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Three Essays on Social Stratification, Gender and Health

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Abstract
This dissertation consists of three essays on health inequalities that arise from interactions between education, gender, and socio-cultural context: gender disparities in the educational gradients in weight status, the gender-specific relationship between mortality of parents and offspring's educational attainment, and the association between adult literacy and self-rated health in 17 developed countries. Methodologically, I use multinomial regression, quantile regression, Cox proportional hazards models, and country fixed-effect approaches aligning my analytic strategies with the nature and scope of the research questions.

The first chapter focuses on whether weight status is socially patterned by the interplay between human capital, economic, and behavioral resources in a highly gendered context of South Korea. The study shows that women who have fewer opportunities to transfer human capital into economic resources may utilize their human capital to obtain symbolic resources, such as physical attractiveness. In contrast, education is not a direct predictor of obesity among men, for whom behaviors promoting healthy weight often conflict with collective ideology at work such as heavy drinking and for whom motivation to obtain professional success is stronger than to obtain symbolic resources.

The second essay focuses on intergenerational support from adult offspring to older parents and examines whether the relationship between children's educational attainment and parental mortality varies by the gender of the parent and the gender of the child. The study reveals that children's education is strongly associated with mothers' mortality beyond mothers' own socioeconomic status (SES). The relationship is less pronounced for fathers and is largely explained by the father's own SES. Furthermore, sons' educational attainment is a stronger predictor of the mortality of parents than daughters' educational attainment.

The third chapter examines whether literacy skills predict self-rated health beyond educational attainment in 17 developed countries using a cross-national survey, the Programme for the International Assessment of Adult Competencies (PIAAC). The study finds that the literacy-related health inequalities are less severe in countries with higher public share of health expenditures that may better address the needs of vulnerable individuals. Curriculum standardization also contributes to reducing health disparities by decreasing variance in skills obtained through education across individuals.

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THREE ESSAYS ON SOCIAL STRATIFIATION, GENDER AND HEALTH

ABSTRACT

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER 1: Skinny Women and Overweight Men: Gender Differences in the Association between Educational Attainment and Body Weight Status among Korean Adults

Introduction

Obesity has emerged as a global epidemic. Obesity is increasingly prevalent in countries where it was rarely a problem in the past as these countries undergo remarkable economic growth accompanied with obesogenic environment, including sedentary lifestyle and excessive caloric intake (Popkin and Gordon-Larsen 2004, Yoon et al. 2006). Identifying proper strategies for the prevention of diseases for which obesity is a major risk factor is becoming a significant global health issue (Wells et al. 2012).

The emergence of obesogenic environments makes education more important because it enhances one's knowledge about the health consequences of obesity and awareness of one's own weight status. Education helps people override unhealthy lifestyles and change established patterns of physical activity and diet by making people more able to deploy resources (Cleland et al. 2009, Ross and Wu 1995).

Obesity is typically more prevalent among women compared to men as women's body is adapted to store more fat due to biological factors related to reproduction (Power and Schulkin 2008). Experience of childbirth significantly increases probability of obesity as well (Davis et al. 2009). Yet, recent studies have documented that the gender differences in overweight and obesity prevalence vary by social and cultural contexts, which indicates that gender is an important social factor of obesity as well as a biological marker (Garawi et al. 2014, Wells et al. 2012).

While research from Western countries links higher education with lower risk of obesity, whether the shape and strength of the relationship vary by gender is inconclusive (McLaren 2007). Relatively less is known about the gender-specific mechanisms through which education is associated with weight status in non-Western societies with a rigid gender hierarchy that have experienced the rapid rise in the obesity rate (Read and Gorman 2010). Men and women are differently exposed to higher education and have unequal socioeconomic returns to education over the life course in these societies (Brinton 1988, Brinton 2001). Furthermore, there are potential gender differences in social consequences of obesity (Wardle, Waller and Jarvis 2002) and in cultural ideologies regarding body size (Meyer, Blissett and Oldfield 2001), which contribute to generating different motivation for men and women to manage emerged obesogenic environments.

More attention should be paid to investigating why gender differences in the educational gradients in weight status strongly exist in specific social contexts (Kanter and Caballero 2012). This paper extends previous literature by examining how the link between education and weight status operate before and after controlling for other socioeconomic (SES) characteristics and health behaviors within the structure of gender relations in South Korea (hereafter 'Korea') where large gender differences have been documented in the association between education and weight status (Devaux and Sassi 2013, Kim, Sharma and Park 2014).

Current study hypothesizes that strict gender inequalities in socioeconomic status in Korea operate to affect the relationship between education and weight status among men and women in several unique ways. First, because of the gender stratification of the labor market and gendered segregation of familial roles that

restrict women's economic returns to education and gendered norms regarding the value of slimness, I hypothesize that women's weight status may be associated with education more directly than will men's. Second, education may not be a strong predictor of overweight and obesity among Korean men, for whom behaviors promoting healthy weight often conflict with collective ideology at work that strongly supports long work hours and heavy alcohol consumption (Lee 2005), and for whom motivation to obtain professional success is stronger than health and physical attractiveness in patriarchal culture. Thus, I hypothesize that well-off men are less likely to feel the need to maintain healthy weight and less likely to be sensitive to weight status compared to well-off women. The purpose of the current study is to investigate whether obesity is socially patterned by the interplay between human capital, economic, and behavioral resources based on gendered processes.

Background

Educational Gradients in Body Weight Status

Education is well known to predict better health (Cutler and Lleras-Muney 2006, Elo 2009). Education improves cognitive abilities to obtain and evaluate information. Education promotes self-efficacy, and enables better decision making that promotes better health. Higher levels of education enable people to be more efficient in health production, e.g., more educated people may be better able to practice efficient allocation of caloric intake and expenditure (Cutler and Lleras-Muney 2006, Kemptner, Jürges and Reinhold 2011). According to a study using 2005-2006 American Time Use Survey better educated individuals allocated more time to regular exercise especially on weekends (Mullahy and Robert 2008). Education helps people recognize whether they maintain proper weight and healthy lifestyles (Wardle and Griffith 2001). Highly educated people are likely to have more

inclination to change established behaviors to avoid health problems as they more highly value the future than the less educated (Adams and White 2009). Cutler and Lleras-Muney (2010) assessed the links between education and various health behaviors using the data from United States and United Kingdom and found that additional years of schooling promoted multiple beneficial health behaviors in both countries, including vigorous physical activity and abstention from excessive drinking.

The effect of education is indirectly attributable to economic resources. The more highly educated are expected to attain higher income, live in neighborhoods with recreational facilities, and hold professional occupations that may protect them against risk factors for obesity (Lantz et al. 1998, Powell et al. 2006, Ross and Wu 1995). For instance, people earning higher income may have better access to healthy foods, costly fitness and medical services which help them maintain optimal body size. Findings regarding the relationship between occupational status and obesity have been mixed. Professional jobs provide better social support, autonomy, and economic resources which in turn promote healthy weight, while such occupations may also reduce physical activity (McLaren 2007, Wardle, Waller and Jarvis 2002).

People obtain cultural values, behavioral norms, and operational skills positively valued by society through education (Abel 2008, Bourdieu 1984). Cultural values and norms shape weight perceptions that influence how well people translate intensions into everyday actions to achieve ideal body shape (Abel 2008, Cockerham 2005, Phelan, Link and Tehranifar 2010). Therefore, socioeconomic inequalities in overweight and obesity can be traced to collective weight perception and weight-related behaviors by specific status groups to reinforce their prestige (Atlantis, Barnes

and Ball 2008, Cockerham 2005). In this context, exploring plausible variation in the extent to which people with different levels of education perceive their own weight status can shed light on the link between education and weight status.

Although many studies have found that educational attainment is negatively associated with obesity there is substantial variation in the extent to which education predicts healthy body weight across social contexts. Recent meta-studies documented that in less developed countries, people who have more resources to access high-calorie foods are more likely to be obese than poorer individuals (McLaren 2007, Monteiro et al. 2004). People with less education are more likely to experience food insecurity and they also tend to be involved in physically demanding jobs, all of which keep them from gaining weight (Popkin 2006). Furthermore, in such societies, knowledge of negative consequences of obesity is not widespread, with malnutrition having been relatively common in the recent past (Caprio et al. 2008). In addition, people tend to prefer larger body size and obesity is not socially stigmatized because of its scarcity value, and thereby education may not be necessarily linked to lower body weight (Brewis 2011).

As development introduced efficient production technologies, costs of food production declined and access to high-calorie foods became easier and cheaper through the growth of convenience food stores and restaurants (Chou, Grossman and Saffer 2004, Hermann et al. 2011, Philipson and Posner 2008). While reduced food costs is contributory to the increase in obesity, knowledge of health consequences of obesity is first spread among highly-educated who become aware of the values of maintaining proper weight and who are more capable of managing healthier lifestyles (Mirowsky and Ross 2003). As cultural preferences for thinness have emerged

through media, high status groups tend to distinguish themselves from low status groups by spending more money and time to maintain healthy weight. Studies in developed countries provide evidence for the observation that upper or middle class people are more likely to support the 'thin ideology' and to practice various weight-loss strategies than working class people (Sobal 2001, Williams, Germov and Young 2011).

Gender Differences in the Educational Gradients in Weight Status

The shape and strength of the relationship between education and health behaviors are not always homogeneous across demographic groups within a country. Women tend to have fewer socioeconomic returns to education than men and lack alternative resources that buffer against risk factors correlated with low education (Ross and Mirowsky 2006). Thus, women are likely to rely more heavily on human capital to promote healthier lifestyles and the negative educational gradients in overweight and obesity may be stronger for women than for men. Compared to men and women with higher education, women with lower education are more likely to be economically disadvantaged, psychologically stressed, and less likely to have access to health-enhancing resources, therefore they are more likely to be exposed to health risk factors.

Education is closely associated with cultural capital and predisposes people to be knowledgeable about normative codes of desirable physical appearance (Abel 2008). Therefore, the variation in the educational gradients in weight status among men and women may be reflective of gender-linked differences in normative cultural codes regarding ideal body size. Social pressure to conform to ideal body shape may thus vary between men and women (Nissen and Holm 2015). Women are more

sensitive to their weight status as they are more likely to be evaluated by the norms based on physical appearance than men. For example, discrimination based on physical appearance in the labor and marriage markets is stronger among women than men (Caliendo and Lee 2013, Cawley 2004). Women's beauty is more likely to be valued as a symbolic asset, e.g., a beauty premium, which translates into tangible social resources particularly in societies with an anti-egalitarian tradition (Buss 1998, French 2002). Therefore, highly educated women nested in an anti-egalitarian culture are more aware of socially "acceptable" body shape and motivated to use their resources to maintain ideal weight.

Findings of gender differences in the link between education and weight status have been mixed (Devaux and Sassi 2013; McLaren 2007). In less developed countries where access to food has been limited, large body size is not stigmatized but rather it is considered to signify affluence, fecundity, and healthiness (McLaren 2007). In these societies, a strong positive association between educational attainment and obesity has been found among women and a positive or insignificant association has been observed among men (McLaren and Kuh 2004, Pampel, Denney and Krueger 2012, Wardle, Waller and Jarvis 2002). Case and Menendez (2009) found that in South Africa, social preference for a voluptuous body shape is stronger among women than men, and thus women of higher social status are considerably more likely to under-perceive their actual body size and be overweight (Case and Menendez 2009). Social preference for a larger body size is frequently observed in Thailand, Vietnam, Tanzania, and India where the prevalence of overweight and obesity is more common among women with higher than lower levels of education (McLaren 2007).

In developed societies, obese individuals are often stigmatized and social penalties for being obese are greater for women than men (Devaux and Sassi 2013, Zhang and Wang 2004). For instance, obese women have lower probability of getting married, earn significantly less income and experience worse employment outcomes compared to women who are not obese and men who are obese (Caliendo and Lee 2013, Cawley 2004). The culture and a fashion industry that convey ubiquitous images of female celebrities with unnaturally thin body also encourage people to consider slimness as feminine beauty and a characteristics of social distinction (Mobius and Rosenblat 2006, Puhl and Heuer 2009). Jeffery et al. (1991) found that US women with higher educational attainment are more likely to have tried to lose weight than women with lower educational attainment (Jeffery, Adlis and Forster 1991). Another study using data from the US found that women aged 20 and older with higher educational attainment tended to have a narrower range of ideal body size than men (Chang and Christakis 2003).

Context Matters: The Korean Setting

Korea experienced a rapid economic development. State-led industrialization has led to an enormous occupational transition from rural primary product sectors to service and manufacturing sectors, which has contributed to reduced physical activity (Kim, Moon and Popkin 2000). Due to the fast economic change most Korean adults who spent early childhood without knowledge of obesity are now facing an obesity epidemic (Aitsi-Selmi et al. 2014). With modernization, pop-culture industry has been growing enormously and a skinny body image of female celebrities frequently displayed in the media has become an ideal body shape for women in Korea (Bordo 2004, Hyun et al. 2014).

