 2009: HI > SSS or HI < SSS (ref: HI = SSS)	0.65	(0.51–0.83)	<0.001	0.98	(0.85–1.13)	0.791	(N = 6982) BIC = −5228 AIC = −5105
Model 6[c]							
Multi-SES trajectory group in 2009–2013: Upper-middle or Privileged (ref: Subsistence or Relative deprivation)	0.27	(0.20–0.35)	<0.001	0.65	(0.55–0.77)	<0.001	(N = 7054) BIC = −5245 AIC = −5122

Abbreviations: Subjective social status (SSS); household income (HI); relative risk ratio (RRR).
Notes.
[a] Reference group: Maximum-stable HRQoL trajectory group.
[b] As a result of multinomial regression, we estimated the relative risk ratio (RRR) of each covariate, which was interpreted as the relative risk of belonging to a comparison group vs. a reference group.
[c] Each model was adjusted using the same set of 2009 covariates (sex, age, education year, economic activity, marital status, house type, homeownership, smoking, drinking, obesity, sleeping time, CCI). Categorical covariates were modified to binary.

developing countries. The psychological mechanism—comprising social class, social value, and social cognitive tendencies that influence SSS—varies across cultures and socio-political contexts (Kraus et al., 2012). The prestigious elements inherent to SSS may elevate health trajectories in developed countries, but they are not active in developing countries.

Interestingly, the positive effects of the multi-SES trajectories did not enhance the HRQoL for those with middle or higher incomes. Indeed, the subsistence-level and relative-deprivation trajectory groups were associated with a low-declining health trajectory. However, the upper-middle and privileged trajectory groups had similar probabilities of having enhanced health trajectories. These results are in agreement with those of Braveman and Gottlieb (2014), who suggested a positive association between social factors and health at thresholds above which greater income or other SES indicators no longer improve health (Braveman & Gottlieb, 2014).

Third, we addressed a variety of SES indicators as predictors of HRQoL trajectory group membership. Every SES measure in our analysis showed that an increase in SES affected the likelihood of belonging to the maximum-stable HRQoL trajectory group. In particular, the longitudinal pattern of multi-SES trajectories significantly predicted health changes compared to the cross-sectional SES measures. Furthermore, one unit of increase in a socioeconomic indicator had a more significant protective effect on the low-declining health vs. maximum-stable health trajectory than on the moderate-stable vs. maximum-stable health trajectory. This means that objective or subjective SES is more effective for preventing a rapid deterioration in health, rather than maintaining a healthy state or increasing health.

This study has three improved methodological aspects. First, this research overcomes the skewness and ceiling effect issues of the EQ-5D index, for which identifying latent class is typically applied (Alava et al., 2012). We applied a latent class growth model to the HRQoL. Second, GBTM is a person-centered approach, as opposed to a variable-centered approach, enabling identification of different developmental courses between individuals based on qualitatively distinct features (Nagin & Odgers, 2010). Furthermore, the multi-GBTM method enabled investigation of the compact and transparent interrelationship between income and SSS. It provides meaningful social grouping, capturing the heterogeneity of the population. This is an improvement over conventional approaches relying on arbitrary decisions that classify the population regarding social class or SES or that define inequalities by calculating, for example, the Gini index or top 1% share of income. Third, the dependent and independent variables were separated temporally using longitudinal datasets. A cross-sectional survey based on self-reporting is subject to common method variance. When the self-report of the internal state is collected simultaneously with the previous status using the same instrument, outcomes and predictors are vulnerable to inflation of correlation (Lindell & Whitney, 2001).

This study also had several limitations. Regarding GBTM with time-stable covariates, observations with missing data in covariates were excluded from the analysis (Jones et al., 2001). Therefore, the missing covariates may influence the effects of risk factors on trajectory group membership (Ray et al., 2018). The EQ-5D indicator with three response levels mainly detects patients who responded 'having extreme problems' as health outcomes. Because mild but significant illness could not be adequately detected, the indicator shows low sensitivity to health changes (Herdman et al., 2011). It therefore may dilute the SES effect on health. Moreover, we used the youth version of the MacArthur Scale to measure subjective social status, which assesses one's familial placement. This hampers comparison with studies using the adult version of

the scale, which evaluates one's own position. In addition, SSS was measured at the individual level, whereas household income was measured at the household level. This income measure does not fully reflect the distribution of income within a household, or differences in resource availability among household members. These measure-related limitations notwithstanding, it is to some degree reasonable that we combined household income and perception of family status in the analysis of multi-group-based trajectories.