Although the prevalence of obesity in Korea is relatively moderate compared to other high- and middle-income countries (less than 30% according to Yoon et al., 2006), it has been growing fast in recent years especially among middle-aged men (Yoon et al. 2006) while the same trend has not been observed among women (Khang and Yun 2010). However, educational disparities in overweight and obesity have been growing rapidly only for women in recent years (Yoo, Cho and Khang 2010). According to the cross-national statistics among the 11 OECD countries the largest educational differences in overweight and obesity have been observed for Korean women along with Spanish women while the smallest educational inequalities have been found for Korean men (OECD, 2011).

In spite of the stark gender differences in educational variation in overweight and obesity, little is known about why educational differences in weight status vary among men and women in Korea. Although human agency and self-control that accrue from education are potentially important in obesity prevention in Korean society where people experience fast changes in dietary intake patterns (Lee and Sobal 2003) prior Korean studies did not pay attention to the role of education in obesity prevention and did not examine factors that might explain why the educational gradient in weight status differs between men and women (Kim, Sharma and Park 2014, Yoo, Cho and Khang 2010, Yoon, Oh and Park 2006). These studies also did not analyze gender differences in other socioeconomic characteristics, such as occupation or income, and health behaviors that could explain the gender variation in weight status.

Despite rapid socioeconomic development and the expansion of higher education, which has reduced the gender gap in educational attainment, gender

inequalities in labor force participation, wages, and type of employment remain substantial in Korea. Studies have documented significant barriers in the Korean labor market that contribute to the interruption of occupational careers of women upon marriage and childbearing (Brinton 2001, Park and Lee 2014). According to the "glass-ceiling index" of the Economist (2016) based on 2014 or the latest cross-national data, Korea is the worst place to be a working woman among 30 OECD countries. Korea has the largest gender wage gap and Korean women are least likely to be in senior managerial positions far behind women in the Scandinavian countries. Most Korean women do not obtain the same level of economic rewards and autonomy as Korean men at a similar level of education. Thus it is possible that for Korean women education, rather than economic resources, plays a direct role in determining weight status. Furthermore, given that women with low education make up a majority of socially vulnerable populations in Korea, these women may be more likely to be exposed to risk factors for obesity, e.g., psychological stress and lack of motivation to change unhealthy behaviors such as physical inactivity.

Korea has a patriarchal socio-cultural system with strong male-breadwinner–female-homemaker tradition and the role of mother and father is differentiated within the family. Married women are expected to be good mothers by staying at home and taking care of children while married men are expected to be good fathers by being capable breadwinners (Park and Raymo 2013, Won 2006). In this context of a strong gender division of labor, men's earning may be a particularly crucial factor in marriage markets and married women's social status is likely to be determined by her husband's social status. Therefore, women's bodies are often sexually objectified by men in the process of mate selection, which may drive young women toward investing in human capital to achieve physical attractiveness (Bordo 1993, Cho 2009).

On the other hand, Korean men are less likely to be under appearance-related social pressures. They value education in order to obtain higher wages or more prestigious employment (Murnen and Seabrook 2012).

Health-related lifestyles are sometimes at odds with the ideology of the group or the organization that people belong to (Phelan, Link and Tehranifar 2010). Individuals are expected to conform to the group's dominant ideology as a collective obligation to avoid possible disadvantages of unfulfilling the normative rules (Dunning and Kim 2007). Collective practices in Korea support the norm favoring longer working hours. OECD data show that Korea has the longest working hours compared to other developed countries (OECD 2014). Long working hours decrease workers' time for outdoor activities and sleep which play a significant role in the etiology of obesity (Gangwisch et al. 2005). Korean male workers are also under pressure to participate in drinking gatherings as an extension of formal work to improve work place relations (Yeh 2015). Embedded in a cultural system of social interactions, alcohol consumption, a 'social lubricant', is positively perceived by professional and sales workers as a way to show solidarity with one’s business network and to ease the stress associated with work (Lee 2005). Heavy drinking falls into a line of masculine icons in Asian culture while it places a taboo on women who drink (Iwamoto et al. 2016). Unhealthy behaviors such as sitting behind a desk all day, overworking while reducing sleep hours, and heavy drinking have been supported as a virtue shared by elite groups that measure social success among Korean men of working age. Given that occupational success can be a stronger motivator than good health especially among men, the pursuit of occupational success may impede the promoting of healthy lifestyles. This may lead Korean men with college education, who are generally more likely to have sedentary jobs and higher

income than men with a low level of education, to be exposed to higher risks for being overweight and/or obese.

Hypotheses

Given that gender gaps in weight status are understudied especially in highly gender-stratified cultural settings, the current study will contribute to the existing literature by investigating the role of education in shaping weight status among Korean men and women. I will examine the following hypotheses:

Hypothesis 1: Korean women who have higher educational attainment are less likely to be overweight and obese than women who have lower educational attainment and the relationship between educational attainment and body weight status will remain strong even after controlling for other socioeconomic resources and health behaviors.

Hypothesis 2a: Korean men who have higher educational attainment are more likely to be overweight and obese than men who have lower educational attainment and the relationship between educational attainment and body weight status will be at least partly explained by occupation and income.

Hypothesis 2b: Korean men who have higher occupational status are more likely to be overweight and obese and the relationship between occupational status and body weight is partly explained by health behaviors.

Hypothesis 3: Korean men are more likely to under-estimate their body weight compared to Korean women. The educational gradient in weight perception will be less pronounced among men than women. Korean women who have higher educational attainment are more likely to perceive their body weight as being higher

than their actual weight status and women with lower educational attainment will perceive their weight as being lower than their actual weight status.

Data and Methods

The data for this study come from the Korean National Health and Nutrition Examination Survey (KNHANES). The KNHANES is a nationally representative survey, consisting of a combination of a health interview, a nutritional survey, and health examinations with comprehensive information on biochemical and anthropometric measurements, health status, health behaviors and socio-demographic characteristics. Therefore, the data are well suited to examine gender differences and the role of SES and health behaviors in weight status.

Standardized health examinations were carried out in a specially equipped mobile examination centers. Similar to the U.S. National Health and Nutrition Examination Survey (NHANES), the KNHANES is a repetitive cross-sectional survey of Korean individuals chosen in a multistage clustered sampling frame based on geographical unit, sex and age, using the 2005 National Census Registry. Since the KNHANES examines independent sets of randomly selected individuals, it very rarely happens to select the same person repeatedly in the following year.

The current study utilizes five recent waves of KNHANES from 2008 to 2012. I restrict the sample to individuals ages 25-64. By age 25 most people have completed their highest level of education, and most individuals ages 25-64, especially men, participated in the labor force at the time of interview. Women who were pregnant at the time of the examination were excluded (N=153). From the pooled weighted KNHANES sample of 19,899, I deleted individuals who were missing information on measured BMI and who had missing information on the explanatory variables

(N=1,952). The final sample size consists of 17,947 individuals of whom 7,109 were males and 10,838 were females.

Measures

Underweight, Overweight, and Obesity

The current study uses body mass index (BMI = weight in kg/ (height in meters)^2) as an indicator of weight status. Height and weight were measured in light indoor clothing without shoes to the nearest 0.1 kg and 0.1 cm respectively. BMI is categorized based on the criteria recommended by the World Health Organization (WHO) for the study of obesity among Asians as follows: underweight (BMI less than 18.5kg/m^2), normal weight (18.5≤BMI<23 kg/m^2), overweight (23≤BMI<27.5kg/m^2), and obesity (BMI higher than 27.5 kg/m^2) (WHO 2004).

The appropriateness of using standard BMI cutoff points of overweight and obesity has been controversial given the fact that adiposity tissue volume and lifestyle factors are heterogeneous across populations (Hubbard 2000). Some studies have recommended lowering BMI cutoff points for Asians, because compared to Caucasians Asians have greater abdominal fat distribution and higher prevalence of obesity-related diseases (type-2 diabetes and cardiovascular diseases) at lower levels of BMI (Snijder et al. 2006, Villareal et al. 2005). In addition, populations with short stature may be considered “obese” at lower levels of BMI because those with small body structure have higher proportion of body fat at each level of BMI (Ibid). However, there is no universal agreement about what BMI cutoff points should be used to define overweight or obesity for a specific population.

Explanatory Variables

I adjust for the following demographic characteristics: age, year of survey, marital status (currently married, separated/divorced/widowed, never married), self-rated health (poor, fair, good), as well as region of residence (metropolitan cities, small cities, rural area). The key explanatory variable is educational attainment coded as follows: middle school or less (< 10 years), high school (10-12 years), and at least some college (>12 years). I include annual household income and current occupational status as economic resources. Annual household income is derived from the income of all household members earned during the last year and is treated as a continuous variable. Household income is logged because it is skewed and it has a higher R-square compared to unlogged household income. The respondent's occupation is coded into four categories based on industry: professional work, clerical/service/sales work, manual work, and unemployed/housewives/students. Manual work includes work in agriculture, forestry, fisheries, and other manual labor. To test whether health behaviors play an important role in the link between education and obesity, I include hours of sleep, smoking behavior, and alcohol consumption. Average hours of sleep is self-reported and coded as a continuous variable ranging from 6 or less hours to 9 or more hours, e.g., 6 or less, 7, 7.5, 8, etc. Hours of sleep is reported based on average duration of sleep during the last 12 months. Respondents are categorized into one of three smoking groups: never smoked, former smoker, and current smoker. Measures of current drinking patterns are based on self-reports on frequency of drinking and amount of alcohol consumed per day: (1) never drink, (2) drink less than 30g ethanol per day on average and once a month, (3) drink less than 30g ethanol per day on average at least twice a month, (4) drink about 40-60g ethanol

per day on average, (5) drink about 60-80g ethanol per day on average, (6) drink more than 80g ethanol per day on average.

The correlation between education and weight could be generated by common hereditary or health endowment that affects both schooling and obesity. Therefore, I additionally control for parental education as a measure of parental socioeconomic status to account for family backgrounds. Father's and mother's educational attainment were coded based on the highest level of school completed. Because of the high correlation between the father's and the mother's educational attainment, I generated a categorical indicator of parental education by using the highest educational attainment of either the father or the mother: no school, lower secondary, and upper secondary or above.

Weight Perception

I will evaluate whether education is associated with weight perception and whether weight perception is highly correlated with individuals' BMI. Weight perception is measured based on the question asking how individuals perceived their own body size with a five-point scale ranging from 'underweight' to 'overweight' (1: underweight, 2: lighter than average, 3: about average, 4: slightly overweight, 5: overweight). This measure of self-rated body perception and is coded into three categories to obtain an adequate number of cases in each category (1: perceived lighter than average (perceived underweight) (1+2), 2: perceived average (3), 3: perceived overweight (4+5)).

Statistical Methods

To examine gender differences in the distribution of the explanatory variables, I use t-tests for quantitative variables and chi-square tests for categorical variables. I estimate multinomial logit models to assess the associations between BMI categories and the explanatory variables. The categorical outcome models compare underweight, overweight, and obese categories relative to the reference category of normal weight. BMI variable is categorized to identify the high-risk groups and makes comparison with other statuses more straight forward (WHO 2004). All models are estimated separately for men and women. All estimates are weighted by survey weights to be nationally representative and account for the complex sampling design of KNHANES.

Model 1 shows bivariate relationship between educational attainment and weight status. Model 2 includes controls for age, year of survey, marital status, and region of residence. In model 3, I introduce income and occupation as plausible economic mediators. In model 4, I add health behaviors to model 3 and examine whether health behaviors further explain the associations between education, economic status, and weight status. Model 2, 3, and 4 also control for parental education and self-rated health, which may affect respondents' educational attainment and health behaviors and reflect family backgrounds (Cutler and Lleras-Muney 2010).

To reduce a controversy over BMI categorization, the results of multinomial logit regressions are complemented by a quantile regression that estimates the association between education and the entire BMI distribution without specifying any cutoff. The quantile regression method focuses on the education gradients in both the right and the left tail of the BMI distributions known to be related with high health

risks (Koenker 2005). It assesses whether the coefficients of education will vary at high versus low quantiles of BMI and how they change before and after controlling for potential mediators.

To see whether there are educational gradients in weight perception among men and women, I regress weight perception on age, year of survey, education, BMI categories (underweight, normal, overweight, obesity), and interaction terms between education and the BMI categories. These analyses assess whether better educated men and women perceive their body size more consistently with their actual weight status or whether they over-perceive their weight status controlling for BMI. I produce predicted probabilities of whether people perceive themselves as having "average" weight using the results of the multinomial logit regressions. I compare the mean difference in the predicted probabilities of perceiving body image as normal by educational attainment and BMI categories for women and men while setting all other covariates at their means. All models were estimated in STATA 12.

Results

Table 1.1 provides sample characteristics including weighted means for continuous variables and percentages for categorical variables for men and women. With respect to weight status, men were more likely to be obese and overweight than women whereas women were more likely to be underweight than men. For example, 10.9% of women and 14.0% of men were obese; 36.9% of women and 51.2% of men were overweight; the percentages of underweight were 5.7% for women and 2.4% for men (Table 1.1). The gender gap in the BMI distribution differs from that observed in prior studies in other developed and developing countries. Medical studies argued that women are more susceptible to obesity than men due to biological differences in body

fat accumulation (Kanter and Caballero 2012), whereas in Korea women were significantly less likely to be overweight and obese than men and also more likely to be underweight relative to men. With respect to weight perception, around 50.5% of women perceived that they were heavier than average compared to about 42.6% of the men despite the fact that men were more likely to be overweight or obese than women. Women reported poorer health compared to men, a finding that is consistent with results of previous studies in many countries and Koreans also rated their health substantially worse than in the U.S. (Molarius et al. 2012).

Women were socioeconomically disadvantaged compared to men. Men were more highly educated than women; 44.0% of men had attended at least some college while 34.2% of women had done so. Higher percentage of women (25.3%) than men (16.9%) had only less than middle school education. Men were significantly more likely to be working in professional jobs than women (21.7% vs. 12.6%). In contrast, almost half of the women (45.7%) were out of the labor force. Furthermore, women were less likely to be single than men as Korean men tend to delay marriage until they have a stable job. Women were more likely to be living in metropolitan cities than men.

The distribution of health behaviors significantly differed by gender. Women reported longer mean sleep durations than men. Women reported slightly longer mean sleep durations than men. On average women reported sleep duration of 7.1 hours and men reported 6.9 hours of sleep. Among women 8.4% reported that they were current smokers, whereas 61.1% of men reported that they were currently smoking. Around 2.9% of women reported that they were heavy drinkers drinking more than 80g

ethanol/a day compared to 21.3% of the men. In contrast, 29.3% of women never drank; the respective percentage for men was 11.7%.

Multinomial Logit Results – Women

Table 1.2 reports coefficients from multinomial logit regression models for women. Educational attainment was a significant predictor of weight status among women such that women with higher levels of schooling were significantly less likely to be overweight or obese (model 1 in table 1.2). According to the odds ratios based on the coefficients reported in model 2 in table 1.2, women who had at least some college level education were much less likely to be obese than women whose education level was middle school or less after controlling for demographic covariates (OR=exp(-1.44) = 0.24 , *p-value*= 0.00). Women with at least some college level education were half as likely to be overweight compared to women with only middle school or less education after controlling for demographic variables (OR=exp(-0.74)=0.48, *p-value*= 0.00). Women with high school level education were significantly less likely to be overweight and obese than women with middle school education as well. Put another way, a woman with middle school level education had the highest risk of being overweight or obese.

The negative education gradient persists even after controlling for annual household income and occupational status (model 3 in table 1.2). Women with higher household income were significantly less likely to be obese but occupational status was not a significant predictor of weight status among women. In general, results from model 3 suggest that economic resources do not appear to be a major source of the educational gradients in overweight and obesity among Korean women.

Adding controls for health related behaviors, including mean hours of sleep, smoking, and alcohol consumption, in Model 4 did not explain the relationship between educational attainment and overweight and obesity among women. Shorter sleep durations and heavy drinking were positively associated with overweight and obesity, a finding that is consistent with other medical studies (Gangwisch et al. 2005). Based on the above results, educational attainment appears to be an important social determinant of weight status among Korean women. An interaction term with age and educational attainment was found to be insignificant in a fully adjusted model, which indicates that association between education and weight status did not vary by age (results not shown but available upon request).

Multinomial Logit Results -Men

Table 1.3 presents the results from models 1-4 for men. As seen in model 1 of table 1.3, educational attainment among men was positively associated with the risk of being obese such that those who had high school and college level education were significantly more likely to be obese than those who had the lowest level of education. The bivariate relationships between education and underweight and overweight were not statistically significant. However, after controlling for age, marital status, region of residence and survey years, the relationship between college level education and overweight became statistically significant. The odds ratio of obesity of men with college level education was 1.41 times higher and the odds ratio of overweight of men with college level education was 1.32 times higher relative to men with middle school level education.

Model 3 in table 1.3 shows that household income and occupational status substantially attenuated the size of the coefficients of education, and education was no

longer statistically significantly associated with weight status. At the same time, more economically advantaged men were more likely to be overweight. Household income was marginally associated with obesity. As hypothesized, men in sedentary occupations were significantly more likely to be overweight and obese. Men who work in the clerical/service/sales and professional occupations were significantly more likely to be overweight and obese compared to men with manual jobs. In separate models that compare the coefficients of education after controlling for household income and occupational status respectively, I found that of the two socioeconomic characteristics occupation played a more crucial role in explaining the association between education and overweight and obesity among men (results not shown). In other words, men with higher educational level were more likely to work in either professional or clerical/sales/service sectors compared to men with middle school level education, which may be closely associated with obesogenic lifestyles.

In model 3, I introduced health behaviors to examine whether these behaviors explained part of the relationships between occupational status and overweight and obesity among men. When health behaviors were adjusted for, the coefficients of the relationship between professional job and clerical/service/sales job and obesity became non-significant at 95% confidence level and the magnitude of the coefficients declined moderately by around 18.8% and 20% respectively. The sizes of coefficients of the relationship between professional job and clerical/service/sales job and overweight decreased slightly. Additional analyses showed that men in clerical/service/sales occupations were more likely to engage in heavy chronic drinking and professional workers slept for much shorter durations than manual workers. Health behaviors did not fully explain the relationship between occupation and weight status; unexplained pathways may include work-related psychological

stress, excessive calorie intake and lack of physical activity. An interaction term with age and education was not statistically significant in a fully adjusted model among men as was the case with women (results not shown).

Results from Quantile Regressions

Table 1.4a-1.4b present results from the fully adjusted quantile regression model examining whether estimates of the relationship between educational attainment and BMI differed along the 10th, 25th, 50th, 75th, and 90th percentiles of the BMI distribution. These results are consistent with estimates from the multinomial logit models for both women and men. Educational attainment remained a strong independent predictor for women across the entire BMI distribution as indicated by the negative coefficients for higher levels of schooling. The negative college level education coefficients were larger at the higher quantiles of BMI, which suggests that college level education had a larger effect at the higher quantiles of BMI and there were larger educational inequalities at the right tail of the BMI distribution. For example, in the fully adjusted models the 10th percentile of BMI for women who had a college degree was -1.00 BMI units lower than for women with middle school level education and at the 90th percentile, the coefficient for the BMI of women who had a college degree was -1.99 (Table 1.4a).

As we can see in Table 1.4b, men did not show any significant educational gradient across entire BMI distribution after controlling for occupational status and health behaviors, consistent with the result of the fully adjusted multinomial logit regression. The coefficients associated with "professional" and "clerical/service/sales" occupations were both positive and statistically significant at all quantiles before controlling for health behaviors and the effects of occupations at the 75th (BMI=26.2)

and 90th (BMI=28.1) percentiles were explained by health behaviors when alcohol intake and sleep hours were adjusted for. Heavy drinking and shorter sleep hours were associated with higher BMI at all quantiles among men (results not shown). The result supports the hypothesis that these health behaviors play a crucial role in well-off men's overweight and obesity status in particular.

Perception of Weight Status

In the analyses of weight perceptions I assessed whether individuals with higher educational attainment had perceptions of their weight status that was more 'consistent' with their actual weight than that of individuals with lower levels of education. In table 1.5, I present results from multinomial logit regression models for women and men with perceived weight as a dependent variable and actual weight status as one of the predictor variables. Education was a significant predictor of weight perception for women. Women with higher educational attainment were significantly less likely to perceive that they were slimmer than average and more likely to perceive that they were heavier than average controlling for their actual body weight status. Figure 1.1 graphs predicted probabilities from the fully-adjusted model with an interaction term between education and weight status for women who perceive that they are of average body size (model 2 in table 1.5). Most women in normal weight category were likely to perceive that they were of average body size and the probability for the highest educated women was greater than that for the lowest educated. The pronounced educational differences were found among women who were overweight and under-estimate their body size. The probability for the women with college education who were overweight and considered their body size was normal was significantly lower than that for the women with middle school level

education. The confidence intervals for the probability of under-perception of these two groups did not overlap, which means that the educational groups are significantly different.

Compared to women the educational gradients in weight perception were less pronounced for men. Figure 1.2 presents predicted probabilities for men who perceive that they are of average body size with different educational attainment across actual weight status categories. Figure 1.2 illustrates that men were more likely to under-perceive their body size than women. Weight perception was not strongly stratified among men across educational attainment unlike women. In Figure 1.2, around half of men who were actually overweight were likely to consider that they were of average body size regardless of their educational attainment. For both men and women there were no significant age differences in the relationships between educational attainment and weight perceptions.

Discussion

The current study examined the association between educational attainment and weight status, whether the association operated mainly through attained economic resources and health behaviors, and whether these associations varied by gender in a society with the strong gender hierarchy. Although many studies have focused on the socioeconomic disparities in obesity, much less is known about the independent role of education in shaping weight particularly among men and women recently experiencing major societal changes and nested in economic, occupational, and cultural characteristics that reflect a female disadvantage. In this sense, Korea is an interesting setting to evaluate the gender-specific mechanisms of the association between educational attainment and weight status.

The analysis demonstrates clear gender differences in the associations between education and weight status and education and weight perception. It provides strong evidence for Hypothesis 1, 2a and 3, which focus on the role of education in weight status that is contingent on dynamics of gender relations. As predicted, in the overall sample women who completed college had lower odds of becoming overweight and obese than women who have lower education level, and the relationships were not explained by economic resource and health behaviors. Direct effect of education on weight status was not found among men. Considering that women have fewer opportunities for transferring educational attainment into economic resources than men and women's social status would be determined by husband's social status in Korea, Korean women may utilize their human capital to obtain symbolic resources such as physical attractiveness to gain additional advantage in marriage and labor markets stratified along gender lines. Previous studies have also argued that education is strongly linked to "physical attractiveness within individuals (beauty and education co-occur) (McClintock, 2014, p.5)" and highly educated women pursue socially desirable body shape (McClintock 2014). With socioeconomic development, public interest in pop-culture has grown and skinny body image of female celebrities in media has promoted thinness as ideal body shape for women (Hyun et al. 2014). Thus, well-educated Korean women are more likely to be sensitive to their body shape and accrue prestige by setting themselves apart with weight-related behaviors reflected in the boom in fitness and plastic surgery industry in Korea (Holliday and Elfving-Hwang 2012). Education increases the demand for dieting although highly educated women have a lower objective “need,” but less educated women are less sensitive to their body weight and have difficulty to pay for diets. For example, the significant educational gradients were found only among women;

overweight women with lower educational attainment are likely to under-estimate their body size. These factors contribute to generating strong educational inequalities in the 'ideal slim look' (Joh et al. 2012).

Education works in opposite way to shape weight status among Korean men. Unlike women, highly educated men are heavier, a pattern which is linked to occupational status. Among men, health behaviors among high-status groups are not consistent with a healthy lifestyle (Phelan, Link and Tehranifar 2010) and more highly educated men may thus not be motivated to engage in healthy behaviors (Cockerham 2000, Phelan, Link and Tehranifar 2010). These behavior patterns can be pronounced in cultures that emphasize collectivity over individuality and where individuals are expected to conform to the group's dominant ideology as a collective obligation to avoid possible disadvantages from unfulfilling the normative rules (Dunning and Kim 2007). For example, Korean culture supports long working hours and sedentary lifestyles are common in higher status occupations, e.g., high-ranking officials have private drivers et cetera. In Korea, average weekly working hours are 45.1 hours, the second longest after Mexico among OECD nations and considerably higher than the OECD average of 36.9 hours (OECD, 2013). Long working hours restrict leisure time physical activities and induce lack of sleep, unhealthy food intake, and stress, all of which give a rise to obesity. In addition, Korean men traditionally tend to place high value on socializing and drinking as important work-related activities while viewing alcohol positively as a crucial factor to build social networks (Lee et al. 2007). Heavy drinking can induce obesity by providing high calories from alcohol as well as by hindering behaviors that promote healthier weight. Given the high prevalence of heavy drinking among Korean men in business related sectors, it

partly explains why higher educational attainment among men is associated with higher weight.

Norms on gender roles influence the ways men and women allocate time to various activities during the day such that men with college education are likely to spend more time at paid work relative to women with college education who are less likely to be in the labor market (Sayer 2005). In a gendered society where the price of time use for non-paid work is much greater for males than females, men may have time constraints and spend less of their time engaged in leisure activities promoting healthy weight, particularly when they are working in sedentary jobs. Koreans also appear to have less aversion regarding large body size for men as large body is a symbol of masculinity and Koreans tend to be less judgmental about men's physical appearance and emphasize the traditional male breadwinner role (Joh et al. 2013). Discrimination based on appearance in the labor and marriage market is relatively mild for men compared to women. As we could see in Figures 1.1 and 1.2 men are likely to under-perceive their body size compared to women, i.e., overweight men tend to consider themselves to be 'average' weight, regardless of their educational attainment. Although education may help maintain healthy weight in developed countries, it may not always be a protective factor in societies with different cultures. These findings encourage future research on the nature of education as an important social determinant of overweight/obesity in rapidly developing societies, especially those that are undergoing changes in gender norms.

One of the main limitations of the study is the lack of longitudinal data on individuals' body weight trajectories. Therefore, I cannot derive further inference about the causal effect of educational attainment on changes in weight status or

weight control behaviors. It is also possible that the correlation between educational attainment and body weight is derived from unobserved factors affecting both educational attainment and weight status such as health endowments and time preference. Even though I controlled for parental education in all models, this may not be adequate. Despite these evident data limitations, I believe that current study provides robust empirical evidence to support the interactions among education, economic resources, health behaviors, and weight status in gender role context which cannot be extended in the present setting given the cross-sectional data set. Future studies also need to consider gender differences in other important behavioral mediators, such as calorie intake, physical activity, social capital, and psychological status, which were not included in current study due to the lack of reliable data.