5. Conclusions

The benefits from social structure are concentrated on the advantaged while low-income groups are left behind. Income inequalities result in a lack of social mobility, both objectively and subjectively, and widen health disparities over time. A fast-growing and affluent society is at risk for inequitable health and unequal access to economic resources, which condemns low-income households to a cycle of being disadvantaged and having a declining health status.

Ethics approval

The institutional review board of Seoul National University approved the research protocol (IRB No. E2010/003–005).

CRediT authorship contribution statement

Eunah Kim: Conceptualization, Methodology, Software, Formal analysis, Data curation, Writing – original draft, Visualization. **Sung-il Cho:** Conceptualization, Writing – review & editing, Supervision.

Declaration of competing interest

None.

Acknowledgements

This research was supported by Specialized Science Research Scholarship 2020 under Seoul National University Innovation program funded by the Ministry of Education (South Korea). The funder had no role in study design, writing of the article, or decision to publish.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2022.101061.

References

Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy, White women. *Health Psychology, 19*(6), 586–592. https://doi.org/10.1037/0278-6133.19.6.586

Adler, N., & Stewart, J. (2007). The MacArthur scale of subjective social status. https://macses.ucsf.edu/research/psychosocial/subjective.php. (Accessed 16 June 2021).

Alava, M. H., Wailoo, A. J., & Ara, R. (2012). Tails from the peak district: Adjusted limited dependent variable mixture models of EQ-5D questionnaire health state utility values. *Value in Health, 15*(3), 550–561.

Atkinson, A. B., & Bourguignon, F. (2014). *Handbook of income distribution* (Vol. 2). Elsevier.

Bartley, M., Sacker, A., Firth, D., & Fitzpatrick, R. (1999). Understanding social variation in cardiovascular risk factors in women and men: The advantage of theoretically based measures. *Social Science & Medicine, 49*(6), 831–845. https://doi.org/10.1016/s0277-9536(99)00192-6

Berkman, L. F. (2009). Social epidemiology: Social determinants of health in the United States: Are we losing ground? *Annual Review of Public Health, 30*(1), 27–41. https://doi.org/10.1146/annurev.publhealth.031308.100310

Bourdieu, P. (1998). *Practical reason: On the theory of action*. Stanford University Press.

Braveman, P., & Gottlieb, L. (2014). The social determinants of health: It's time to consider the causes of the causes. *Public Health Reports, 129*(1_suppl2), 19–31. https://doi.org/10.1177/00333549141291s206

Demakakos, P., Nazroo, J., Breeze, E., & Marmot, M. (2008). Socioeconomic status and health: The role of subjective social status. *Social Science & Medicine, 67*(2), 330–340. https://doi.org/10.1016/j.socscimed.2008.03.038

Doob, C. B. (2019). Social inequality and social stratification in US society. https://doi.org/10.4324/9780429279331.

Fitzmaurice, G., Davidian, M., Verbeke, G., & Molenberghs, G. (2008). *Longitudinal data analysis*. CRC press.

Giatti, L., Camelo, L. D. V., Rodrigues, J. F. D. C., & Barreto, S. M. (2012). Reliability of the MacArthur scale of subjective social status - Brazilian longitudinal study of adult health (ELSA-Brasil). *BMC Public Health, 12*(1), 1096. https://doi.org/10.1186/1471-2458-12-1096

Glymour, M. M., Avendano, M., & Kawachi, I. (2014). *Social epidemiology: Ch 2. Socioeconomic status and health*. Oxford University Press.

Goodman, E., Adler, N. E., Daniels, S. R., Morrison, J. A., Slap, G. B., & Dolan, L. M. (2003). Impact of objective and subjective social status on obesity in a biracial cohort of adolescents. *Obesity Research, 11*(8), 1018–1026. https://doi.org/10.1038/oby.2003.140

Goodman, E., Adler, N. E., Kawachi, I., Frazier, A. L., Huang, B., & Colditz, G. A. (2001). Adolescents' perceptions of social status: Development and evaluation of a new indicator. *Pediatrics, 108*(2), e31. https://doi.org/10.1542/peds.108.2.e31. e31.

Goodman, E., Maxwell, S., Malspeis, S., & Adler, N. E. (2015). Developmental trajectories of subjective social status. *Pediatrics, 136*(3), e633–e640.