Tables

Table 1.1. Sample Characteristics by Gender, Ages 25-64, Distribution (%) or Mean (SD), 2008–2012 Korean National Health and Nutrition Examination Survey (KNHANES), (N= 17,947)

Characteristics	Total (N= 17,947)	Women (N= 10,838)	Men (N= 7,109)	p-value[1]
Weight status				
Underweight (BMI<18.5)	4.0	5.7	2.4	0.00
Normal weight (18.5≤BMI<23)	39.3	46.6	32.3	
Overweight (23≤BMI<27.5)	44.2	36.9	51.3	
Obese (27.5≤BMI)	12.5	10.9	14.0	
BMI (continuous)	23.8(3.4)	23.2(3.5)	24.3(3.2)	0.00
Self-perceived weight status				
Lighter than average	15.1	10.2	19.9	0.00
Average	38.4	39.4	37.6	
Heavier than average	46.5	50.5	42.6	
Self-rated health				
Poor	16.0	18.8	13.3	0.00
Fair	45.5	45.9	45.2	
Good	38.4	35.3	41.4	
Socio-demographic characteristics				
Educational attainment				
Middle school (≤9 years)	21.0	25.3	16.9	0.00
High school (10-12 years)	39.8	40.6	39.0	
Some college and above (>12 years)	39.2	34.2	44.0	
Age (mean)	42.9(10.6)	43.1(10.6)	42.6(10.6)	0.00
Parent's education				
No school	14.5	15.0	14.1	0.16
Lower secondary	51.2	51.7	50.7	
Upper secondary/above	34.3	33.4	35.2	
Marital status				
Single	15.8	11.2	20.3	0.00
Married	77.8	80.0	75.7	
Separated/divorced/widow	6.4	4.0	8.8	
Region of residence				
Metropolitan cities	47.9	49.0	46.9	0.01
Small cities	34.6	34.8	34.5	
Rural area	17.4	16.2	18.6	
Annual Household Income	5222.4 (10197)	5193.5 (10651)	5250.2 (9737.6)	0.78
Occupational status				
Professional worker	40.4	12.6	21.7	0.00
Clerical/service/sales work	26.0	25.0	27.0	
Manual worker	27.8	16.8	38.0	
Not in the labor force	31.9	45.7	13.3	
Health behaviors				
Hours of sleep	7.0(0.9)	7.1(1.0)	6.9(0.9)	0.00
Smoking				
Current Smoker	35.2	8.4	61.1	0.00
Former smoker	12.5	4.0	20.6	
Non-smoker	52.4	87.6	18.3	
Drinking				
Never	20.3	29.3	11.7	0.00
Light drinker	24.7	36.3	13.6	
Light and frequent drinker	16.7	19.0	14.5	
Moderate drinker	14.4	8.8	19.7	
Heavy drinker(60-80g ethanol/a day)	11.6	3.7	19.2	
Heavy drinker(>80g ethanol/a day)	12.2	2.9	21.3	

Notes: [1] p-value refers to the difference in the distribution of the explanatory variable between males and females based on a chi-square test for categorical variables and t-test for continuous variables.

Table 1.2. Coefficients from Multinomial Logit Regression Models for Weight Status among Women, 2008–2012 Korean National Health and Nutrition Examination Survey (KNHANES), (N=10,838)

	Model1[a]			**Model 2[a]**		
Characteristic	**Under weight**	**Over weight**	**Obesity**	**Under weight**	**Over weight**	**Obesity**
Socio-demographic characteristics[1]						
Educational attainment (middle school or less)						
High school (10-12 years)	0.70**	-0.74**	-0.80**	-0.15	-0.38**	-0.71**
College and above (>12 years)	1.24**	-1.27**	-1.58**	0.01	-0.74**	-1.44**
Household income (logged)						
Occupational status (manual worker)						
Professional/service						
Clerical/service/sales						
Not in the labor force (housewife/student)						
Marital status (married)						
Single				0.36*	-0.14	-0.35+
Separated/divorced/widow				-0.12	-0.08	-0.06
Health behaviors						
Hours of sleep						
Smoking (non-smoker)						
Current smoker						
Former smoker						
Drinking (Never/Less than once a month)						
Light drinker						
Light and frequent drinker						
Moderate drinker						
Heavy drinker(60-80g ethanol/a day)						
Heavy drinker(>80g ethanol/a day)						
Constant	-3.00**	0.50**	-0.63**	-0.85	-0.96**	-1.86**

Notes: p-value **< 0.01; * < 0.05; + < 0.10. Age, survey year, self-reported health, region of residence, parental education are controlled for in model 2-4.
[1] Omitted category is shown in parenthesis. [a] Normal weight is a reference outcome.

Table 1.2. (Continued) Coefficients from Multinomial Logit Regression Models for Weight Status among Women, 2008–2012 Korean National Health and Nutrition Examination Survey (KNHANES), (N=10,838)

Characteristic	Model 3[a] Under weight	Over weight	Obesity	Model 4[a] Under weight	Over weight	Obesity
Socio-demographic characteristics[1]						
Educational attainment (middle school or less)						
High school (10-12 years)	-0.24	-0.39**	-0.69**	-0.22	-0.39**	-0.68**
College and above (>12 years)	-0.12	-0.73**	-1.42**	-0.12	-0.72**	-1.38**
Household income (logged)	0.12	0.03	-0.16**	0.12	0.02	-0.16**
Occupational status (manual worker)						
Professional/service	0.30	-0.08	0.24	0.26	-0.08	0.25
Clerical/service/sales	0.39+	0.06	0.25+	0.39+	0.06	0.25+
Not in the labor force (housewife/student)	0.37+	-0.02	0.15	0.32	0.00	0.18
Marital status (married)						
Single	0.38*	-0.14	-0.43*	0.42**	-0.17	-0.49*
Separated/divorced/widow	-0.03	-0.07	-0.16	-0.01	-0.08	-0.22
Health behaviors						
Hours of sleep				0.09+	-0.07*	-0.16**
Smoking (non-smoker)						
Current smoker				0.05	-0.20+	-0.02
Former smoker				-0.41	0.08	0.29
Drinking (Never/Less than once a month)						
Light drinker				0.03	0.01	0.04
Light and frequent drinker				-0.15	-0.02	-0.01
Moderate drinker				-0.49	0.01	0.12
Heavy drinker(60-80g ethanol/a day)				0.04	0.33*	0.40+
Heavy drinker(>80g ethanol/a day)				-0.02	0.51**	0.71**
Constant	-2.13*	-1.18**	-0.74	-1.38	-0.88*	1.32*

Notes: p-value **< 0.01; * < 0.05; + < 0.10. Age, survey year, self-reported health, region of residence, parental education are controlled for in model 2-4.
[1] Omitted category is shown in parenthesis. [a] Normal weight is a reference outcome.

Table 1.3. Coefficients from Multinomial Logit Regression Models for Weight Status among Men, 2008–2012 Korean National Health and Nutrition Examination Survey (KNHANES), (N= 7,109)

	Model1[a]			**Model 2[a]**		
Characteristic	**Under weight**	**Over weight**	**Obesity**	**Under weight**	**Over weight**	**Obesity**
Socio-demographic characteristics[1]						
Educational attainment (middle school or less)						
High school (10-12 years)	-0.16	0.01	0.34**	-0.15	0.14+	0.29*
College and above (>12 years)	-0.22	0.12	0.42**	-0.22	0.28**	0.34*
Household income (logged)						
Occupational status (manual worker)						
Professional/service						
Clerical/service/sales						
Not in the labor force (housewife/student)						
Marital status (married)						
Single				0.16	-0.35**	-0.34*
Separated/divorced/widow				0.41	0.01	-0.04
Health behaviors						
Hours of sleep						
Smoking (current smoker)						
Non smoker						
Former smoker						
Drinking (Never/Less than once a month)						
Light drinker						
Light and frequent drinker						
Moderate drinker						
Heavy drinker(60-80g ethanol/a day)						
Heavy drinker(>80g ethanol/a day)						
Constant	-2.44**	0.41**	-1.16**	-0.99	-0.05	-0.14

Notes: p-value **< 0.01; * < 0.05; + < 0.10. Age, survey year, self-reported health, region of residence, parental education are controlled for in model 2-4.
[1] Omitted category is shown in parenthesis. [a] Normal weight is a reference outcome.

Table 1.3. (Continued) Coefficients from Multinomial Logit Regression Models for Weight Status among Men, 2008–2012 Korean National Health and Nutrition Examination Survey (KNHANES), (N= 7,109)

Characteristic	Model 3[a] Under weight	Over weight	Obesity	Model 4[a] Under weight	Over weight	Obesity
Socio-demographic characteristics[1]						
Educational attainment (middle school or less)						
High school (10-12 years)	-0.03	0.06	0.20	-0.05	0.05	0.18
College and above (>12 years)	0.03	0.08	0.13	0.02	0.08	0.11
Household income (logged)	-0.14+	0.12**	0.10+	-0.11	0.12**	0.10
Occupational status (manual worker)						
Professional/service	-0.30	0.31**	0.32*	-0.26	0.29**	0.26+
Clerical/service/sales	-0.48+	0.21*	0.25*	-0.46	0.19*	0.20
Not in the labor force (housewife/student)	0.22	0.05	-0.22	0.18	0.05	-0.12
Marital status (married)						
Single	-0.08	-0.26*	-0.19	-0.02	-0.25	-0.18
Separated/divorced/widow	0.18	0.12	0.12	0.25	0.08	-0.02
Health behaviors						
Hours of sleep				0.02	-0.09*	-0.25**
Smoking (current smoker)						
Non smoker				-0.62*	0.03	0.07
Former smoker				-0.08	0.25**	0.09
Drinking (Never/Less than once a month)						
Light drinker				0.22	-0.10	-0.16
Light and frequent drinker				0.06	-0.16	-0.55**
Moderate drinker				-0.19	0.19	0.01
Heavy drinker(60-80g ethanol/a day)				-0.49	0.12+	0.00
Heavy drinker(>80g ethanol/a day)				-0.66	0.42**	0.71**
Constant	0.24	-1.08**	-1.03+	0.30	-0.59	0.44

Notes: p-value **< 0.01; * < 0.05; + < 0.10. Age, survey year, self-reported health, region of residence, parental education are controlled for in model 2-4.
[1] Omitted category is shown in parenthesis. [a] Normal weight is a reference outcome.

Table 1.4a. Coefficient Estimates from a Quantile Regression on Body Mass Index (BMI) among Women (N= 10,838)

Women Characteristic	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**
Educational attainment (college and above)					
High school (10-12 years)	-0.52**	-0.57**	-0.73**	-0.60**	-0.63**
College and above (>12 years)	-1.00**	-1.18**	-1.36**	-1.61**	-1.99**
Occupational status (manual worker)					
Professional/service	0.11	0.11	-0.05	-0.06	0.13
Clerical/service/sales	0.30*	0.20	0.02	0.17	0.21
Not in the labor force (housewife/student)	0.19	0.15	-0.11	-0.03	0.16
Constant	17.14**	18.52**	22.41**	27.9**	34.2**

Notes: p-value **< 0.01; * < 0.05. Age, survey year, marital status, self-rated health, region of residence, parental education, income, and health behaviors are controlled for in the model

Table 1.4b. Coefficient Estimates from a Quantile Regression on Body Mass Index (BMI) among Men (N= 7,109)

Men Characteristic	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**
Educational attainment (college and above)					
High school (10-12 years)	0.09	-0.03	0.06	-0.01	-0.07
College and above (>12 years)	0.08	0.01	0.04	0.05	0.02
Occupational status (manual worker)					
Professional/service	0.34*	0.40*	0.48**	0.45*	0.28
Clerical/service/sales	0.37**	0.32**	0.35*	0.28	0.33
Not in the labor force (housewife/student)	0.02	0.02	0.00	0.05	-0.23
Constant	17.0**	19.9**	24.13**	27.43**	30.73**

Notes: p-value **< 0.01; * < 0.05. Age, survey year, marital status, self-rated health, region of residence, parental education, income, and health behaviors are controlled for in the model

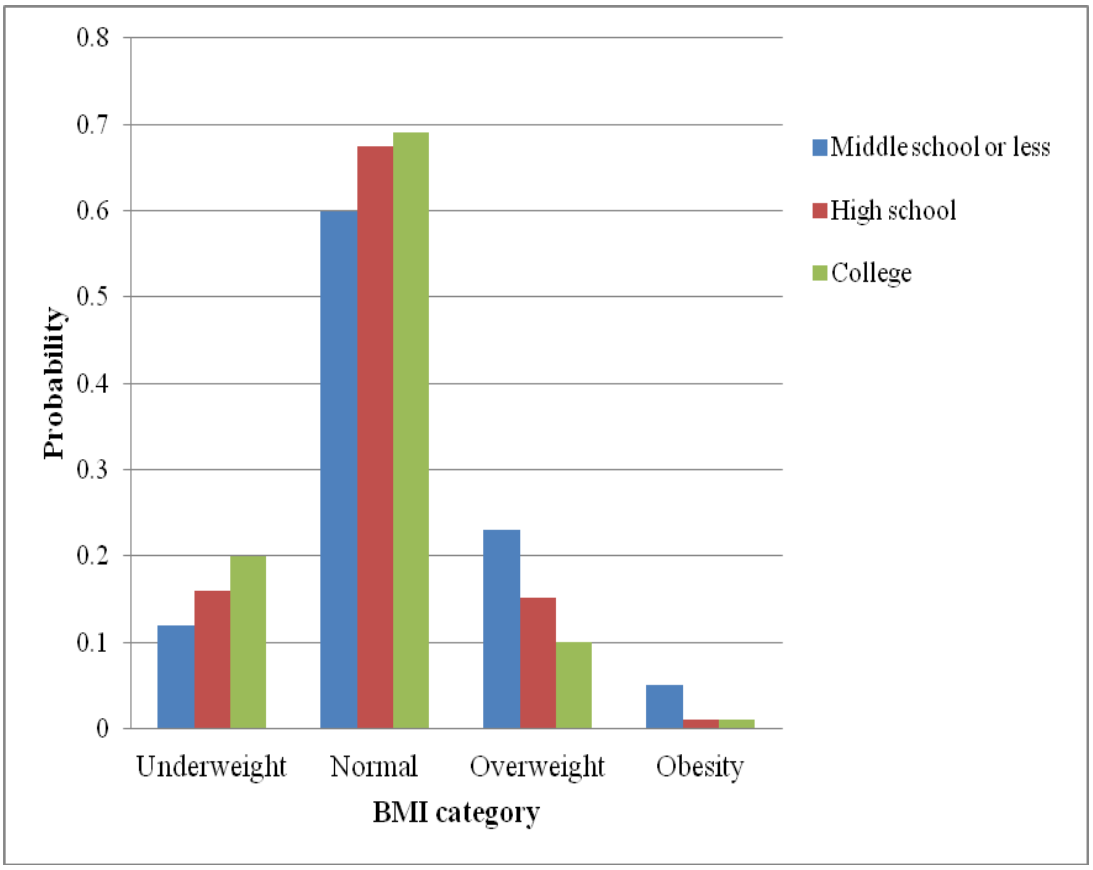
Table 1.5. Coefficients from Multinomial Logit Regression Models for Weight Perception among Women (N= 10,838) and Men (N= 7,109), 2008–2012 Korean National Health and Nutrition Examination Survey (KNHANES)

	Women				**Men**			
	Model1[a]		Model2[a]		Model 1[a]		Model2[a]	
Characteristic	Perceived Under weight	Perceived Over weight	Perceived Under weight	Perceived Over weight	Perceived Under weight	Perceived Over weight	Perceived Under weight	Perceived Over weight
Educational attainment (middle school or less)								
High school (10-12 years)	-0.42**	0.45**	-0.49**	-0.02	-0.18	0.13	-0.03	0.10
College and above (>12 years)	-0.40**	0.38**	-0.44**	-0.17	-0.23+	0.34*	0.11	0.41
BMI category(normal)								
Underweight	3.31**	-17.0	3.21**	-19.65	4.0**	1.52	3.06**	2.35+
Overweight	-1.50**	2.87**	-1.59**	2.33**	-3.02**	2.84**	-2.42**	2.93**
Obesity	-0.58	4.91**	-0.72+	4.14**	-2.07**	5.82 **	-2.06**	5.35**
Interaction								
High school*Underweight			0.23	0.62			15.65	0.44
High school*Overweight			0.21	0.55**			-1.08**	-0.04
High school*Obesity			-11.41	1.98**			0.05	0.55
College/above*Underweight			0.05	0.57			1.03	-14.51
College/above *Overweight			-0.21	0.94**			-0.73*	-0.15
College/above *Obesity			-11.7	1.65*			-0.15	0.88
Constant	-3.08**	0.11	-3.02**	0.60**	0.30	-2.2**	0.16	-2.22**

Notes: p-value **< 0.01; * < 0.05; + < 0.10. Age and survey year are controlled for in all models. [1] Omitted category is shown in parenthesis.
[a] People who considered themselves to be 'average' are a reference outcome.

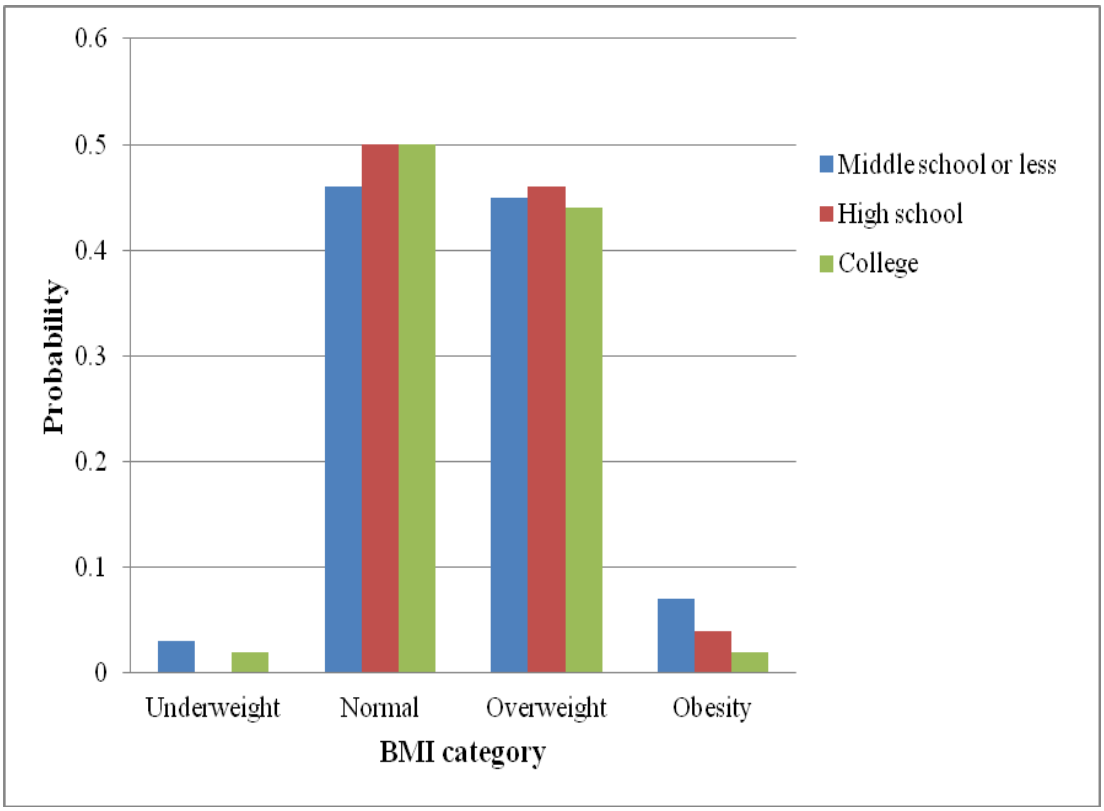
Figures

Figure 1.1. Predicted Probability of Weight Perception of Average among Women



Notes: Weight perception refers to whether people perceive that they are of average weight. Model controls for age, survey year, education, weight status, and education*weight status.

Figure 1.2. Predicted Probability of Weight Perception of Average among Men



Notes: Weight perception refers to whether people perceive that they are of average weight. Model controls for age, survey year, education, weight status, and education*weight status.

CHAPTER 2: Who Benefits from Children? Exploring the Role of Offspring's Education in Parental Survivorship in South Korea

Introduction

While research investigating the relationship between socioeconomic status (SES) and health and mortality is proliferating, studies have not fully considered the various links between family-level socioeconomic resources and health. Previous studies have proposed that the socioeconomic resources of a person may have positive consequences for others in his or her family network. For example, grandparents' and parents' resources influence children's health outcomes by transmitting economic resources and providing affective support (Cohen et al. 2010, Osler et al. 2005). However, very few studies have focused on the reverse direction of intergenerational support from adult offspring to older parents, and whether and how adult children's socioeconomic characteristics may matter for their aging parents' health and mortality, independent of parents' own SES.

Children are an important part of parents' social networks. Thus, as people age and retire, adult children may increasingly become an important source of support for older parents. Direct support from offspring may include economic transfers that facilitate their aging parents' healthcare consumption as well as practical and emotional assistance to parents. Children can also influence parental health by sharing health knowledge and lifestyles. All of these comprise family-level social resources (Friedman and Mare 2014). Understanding the role of children in parental health and well-being is important not only for revealing how parents' longevity is shaped by their broad family environment, but also for developing policies to address public

concerns regarding the financing of healthcare for aging populations (Silverstein, Gans and Yang 2006).

Recent studies from Taiwan, Sweden, and the United States have examined the relationship between adult children's schooling and parents' mortality and find that children's educational attainment is positively associated with older parents' survivorship even after controlling for parent's own educational attainment and economic status (Friedman and Mare 2014, Torssander 2013, Torssander 2014, Zimmer et al. 2007). Critical questions involve which parent benefits more from children's education and whether the strength of the relationship varies by demographic characters of the child, e.g., whether adult children's resources are equally important to fathers and mothers or whether education of sons and daughters equally contribute to parents' longevity. Previous studies in Western countries have found that there is no significant difference in the relationship between the longevity of fathers and mothers and the gender of their children (Friedman and Mare 2014, Torssander 2013). However, Western patterns for old age support may not be applicable to non-Western contexts where adult sons are expected to be the main sources of support for parents and the share of the elderly population is rapidly increasing while governmental support of the elderly remains limited (Hermalin 1997, Kim 2015). In addition, because of structural inequalities embedded in the gendered hierarchy, women tend to be less educated and less likely to participate in full-time work and in national pension programs compared to men in Asian countries (Brinton 2001). Therefore, women are likely to be exposed to old-age income insecurity, which makes older women more likely to rely on their offspring's socioeconomic resources than older men.

The current research extends previous work in three ways. First, the study evaluates whether the relationship between adult children's education and the health of their older parents would vary by the gender of parents in the culture of a societal gender hierarchy. Second, prior studies have lacked comprehensive information related to the pathways underlying the relationship between children's educational attainment and the mortality of their parents. Additional analyses of the mechanisms may help further demonstrate how children's education is associated with the health of parents. Thus, in addition to smoking and exercise, indicators of parental health behaviors used in Friedman and Mare's study (2014), we include two other crucial measures of parental health behaviors, namely alcohol intake and routine health check-ups. Furthermore, we add an indicator of average frequency of contact with all adult children, which is hypothesized to partially explain the relationship between children's education and parental health. Finally, the study will look into whether sons and daughters are likely to have different effects on their parents' mortality in South Korea (hereafter, 'Korea'), a country that traditionally has a patrilineal family structure, i.e., parents invest more in sons than daughters and sons are expected to give primary support for their older parents. This would help shed light on whether the effect of children's education on parental mortality depends on cultural norms around family relations.

Background

Intergenerational Support and Gender Relation in Korea

In response to growing interest in the effect of adult children's education on elderly parents' health, this study focuses on Korea, a rapidly aging and strongly gendered setting. Korea provides an excellent opportunity for addressing the

relationship between adult children's education and parents' mortality as it offers comprehensive and robust survey data about the intergenerational pathways speculated in previous studies. Furthermore, the investigation of how intergenerational support is contingent on gender is meaningful in Korea where gender signifies unique structural positions of men and women, and it influences who in the family needs more help and who will meet those needs.

Korea has a patriarchal socio-cultural system with a strong male-breadwinner–female-homemaker tradition and a strong differentiation between the role of mother and father within the family. Married women are expected to be good mothers by staying at home and spending more time with their children, while married men are expected to be good fathers by earning more money to support their family (Park and Raymo 2013, Won 2006). Gender inequalities in labor force participation, wages, and type of employment have been substantial in Korea, although weakening over time (Ibid). Researchers have found significant barriers in the Korean labor market that lead to the interruption of the occupational careers of women upon marriage and childbearing (Brinton 2001, Park and Lee 2014). Data from the Organization for Economic Cooperation and Development (OECD) showed that the employment rate among Korean women aged 35-39 was around 54.9% in 2014, which was the third lowest employment rate among 34 OECD countries. In addition, the gender wage gap was the largest in Korea among these 34 countries (OECD 2014). Most Korean women have fewer economic resources and autonomy compared to men. Married women's social status is likely to be determined by husband's SES and children's educational success. This makes children a key resource in older Korean women's social networks and contributes to the development of

stronger emotional ties between children and their mothers compared to children and their fathers (Jeon et al. 2013).

Korea is also an important case for examining the role of children's education and their parents' health because of its national institutional characteristics, including a lack of social security and national pension programs for the elderly. Together with rapid socioeconomic development, life expectancy in Korea has increased while the birth rate has decreased (Bloom, Canning and Finlay 2010). These developments have made Korean society transition into an aging society. The proportion of people over 65 has increased by 4.3% from 1960 to 2000 and is projected to reach 14% by 2022 (United Nations 2000). Korea thus faces a serious challenge in finding an appropriate solution to the increased demand for supporting the elderly and the current lack of public provision of such support (Rhee, Done and Anderson 2015).