Herdman, M., Gudex, C., Lloyd, A., Janssen, M., Kind, P., Parkin, D., Bonsel, G., & Badia, X. (2011). Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of Life Research, 20*(10), 1727–1736. https://doi.org/10.1007/s11136-011-9903-x

Hodge, R. W., & Treiman, D. J. (1968). Class identification in the United States. *American Journal of Sociology, 73*(5), 535–547.

Hoebel, J., & Lampert, T. (2020). Subjective social status and health: Multidisciplinary explanations and methodological challenges. *Journal of Health Psychology, 25*(2), 173–185. https://doi.org/10.1177/1359105318800804

Hout, M. (2008). How class works: Objective and subjective aspects of class since the 1970s. In A. Lareau, & D. Conley (Eds.), *Social class* (pp. 25–64). Russell Sage Foundation. http://www.jstor.org/stable/10.7758/9781610447256.6.

Jones, B. L., & Nagin, D. (2012). A stata plugin for estimating group-based trajectory models. https://doi.org/10.1184/R1/6470963.v1.

Jones, B. L., Nagin, D. S., & Roeder, K. (2001). A SAS procedure based on mixture models for estimating developmental trajectories. *Sociological Methods & Research, 29*(3), 374–393. https://doi.org/10.1177/0049124101029003005

KIHASA, & NHIS. Introduction and survey design of Korea health panel survey. Korea Institute for health and social Affairs (KIHASA), National Health Insurance Service (NHIS). Retrieved 11 Jan 2022 from https://www.khp.re.kr:444/eng/main.do.

Kraus, M. W., & Park, J. W. (2014). The undervalued self: Social class and self-evaluation. *Frontiers in Psychology, 5*. https://doi.org/10.3389/fpsyg.2014.01404

Kraus, M. W., Piff, P. K., & Keltner, D. (2011). Social class as culture. *Current Directions in Psychological Science, 20*(4), 246–250. https://doi.org/10.1177/0963721411414654

Kraus, M. W., Piff, P. K., Mendoza-Denton, R., Rheinschmidt, M. L., & Keltner, D. (2012). Social class, solipsism, and contextualism: How the rich are different from the poor. *Psychological Review, 119*(3), 546. https://doi.org/10.1037/a0028756

Krieger, N., Williams, D. R., & Moss, N. E. (1997). Measuring social class in US public health research: Concepts, methodologies, and guidelines. *Annual Review of Public Health, 18*(1), 341–378. https://doi.org/10.1146/annurev.publhealth.18.1.341

Lee, Y. K., Nam, H. S., Chuang, L. H., Kim, K. Y., Yang, H. K., Kwon, I. S., Kind, P., Kweon, S. S., & Kim, Y. T. (2009). South Korean time trade-off values for EQ-5D health states: Modeling with observed values for 101 health states. *Value in Health, 12*(8), 1187–1193. https://doi.org/10.1111/j.1524-4733.2009.00579.x

Li, C. (2013). Little's test of missing completely at random. *STATA Journal: Promoting communications on statistics and Stata, 13*(4), 795–809. https://doi.org/10.1177/1536867x1301300407

Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology, 86*(1), 114.

Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior*, 80–94.

Little, R. J. A. (1995). Modeling the drop-out mechanism in repeated-measures studies. *Journal of the American Statistical Association, 90*(431), 1112–1121. https://doi.org/10.1080/01621459.1995.10476615

Liu, W. M., Ali, S. R., Soleck, G., Hopps, J., dunston, K., & Pickett, T., Jr. (2004). Using social class in counseling psychology research. *Journal of Counseling Psychology, 51*(1), 3–18. https://doi.org/10.1037/0022-0167.51.1.3

Macleod, J., Smith, G. D., Metcalfe, C., & Hart, C. (2005). Is subjective social status a more important determinant of health than objective social status? Evidence from a prospective observational study of scottish men. *Social Science & Medicine, 61*(9), 1916–1929. https://doi.org/10.1016/j.socscimed.2005.04.009

Marmot, M. G. (2006). Status syndrome. *JAMA, 295*(11), 1304. https://doi.org/10.1001/jama.295.11.1304

Mcleod, J. D. (2013). Social stratification and inequality. In *Handbooks of sociology and social research* (pp. 229–253). Springer Netherlands. https://doi.org/10.1007/978-94-007-4276-5_12.

Nagin, D. (2009). *Group-based modeling of development*. Harvard University Press. https://doi.org/10.4159/9780674041318

Nagin, D. S., Jones, B. L., Passos, V. L., & Tremblay, R. E. (2018). Group-based multi-trajectory modeling. *Statistical Methods in Medical Research, 27*(7), 2015–2023. https://doi.org/10.1177/0962280216673085

Nagin, D. S., & Odgers, C. L. (2010). Group-based trajectory modeling in clinical research. *Annual Review of Clinical Psychology, 6*(1), 109–138. https://doi.org/10.1146/annurev.clinpsy.121208.131413

Niedzwiedz, C. L., Katikireddi, S. V., Pell, J. P., & Mitchell, R. (2012). Life course socio-economic position and quality of life in adulthood: A systematic review of life course models. *BMC Public Health, 12*(1), 628. https://doi.org/10.1186/1471-2458-12-628

Nobles, J., Weintraub, M. R., & Adler, N. E. (2013). Subjective socioeconomic status and health. *Relationships reconsidered, 82*, 58–66. https://doi.org/10.1016/j.socscimed.2013.01.021

Oakes, J. M., & Rossi, P. H. (2003). The measurement of SES in health research: Current practice and steps toward a new approach. *Social Science & Medicine, 56*(4), 769–784. https://doi.org/10.1016/s0277-9536(02)00073-4

Operario, D., Adler, N. E., & Williams, D. R. (2004). Subjective social status: Reliability and predictive utility for global health. *Psychology and Health, 19*(2), 237–246. https://doi.org/10.1080/08870440310001638098

Organisation for Economic Co-operation and Development [OECD]. (2012). *Quality review of the OECD database on household incomes and poverty and the OECD earnings database*. OECD Social Policy Division. http://www.oecd.org/social/inequality.htm.

Piketty, T. (2015). About capital in the twenty-first Century. *The American Economic Review, 105*(5), 48–53. https://doi.org/10.1257/aer.p20151060

Quan, H., Li, B., Couris, C. M., Fushimi, K., Graham, P., Hider, P., Januel, J. M., & Sundararajan, V. (2011). Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. *American Journal of Epidemiology, 173*(6), 676–682. https://doi.org/10.1093/aje/kwq433

Ray, J. V., Sullivan, C. J., Loughran, T. A., & Jones, S. E. (2018). The impact of missing risk factor data on semiparametric group-based trajectory models. *Journal of Developmental and Life-Course Criminology, 4*(3), 276–296. https://doi.org/10.1007/s40865-018-0085-x

Roser, M., & Ortiz-Ospina, E. (2016). *Income inequality*. OurWorldInData.org. Retrieved 23 June 2021 from https://ourworldindata.org/income-inequality.

Singh-Manoux, A., Adler, N. E., & Marmot, M. G. (2003). Subjective social status: Its determinants and its association with measures of ill-health in the whitehall II study. *Social Science & Medicine, 56*(6), 1321–1333. https://doi.org/10.1016/s0277-9536(02)00131-4

Singh-Manoux, A., Marmot, M. G., & Adler, N. E. (2005). Does subjective social status predict health and change in health status better than objective status? *Psychosomatic Medicine, 67*(6), 855–861. https://doi.org/10.1097/01.psy.0000188434.52941.a0

United Nations Conference on Trade and Development [UNCTAD]. (2021). *Membership of UNCTAD and membership of the trade and development board*.

Van Der Nest, G., Lima Passos, V., Candel, M. J. J. M., & Van Breukelen, G. J. P. (2020). An overview of mixture modelling for latent evolutions in longitudinal data: Modelling approaches, fit statistics and software. *Advances in Life Course Research, 43*, Article 100323. https://doi.org/10.1016/j.alcr.2019.100323

Wilkinson, R., & Pickett, K. (2010). *The spirit level: Why equality is better for everyone* (Vol. 33). Penguin books.

Wolff, L. S., Acevedo-Garcia, D., Subramanian, S. V., Weber, D., & Kawachi, I. (2010). Subjective social status, a new measure in health disparities research. *Journal of Health Psychology, 15*(4), 560–574. https://doi.org/10.1177/1359105309354345

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

World Health Organization. (2000). *The Asia-Pacific perspective: Redefining obesity and its treatment*.

Wright, C. E., & Steptoe, A. (2005). Subjective socioeconomic position, gender and cortisol responses to waking in an elderly population. *Psychoneuroendocrinology, 30*(6), 582–590. https://doi.org/10.1016/j.psyneuen.2005.01.007

Zang, E., & Bardo, A. R. (2019). Objective and subjective socioeconomic status, their discrepancy, and health: Evidence from east Asia. *Social Indicators Research, 143*(2), 765–794. https://doi.org/10.1007/s11205-018-1991-3