According to recent OECD data, the poverty rate of people aged 65 and older in Korea was around 45% in 2010, which was the highest among OECD countries (OECD 2011). Furthermore, the level of net pension entitlement divided by the net pre-retirement earnings, i.e., net pension replacement rates, was very low in Korea; only five countries (Mexico, Japan, Britain, New Zealand and Ireland) had lower net replacement rates than Korea, and poverty rates among the elderly in these other countries were much lower than in Korea (OECD 2012). The introduction of a national pension program in Korea lagged behind other developed countries and started only in 1988. Therefore, today's elderly have had a relatively short period of time to pay their premiums and receive adequate pension benefits. This pension program covered 68.4% of salaried workers in 2013. The non-contributory Old-Age Basic Pension program was initiated later in 2008 and provides much less support

than what is required for the minimum cost of living (Yoon 2013). Within the context of an employment-based pension system, older women—whose opportunities to work as regular workers have been restricted—are likely to be voluntary contributors, which has resulted in large gender differences in the amount of pension benefits people receive. Despite government's effort to reduce the number of women who are not covered by the program (e.g., full time housewives, workers in the informal sector), there have been far fewer female old-age pension beneficiaries than male beneficiaries (National Pension Service 2012). The proportion of elderly women covered by the national pension system was 41.8% while the proportion of elderly men covered by the national pension program was 58.2% in 2012 (Ibid).

Due to the relatively low level of public support, there is a high incidence of income insecurity among the elderly, and because of the expense of health care services, many of the aged may not receive proper medical treatment without the support from the family (Baek, Sung and Lee 2011). Even though Korea has universal coverage through the mandatory National Health Insurance (NHI), the share of public spending in total health expenditure was only 58.2% in 2010, which is below the average public expenditure of OECD (72.2%) (OECD 2010). Additionally, out-of-pocket payments constituted 43.8% of total health expenditure and the contribution of employees, employers, and the self-employed was about 38.2% (Ibid). Korea does not have financial support for health care services that focuses on older people, such as Medicare in the United States. The NHI is not financially able to meet the future healthcare needs of the elderly as life expectancy increased rapidly. One way to maintain health insurance for parents who already retired is to rely on their children or children's spouse, which may result in high copayments for treatment (Cho et al. 2004). Therefore, if a child has a stable job that supports their parents' health

insurance by sharing burden of copayment cost that may be a great help for parents in need in Korea.

The emphasis on strong family ties in Korean culture makes family a major source of support, as indicated by high rates of co-residence between parents and their adult children (Kim 2010). According to a study by Kim (2015), the direction of net transfers in Korea is mainly upward; around 68% of parents receive financial support from their adult children, accounting for about 18% of parents' total income in 2005 (Kim 2015). Thus, having children with higher SES may be strongly associated with additional advantages for older parents (Park 2015). In this sense, the Korean case provides some additional insights into the role of family-level resources for the maintenance of health in old age in countries that face challenges regarding the financing of healthcare and old age support for elderly residents.

Korea also experienced rapid educational expansion during the last few decades, which has led to a large gap in educational attainment between the younger generations and their parents (Park and Kang 2008). The differences in educational attainment across generations may contribute to amplifying benefits from children's schooling as children's advanced knowledge spills over into their parents and promotes good health behaviors (Friedman and Mare 2014). Many older people born before 1940 spent their childhoods in poverty due to high opportunity costs of schooling during the Japanese colonial period and the Korean War. Because of a restriction on women's entry into the labor market, economic returns to education for women were significantly lower than for men. Thus, older women were much less likely to be educated than men (i.e., less likely to receive the same amount of investment from parents than men) and expected to yield their educational

opportunities to male siblings (Butcher and Case 1994). In contrast to the older generation, the younger generation spent their adolescence under the influence of rapid economic growth and educational expansion and thus had more chances to receive higher levels of schooling (Park 2007a). The college enrollment rate also increased from 30% to 80% through the 1990s, which transformed those with a college degree from minority to majority members of the society (Sandefur and Park 2007). Around 66% of people aged 25 to 34 had attained college level education in 2012. This was more than four times the proportion of those aged 55 to 64, among whom only 14% had gained a college degree (OECD 2014). Gender differences in higher educational attainment decreased considerably with educational expansion in recent years as well (Ibid). The college entrance rate increased from 33.9% in 1990 to 77.6% in 2010 among men and from 32.4% in 1990 to 80.5% in 2010 among women (KEDI 2010). The current study will assess whether the increased institutional investment in children's education contributed to the health of parental generations, particularly to the health of older women who are more socioeconomically disadvantaged compared to older men.

Children's Education and Parental Health

As the means to access healthcare services and health-related information have diversified through the late 20th century, the role of education in shaping health has become more important (Hayward, Hummer and Sasson 2015). Highly educated individuals can bring health-related information into the family and encourage other members to adopt healthier lifestyles. Highly educated children can provide better quality health-related support for the elderly by taking advantage of advanced knowledge and social networks (Zimmer et al. 2007). Better educated children are

better at monitoring the health conditions of parents and giving appropriate advice, such as encouraging preventive care e.g., routine blood testing or cancer screening (House et al. 1994, Ikkink, Van Tilburg and Knipscheer 1999). Children with more knowledge can help parents control their diseases and self-care by assisting with healthcare service utilization and consultation with medical specialists. In this way, the elderly who have well-educated children are more likely to be informed about health risk factors and better able to deal with complex medical situations (Torssander 2013, Zimmer, Hermalin and Lin 2002). Friedman and Mare (2014) found that adult children's educational attainment is positively associated with the likelihood that their parents give up smoking and engage in regular exercise, which partially explained the association between children's education and parents' mortality in the United States. Further research is still needed, however, to examine whether other health behaviors may similarly be associated with children's education.

The relationship between the offspring's education and parental health can be explained by the time spent with parents. Children may provide more information and exert stronger social influence on a parent with whom they frequently interact. Kalmijn (2006) found that highly educated children are more capable of developing positive family relations over time and provide better emotional support to their parents particularly when they need help. Educated children can use frequent phone calls to compensate for a lack of face-to-face contact due to work obligations, especially at times when their parents need help. Frequent interaction with parents facilitates the flow of resources in family networks and can contribute to better health outcomes. In other words, children's resources may benefit a parent with whom they develop closer emotional ties and with whom they interact more frequently to share lifestyle and health values.

Prior studies have found that family is an important source of financial support for older family members because of an expectation of reciprocity or altruistic concerns, particularly in societies where public support for the elderly is low (Silverstein et al. 2002, Sloan, Zhang and Wang 2002). Therefore, offspring's resources may play a substantial role in societies where the elderly are exposed to income insecurity and where a sense of filial piety is a strong form of altruism (Deindl and Brandt 2011). Some children are in a better situation to transfer economic resources to their parents than others are. More highly educated children are more likely to have job security, health insurance, and higher incomes, all of which can then increase the likelihood of upward transfers. A study examining people aged 50 and over in European countries found that well-educated children are more likely to give financial support to their parents and that support increases particularly when parents are ill (Bonsang 2007). A similar pattern was found in Indonesia and Malaysia where there was a positive relationship between sons and daughters' level of schooling and the amount of money parents receive from children who were not co-residing with them (Frankenberg, Lillard and Willis 2002). According to Wong and DeGraff (2009), the level of children's educational attainment was positively associated with the wealth of older people in Mexico, where upward transfers within a household are relatively common (Wong and DeGraff 2009).

The likelihood of receiving a transfer also can be systematically associated with the needs of the receiver. Children's resources are likely to be transferred to offset consequences of lacking resources in parental generations. In other words, offspring's SES is more important for the survivorship of a parent who is likely to be more economically disadvantaged. Therefore, it is plausible that the relationship between children's education and parents' mortality is stronger among mothers than

fathers in countries where most women are socioeconomically disadvantaged compared to men.

Hypotheses

The current study contributes to previous literature by assessing three testable hypotheses. First, we evaluate variations in the relationship between adult children's schooling and parental mortality across fathers and mothers. We hypothesize children's education will benefit health more for mothers, who are more likely to be exposed to income insecurity and have closer attachment with children, than for fathers (Hypothesis 1). Through this analysis, we can have more information on whether health benefits of children's educational attainment are contingent on the gender of parents in a gendered society.

Second, our study includes a more comprehensive set of potential mediators hypothesized to underlie the mechanisms through which children's education may play an important role in shaping parents' survival than in prior studies. We expect that highly educated children are more capable of improving parents' health practices, particularly use of routine health checkups that can be important for preventing the development of chronic diseases or detecting them at an early stage (Hypothesis 2a). More highly educated children can also promote parents' well-being by facilitating interactions, including face-to-face contact, conversations through telephone calls, or by living together. We thus hypothesize that parents of more highly educated children engage in more frequent interactions with their children than parents of children with lower levels of schooling, which is positively associated with parental survivorship (Hypothesis 2b).

Third, the study examines whether the benefits of children's educational attainment vary by the gender of the child. As discussed above, earlier studies of East Asian families have documented how sons are under cultural pressure to repay parental investment in their educations by providing financial support, while daughters have less of an obligation to support parents, especially when they marry (Lee, Parish and Willis 1994, Takagi and Silverstein 2006). Adult daughters may provide emotional support and some instrumental help in the absence of sons (Fingerman 2003). We hypothesize that adult sons' educational attainment is more important than that of daughter's as sons (and daughters-in-laws) are expected to provide primary support for parents (Hypothesis 3).

Data and Methods

Korea has collected a rich set of micro-data on intergenerational transfers to encourage empirical studies of family support for the elderly (Kim 2010). The current analyses are based on a nationally representative survey, the Korean Longitudinal Study of Aging (KLoSA), which focused on individuals who were at least 45 years old (www.kli.re.kr). The first survey wave was conducted in August through December 2006. All independent variables included in this study were derived from the first wave of the survey and are time-invariant.

The survey selected 15 cities and provinces stratified by type of area (urban and rural) and then by type of housing (apartment complex and single family homes). In each strata, 1,000 enumeration districts were further selected, and between 1 and 12 households were interviewed within each enumeration district. The household response rate was 70.7%, and the individual response rate within households was 75.4% (Ibid).

The survey collected information on an individual's socio-demographic characteristics (age, gender, marital status, region of residence, educational attainment), and individual and household economic status, including different sources of annual income, house ownership, and wealth. When both spouses participated in the survey and were 45 years old or over each spouse provided information for himself or herself. If a spouse was younger than 45, she or he did not directly participate in the survey. Instead, the respondent provided basic information (such as date of birth and educational attainment) for her or his spouse. The proportion of respondents whose spouse also participated in the survey was 63.6%.

Information about each child who was alive at the time of the interview was provided by parents. If both spouses participated in the survey, a randomly chosen spouse provided information about the children, and this information was attached to the other spouse. In other words, information about the children were identical for fathers and mothers within a household and include the total number of surviving children and their age, gender, marital status, location, and educational attainment, as well as frequency of contact with the parent and whether the child is co-residing with the parent.

In this paper, we restricted the sample to individuals aged 50 to 84 in 2006, the baseline survey year. KLoSA followed respondents until December 31 2014, resulting in a maximum follow-up period of 8 years. The date and cause of death were based on the death certificate. Survival time for those who did not die was censored at the end of the follow-up period, December 31 2014.

Individuals without living children (n=164) or who did not have any children who were at least 25 years of age in 2006 (n= 476) were excluded. Given that most

people have completed their highest level of education by age 25, the study focuses on parents with children who had completed their educations and thus were more likely to be independent of their parents at the time of the interview. Additionally, cases with ‘missing' and 'inconsistent' reports about the respondent’s spouse were deleted (n=432).[1] We also deleted individuals who were missing information on children's education and who had missing information on the explanatory variables (n=372). Our final sample includes 6,429 parents and consists of 2,592 fathers and 3,827 mothers whose mean age was 66 years in 2006 and of whom 907 (14.1%) had died by the end of 2014.

Measures

Children’s Educational Attainment

The average age of the parents’ first child was 42 years in 2006. Because most families in this analysis have multiple offspring, there are several possible ways to measure the schooling of the children in the family. In this study, children's education was measured based on the proportion of the children (1) with middle school or lower level of education, (2) with high school completion, and (3) with college or higher level of education[2], following the earlier study of Freedman and Mare (2014). This coding accounts for overall distribution of children's educational attainment in the family. The three proportions sum to 1 for each parent and are treated as a categorical variable. The reference category is the proportion of the children in the family who have a college or higher level of education. Sensitivity analyses were performed, comparing two alternative ways of coding the children's educational attainment. First,

[1] For instance, individuals who reported that they had no living spouse but also reported that they were currently married or had a partner who was alive but information on the spouse/partner was missing and was not found in the survey data (n= 432).
[2] College includes 2-year junior college and 4-year university.

children's educational attainment was measured by the highest level of education attained by any of the children. This variable has three categories: (1) middle school or less, (2) high school, (3) college or higher. Second, children's education was represented by the educational level of the oldest child in the family. Again this variable has the same three categories: (1) middle school or less, (2) high school, and (3) college or more.

To test our main hypothesis that the education of a son is likely to have a greater effect on parents' mortality than that of a daughter, we also examined the associations between the educational attainment of sons and daughters separately. The coding of the educational variable for sons and daughters is as follows: (1) the proportion of adult sons in the family with middle school or lower level of schooling, (2) with high school completion, (3) with college or higher level of education, and (4) no son. The four proportions sum to 1 for each parent. Daughters' education was coded in the same way.

Parents' Characteristics

We included the following demographic characteristics of the parents: age and region of residence (urban area, rural area). Separate models were estimated for mothers and fathers. We measured parents' SES by their educational attainment, household income, and home ownership. Educational attainment of a parent was coded as follows: no school, elementary school, and middle school or higher. Educational attainment of the parent's spouse was coded as follows: no school, elementary school, middle school or higher, and a fourth category indicating whether the spouse had died or the parent was separated or divorced. Household income was derived from the earned income of all household members. It also includes money

from public transfers, pension and other financial assets. Household income was divided into quartiles as a nonlinear relationship was found between household income and mortality. Home ownership (yes/no) was considered to reflect wealth accumulated over the lifetime and was added as an additional measure of parents' economic well-being.

To test possible mechanisms underlying the relationship between children's education and parents' mortality, we included a set of potential mediators: health behaviors and average frequency of contact with the children. Positive health behaviors of the parents included (1) whether the parent engages in regular exercise more than 3 times a week (vs. does not engage in regular exercise more than 3 times a week) and (2) preventive healthcare utilization which was measured by whether parents had a regular health examination or a routine visit for preventive care (vs. did not have a regular health examination or a routine visit) during the last 24 months. Negative health behaviors included (3) whether the parent currently smokes more than 10 cigarettes per day; smoking habit was not included in the final model for women as only a few women reported that they were current smokers (2.7%) and (4) the parents' drinking habits measured by self-reports on frequency of drinking and amount of alcohol consumed and was coded as follows: drank more than 30g ethanol per day more than once a week versus drank less than this amount.

The measurement of the frequency of contact was based on two dimensions of interaction between a child and his or her parents who are not living together: face-to-face contact and contact with phone or email. The survey includes information on the number of times each child visits the parents and the number of interactions through email or phone per a week in the past 12 months. This information was provided by

the parents. We averaged frequency of contacts of all children, i.e., we added up average number of weekly contacts of all children and divided it by the number of children. In both cases when the parents are living with the child the frequency of contact with the child during the past 12 months was assumed to be 7 days a week. To test the linear specification was proper in terms of frequency of contacts we used logged frequency of contacts as well as squared term of frequency of contacts. Since both variables were not statistically significant and did not improve the model fit, we treated the variable as linear.

Statistical Methods

Cox proportional hazards models were used to estimate the hazard function of mortality as follows:

$$\log h_i(t) = \log h(t) + \sum_{\mathrm{j}} \beta_{\mathrm{j}} \mathrm{CHE}_{\mathrm{j}i} + \sum_{k} \gamma_{\mathrm{k}} \mathrm{X}_{ki} \quad , \quad (1)$$

In equation (1), $h(t)$ is the baseline hazard function and t indicates age of individual i. CHE measures children's educational attainment – our key explanatory variable; X refers to parental characteristics, including education, income, health behaviors and frequency of contact. Censoring occurred in the end of December 2014, i.e., individuals who were alive by the end of follow-up were censored at that time (Allison 2010). Individuals entered the analyses from August to December 2006. Age was used as the time unit of the analysis, which allows for unrestricted nonlinearity in its effects and, in the construction of the partial likelihood, makes comparisons only among people of the same age. We used t-tests to assess the significance of individual coefficients. All models were estimated separately for fathers and mothers. To test

whether we can reject the null hypothesis that the coefficients for children's education are the same across fathers and mothers we estimate a z-score as follows:

$$z = \frac{b1 - b2}{\sqrt{[s.e.(b1)]^2 + [s.e.(b2)]^2}}$$

To assess the separate and joint influence of the children's characteristics on parents' mortality, we estimated the following models. Model 1 included children's characteristics (educational attainment, number of sons and daughters) and the age of the parent in the baseline year. In Model 2, parental characteristics were added including the parent's region of residence, educational attainment, and economic resources (household income, home ownership). In Model 3a, we added health behaviors into Model 2. Model 3b included a control for average frequency of contacts with children instead of health behaviors. In model 4, we adjusted for health behaviors and average frequency of contacts simultaneously to see to what extent they together can explain the relationship between children's education and parental mortality. We also tested the sensitivity of the results with the alternative coding of children's educational attainment: the highest level of schooling among all living children and the educational attainment of the oldest child (Appendix 1).

To test our hypothesis that the educational attainment of sons will have a greater effect on parents' mortality than that of daughters, we included children's education specified by gender of the child as follows:

$$\log h_i(t) = \log h(t) + \sum_j \beta_j SE_{ji} + \sum_k \beta_k DE_{ki} + \sum_l \gamma_l X_{li} \quad , \quad (2)$$

SE and DE refer to the education of sons and daughters, respectively. These categorical variables were derived from the proportion of adult sons and daughters in

the family with middle school or lower level of education, with high school completion, with college or higher level of education, and no son or daughter. The parameters β_j and β_k indicate the effect of sons' education and daughters' education on the odds of mortality of the parent. All models were weighted and estimated with Stata 13.

Results

Table 2.1 includes descriptive characteristics of the outcome and explanatory variables by gender of the parents. Compared to fathers, mothers were much less likely to obtain higher levels of schooling and more likely to have lower level of income. Despite disadvantaged SES, mothers were more likely to be alive than fathers reflecting that women's life expectancy is longer than men's life expectancy in Korea. For example, life expectancies in 2014 were 85.5 years for women and 79.0 years for men (Yang et al. 2012). Compared to their parents the children were more highly educated. Although the percentage of the parents who do not have formal education were around 23.4% and mothers who do not have formal education were 32.2%, only 11% of their children had middle school or lower than middle school level education, and over one-half had college or higher level of education. More than 70% of parents reported that they have at least one child with college or higher level of education; around 46.1% of first-born children have some college level degree. On average, 53% of sons have more than some college level education, while only 34% of daughters had this level of education. The result shows that there is a gap in the level of schooling between sons and daughters in Korea. Tables 2.2 and 2.3 present the coefficients from the Cox survival models for fathers. Tables 2.4 and 2.5 present the coefficients for mothers.

Results – Fathers

Model 1 of Table 2.2 examines the associations between children's educational attainment and fathers' mortality controlling for father's age at baseline. Children's educational attainment was negatively associated with fathers' mortality. A one-unit increase in the proportion of children with middle school or lower level of education (proportion from having no child (0%) to having all children (100%) with middle school or lower level of education) increased the mortality of fathers by 65% ($e^{0.50}$=1.65) compared to the same increase in the proportion of children with college or higher level of education. A one-unit increase in the proportion of children with a high school diploma was associated with 43% increase in the risk of death ($e^{0.36}$=1.43) compared to the same increase in the proportion of children with college or higher level of education. Model 2 shows that children's educational attainment was only marginally associated (p=0.10) with the mortality risk of fathers when parental SES was added to Model 1. Father's own educational attainment and his partner's educational attainment were not statistically significant predictors of mortality. Household income exhibited a non-linear relationship with mortality risks of fathers. Fathers in the third quartile of household income were about 27% ($e^{-0.31}$=0.73) less likely to die compared to fathers in the first quartile of household income. Fathers in the highest quartile of household income were also less likely to die but the coefficient was not statistically significant.

In Model 3a, when health behaviors were controlled for, the coefficients of the children's education were further reduced and were no longer statistically significant at the 0.1 level. Fathers who had regular health check-ups were less likely die and those who reported that they were current smokers were significantly more

likely to die. However, fathers who drank were less likely to die, which might indicate that healthier individuals were more likely to engage in frequent drinking. Frequency of contacts with children was not a significant predictor of the mortality of fathers and it did not attenuate the relationship between children's education and father's mortality (Model 3b). In separate analyses (not shown here), a higher level of children's educational attainment was significantly associated with a greater likelihood that fathers engaged in healthy behaviors, quit smoking and had a routine health examination. Children's education was not significantly related with drinking habits for fathers. When these health behaviors and frequency of contacts were controlled for in Model 4, the magnitude of the coefficient of the proportion of children with middle school or lower decreased by about 29.2% and the magnitude of the coefficient of the proportion of children with a high school diploma was reduced by around 20% compared to Model 2.

The results of the analysis that compared the coefficients of sons' and daughters' education are displayed in Table 3. According to Model 1, sons' educational attainment was significantly associated with the risk of mortality of fathers while coefficients of daughters' educational attainment were not statistically significant. For example, a one-unit increase in the proportion of sons with a high school degree was associated with 54% increase in the odds of dying ($e^{0.43}$=1.54) compared to the same increase in the proportion of sons with at least some college level degree. Having no son was also marginally associated with father's higher mortality. Controlling for father's own SES (Model 2) and health behaviors slightly reduced the magnitude of the coefficient of son's high school level education but they did not change the association between sons' educational attainment and mortality of fathers substantially.

Results – Mothers

Children's educational attainment also exhibited a significant relationship with the mortality of mothers. Mothers with the higher proportion of children with lower educational attainment were more likely to die. An increase in the proportion of children with middle school or lower level of education increased the risk of mortality by 2.5 times ($e^{0.90}$=2.46) compared to the same increase in the proportion of children with college or higher level of education. A one-unit increase in the proportion of children with a high school degree increased the risk of death by about 84% ($e^{0.61}$=1.84) than the same increase in the proportion of children with some college or higher level of education (Model 1, Table 4).

In contrast to fathers, children's education remained as a significant predictor of mother's mortality even after controlling for parental SES (Model 2). An increase in the proportion of children with middle school or lower level of schooling doubled the risk of mortality ($e^{0.70}$=2.01) compared to a similar increase in the proportion of children with some college or higher level of education. In other words, mortality risk of a mother whose all children obtained middle school or lower than middle school level education is two times higher than a mother whose all children completed college level education. A one-unit increase in the proportion of children with a high school degree was associated with about 60% ($e^{0.47}$=1.60) higher mortality risk.

The next step is to examine the role of potential mediators that may explain the relationship between children’s education and mothers' mortality (Model 3a-4). Some of the association between children’s educational attainment and the mortality of mothers was explained when the health behaviors were adjusted for (Model 3a). Among these health behaviors regular health check-ups was the most important

predictor of mothers' mortality. For instance, mothers who reported that they had regular health check-ups within the last 24 months were about 20% less likely to die during the follow up period ($e^{-0.22}$=0.80). Other health behaviors were not statistically significant predictors of mortality of mothers. Unlike fathers, frequency of contacts with children was an important factor associated with mortality; mothers who had more frequent contacts with their children were less likely to die. This finding may reflect the fact that children are more likely to develop a closer emotional relationship with mothers than fathers, which results in a stronger positive impact on mothers' health. In bivariate models not shown in this paper, we found that highly educated children were more likely to engage in a frequent interaction with their parents (i.e., children's education was significantly correlated with frequency of contacts). Additionally, within a family with multiple offspring there was a strong tendency that parents were more likely to interact with a child with the highest level education (results not shown). When both health behaviors and frequency of contacts are controlled for in Model 4, the magnitude of the coefficient of the proportion of children with middle school or lower was reduced by about 9% and the size of the coefficient of the proportion of children with a high school degree decreased by around 7.4% compared to Model 2.

According to Model 1 of Table 2.5, sons' educational attainment was significantly associated with mortality of mothers while coefficients of daughters' educational attainment were not statistically significant at the 0.05 level or below. An increase in the proportion of sons with middle school or lower level of schooling was associated with 84% increase in relative odds of mortality risk ($e^{0.61}$ = 1.84) compared to the same increase in the proportion of sons with at least some college level degree. A one-unit increase in the proportion of sons with a high school degree increased the

risk of mortality by about 36% ($e^{0.31} = 1.36$) compared to the same increase in the proportion of sons with college or higher level education. Mothers with no son were also significantly more likely to die than mothers with highly educated sons. After adjusting for mother's own SES (Model 2) the magnitude of coefficients of sons' educational attainment was reduced and the coefficient of the proportion of sons with high school level education was no longer significant at the 0.1 level. Adding mothers' health behaviors and frequency of contacts (Models 3a-4) further explained the relationship between sons' educational attainment and mortality among mothers but this decrease was modest.

As hypothesized, the education of sons was a more robust predictor of mortality than that of daughters after controlling for parental own SES. The results suggest that SES of sons plays a more important role in parental longevity compared to that of daughters in Korea. In other words, having less educated sons may potentially increase the risk of mortality of parents if that lowers the average SES of adult sons in the household who are expected to be one of the main sources of support for aging parents.

Children's educational attainment was more strongly associated with mothers' mortality compared to fathers' mortality before and after controlling for potential mediators. The z-scores obtained from models 1-4 using the formula described in the method section and comparing the coefficients for children's education between fathers and mothers support our hypothesis that children's education is more strongly associated with mother's mortality relative to that of fathers. For example, the z-scores estimated from the coefficients on children's education in Model 2 were over 3 (p-

value <0.01), which means that we can reject the null hypothesis that the coefficients for children's education are the same for fathers and mothers.

The relationships between children's education and mortality risks of fathers and mothers were consistent regardless of the way in which children's education was parameterized; in all cases children's education was strongly and negatively associated with parental mortality while the relationship was less pronounced for fathers after controlling for parental SES. The model fits estimated based on AIC and BIC were equally good and all models produced similar conclusions. Thus, these sensitivity tests have demonstrated that the association between children's educational attainment and parents' mortality is not sensitive to the way children's education is coded. The conclusion, which is consistent across these specifications, is that the education of children is a more important predictor of mothers' than fathers' mortality beyond parents' own SES and that the level of education of sons is more important than that of the daughters. Results of the sensitivity analyses are presented in Appendix 1, Tables A1-A4.

Discussion

The current study examined whether the children's education benefits parental longevity and extended previous research by focusing on additional mechanisms that may account for this relationship, namely health behaviors such as regular health check-ups and frequency of contacts between children and their parents. The study also examined whether adult children's resources are equally important to fathers and mothers and whether sons and daughters equally contribute to parents' survival within a strongly gendered context of Korea. Using recent survey data from Korea, this study added new evidence regarding the role of children in improving the health of their

parents in a society where older people comprise a large proportion of those living in poverty.

The relationship between children's education and parents' mortality was more pronounced for mothers than for fathers and the association persisted even after controlling for parents' own SES. Our results with respect to gender-specific analyses of parents' mortality differ from those found in the U.S. where there was no gender difference in the relationship between children's educational attainment and parents' mortality (Friedman and Mare 2014). In Korea, education of adult children is more beneficial for mothers' health than for fathers' health. The result suggests that in societies with a strict gender hierarchy and weak social welfare system women who are less likely to be highly educated, have control of the economic resources, and thus more likely to be exposed to old-age income insecurity benefit more from their children's SES. As noted earlier, children's education may compensate for less educated parents' lack of resources. In other words, by producing well-educated offspring, the elderly who may have less social and economic resources can gain the additional support.

More up-to-date knowledge of better-educated children may be important to improve older people's health behaviors. In particular, the study found that regular health examination is a part of the pathways underlying the link between children's educational attainment and parents' mortality. More highly educated children may help parents maneuver through complicated health insurance and health care delivery system in Korea. It is also plausible that parents who have highly educated children might have more inclination to take care of themselves than those with less-educated children.

Highly educated children are more likely to build closer emotional ties with their parents, to interact with them, and to give better support to parents in need. This relationship was observed only for mothers in this study, which is consistent with Korean culture that supports a strong gender role division within the family. Labor force participation rate has been low among Korean women who are mainly responsible for childcare. Women's social achievement is likely to be determined by children's educational success and children with higher education are under pressure to respond to their mothers' efforts (Kim et al. 2005). In this sense, children tend to develop a relationship that is more intimate with their mothers compared to their fathers.

The study also found that educational attainment of sons was more important in its influence on parents' mortality compared to daughters' educational attainment. This finding is consistent with other findings in East Asian countries where sons and daughters-in-law are expected to repay parents' investment in their education while daughters have less of an obligation to support parents especially when they marry (Lee, Parish and Willis 1994, Takagi and Silverstein 2006). Although some studies found that the material support from children to parents has decreased during recent decades (Kim 2015), this study demonstrates that private supports for the elderly from adult sons still comprise a large proportion of old-age care and contribute to parental longevity (Yoon 2013).

The current study shows that recent concerns regarding the decline in the norms of filial piety among children do not necessarily mean a collapse of the traditional Korean elder support system. Furthermore, children's educational attainment may significantly contribute to reducing socioeconomic inequality among

the elderly in Korea. The findings emphasize the importance of preserving the children's role in designing public financial support programs for older people that can address conflicts between increasing demand and lack of public supply of health care for the elderly.

Some limitations should be addressed in future work. Even if we controlled for various explanatory variables and empirically tested potential mechanisms, additional evidence is needed to address causality since "it is impossible in practice, to adjust for all potential confounders in observational studies (Torssander 2013, 654p)." For instance, parents and children are likely to share unobserved genetic factors that may influence both children's education and parental health. Although differences in the strength of the relationship between children's education and parental mortality across fathers and mothers suggests that the relationship would not be due to genetic factors, these confounding factors and selective processes were not eliminated from the current study. Further analyses also need to focus on causes of death that are associated with children's education which may provide more evidence about why adult children's resources are associated with their parents' survival.

Despite these limitations, the main contribution of this study is an assessment of the ''upstream'' influence of adult children's schooling on parents' health in a context where the poverty rate among the elderly is high along with low levels of public subsidies and gender hierarchy is strong. The results presented in this study add to mounting evidence that highly educated children may protect parents from deteriorating health conditions in later life. The current study also has implications for intergenerational support in other countries in East and Southeast Asia. These countries share common characteristics with Korea in terms of family structures,

gender roles, and elder care including the traditional reliance on families for elder care provision. These countries also have been exposed to fast economic development, educational expansion, and rapid population ageing, followed by concurrent social changes such as a shift in family structure in recent years (Chan 2005). Given that Korea has experienced such social transitions earlier than most countries findings in Korea can serve as instructive ‘leading indicators’ for its neighbor countries.

Tables

Table 2.1. Sample Characteristics by Gender of Parents Ages 50-84, Distribution (%) or Mean (SD), 2006 Korean Longitudinal Study of Ageing (N= 6,429)

Characteristic	Total (N= 6,429)	Men (N= 2,592)	Women (N= 3,837)	P- value[1]
Survival Status, 2014				
Alive	85.89	81.06	89.16	0.00
Dead	14.11	18.94	10.84	
Children's characteristics				
Proportion of children with				
Middle school or lower	0.11	0.07	0.14	0.00
High school	0.38	0.36	0.39	
College or higher	0.51	0.57	0.47	
Highest level of children's education				
Middle school or lower	3.69	1.58	5.11	0.00
High school	25.84	21.99	28.43	
College or higher	70.48	76.43	66.46	
Education of oldest child				
Middle school or lower	16.27	11.46	19.52	0.00
High school	37.64	36.92	38.13	
College or higher	46.09	51.62	42.35	
Proportion of sons with				
Middle school or lower	0.08	0.05	0.10	0.00
High school	0.31	0.29	0.33	
College or higher	0.53	0.58	0.50	
No son	0.07	0.08	0.07	
Proportion of daughters with				
Middle school or lower	0.12	0.08	0.15	0.00
High school	0.35	0.34	0.36	
College or higher	0.34	0.39	0.31	
No daughter	0.19	0.19	0.18	
Number of sons	1.78(1.03)	1.72(0.99)	1.82(1.06)	0.00
Number of daughters	1.62(1.30)	1.56(1.24)	1.66(1.33)	0.00

Notes:[1] p-value refers to the difference in the distribution of the explanatory variable between males and females based on a chi-square test for categorical variables and t-test for continuous variables. Standard deviations are in parentheses.

Table 2.1.(Continued) Sample Characteristics by Gender of Parents Ages 50-84, Distribution (%) or Mean (SD), 2006 Korean Longitudinal Study of Ageing (N= 6,429)

Characteristic	Total (N= 6,429)	Men (N= 2,592)	Women (N= 3,837)	P- value[1]
Parents' characteristics				
Age in the baseline year	65.99(8.31)	66.34(7.71)	65.75(8.69)	0.01
Parent's education				
No formal education	23.39	10.42	32.16	0.00
Elementary school	34.87	28.51	39.17	
Middle school or higher	41.73	61.07	28.67	
Partner's education				
No formal education	11.63	18.87	6.75	0.00
Elementary school	26.04	38.46	17.64	
Middle school or higher	36.43	35.42	37.11	
No partner	25.90	7.25	38.49	
Region of residence				
City area	73.56	72.99	73.94	0.56
Rural area	26.44	27.01	26.06	
Household income				
1st quartile	26.43	21.76	29.58	0.00
2nd quartile	25.32	25.89	24.94	
3rd quartile	23.77	25.81	22.39	
4th quartile	24.48	26.54	23.09	
Home ownership				
Yes	78.60	80.90	77.04	0.00
No	21.40	19.10	22.96	
Regular exercise				
Yes	69.48	64.39	72.92	0.00
No	30.52	35.61	27.08	
Health examination				
Yes	53.88	56.44	52.15	0.00
No	46.12	43.56	47.85	
Current smoker				
Yes	23.78	54.94	2.74	0.00
No	76.22	45.06	97.26	
Drinking				
Yes	32.06	57.48	14.88	0.00
No	67.94	42.52	85.12	
Frequency of contacts (days/a week)	2.22(2.04)	2.21(2.1)	2.11(2.0)	0.06

Notes: [1] p-value refers to the difference in the distribution of the explanatory variable between males and females based on a chi-square test for categorical variables and t-test for continuous variables. Standard deviations are in parentheses.

Table 2.2. Coefficients from Cox Survival Model Predicting Risk of Death of Fathers (N= 2,592)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Children's characteristics					
Proportion of children with: (College or higher)[1]					
Middle school or lower	0.50(0.20)*	0.41(0.23)+	0.30(0.23)	0.40(0.23)	0.29(0.23)
High school	0.36(0.14)*	0.30(0.16)+	0.24(0.16)	0.29(0.16)	0.24(0.16)
Number of sons	0.03(0.05)	0.01(0.05)	0.01(0.05)	0.01(0.05)	0.02(0.05)
Number of daughters	-0.01(0.04)	-0.02(0.04)	-0.01(0.04)	-0.02(0.04)	-0.01(0.04)
Parents' characteristics					
Parent's education (Middle school or higher)					
No formal education		-0.13(0.17)	-0.14(0.17)	-0.13(0.17)	-0.14(0.17)
Elementary school		-0.01(0.12)	-0.02(0.12)	-0.01(0.12)	-0.02(0.12)
Partner's education (Middle school or higher)					
No formal education		0.27(0.18)	0.26(0.18)	0.27(0.18)	0.27(0.18)
Elementary school		0.14(0.15)	0.13(0.15)	0.14(0.15)	0.13(0.15)
No spouse		0.31(0.20)	0.30(0.20)	0.31(0.20)	0.30(0.20)
Household income (1st quartile)					
2nd quartile		-0.09(0.12)	-0.10(0.12)	-0.09(0.12)	-0.10(0.12)
3rd quartile		-0.31(0.15)*	-0.32(0.15)*	-0.31(0.15)*	-0.32(0.15)*
4th quartile		-0.10(0.15)	-0.11(0.15)	-0.11(0.15)	-0.12(0.15)
Health behaviors					
Exercise(No exercise)			-0.07(0.12)		-0.07(0.12)
Regular health examination(No health examination)			-0.21(0.10)*		-0.21(0.10)*
Current smoker(Non- smoker)			0.26(0.10)*		0.26(0.10)*
Drinking (Barely drinking)			-0.30(0.10)**		-0.30(0.10)**
Frequency of contact				0.01(0.03)	0.01(0.03)

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership and region of residence are controlled for in models 2-4. [1]Omitted category is in parenthesis. Numbers in parentheses are standard errors.

Table 2.3. Coefficients from Cox Survival Model Predicting Risk of Death as a Function of Sons' and Daughters' Education of Fathers (N= 2,592)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Children's characteristics					
Proportion of sons with: (College or higher)[1]					
Middle school or lower	0.34(0.23)	0.29(0.24)	0.26(0.24)	0.29(0.24)	0.26(0.24)
High school	0.43(0.13)**	0.40(0.14)**	0.38(0.14)**	0.40(0.14)**	0.38(0.14)*
No son	0.36(0.20)+	0.36(0.20)+	0.33(0.21)	0.36(0.21)+	0.33(0.21)
Proportion of daughters with: (College or higher)					
Middle school or lower	-0.06(0.14)	-0.12(0.14)	-0.06(0.20)	0.00(0.21)	-0.06(0.20)
High school	0.09(0.20)	0.00(0.21)	-0.16(0.14)	-0.12(0.14)	-0.16(0.14)
No daughter	0.01(0.17)	0.00(0.17)	-0.06(0.17)	0.00(0.17)	-0.06(0.17)
Parents' characteristics					
Parent's education (Middle school or higher)					
No formal education		-0.12(0.17)	-0.15(0.17)	-0.12(0.17)	-0.15(0.17)
Elementary school		0.01(0.12)	-0.01(0.12)	0.01(0.12)	-0.01(0.12)
Household income (1st quartile)					
2nd quartile		-0.09(0.12)	-0.11(0.12)	-0.09(0.12)	-0.11(0.12)
3rd quartile		-0.31(0.15)*	-0.32(0.15)*	-0.31(0.15)*	-0.32(0.14)*
4th quartile		-0.10(0.15)	-0.12(0.15)	-0.11(0.15)	-0.12(0.15)
Health behaviors					
Exercise(No exercise)			-0.08(0.12)		-0.08(0.12)
Regular health examination(No health examination)			-0.23(0.10)*		-0.23(0.10)*
Current smoker(Non- smoker)			0.25(0.10)*		0.25(0.10)*
Drinking(Barely drinking)			-0.30(0.10)**		-0.30(0.10)**
Frequency of contact				0.00(0.03)	0.00(0.03)

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership, parents' partners' education, region of residence are controlled for in models 2-4. [1]Omitted category is in parenthesis. Numbers in parentheses are standard errors.

Table 2.4. Coefficients from Cox Survival Model Predicting Risk of Death of Mothers (N= 3,837)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Children's characteristics					
Proportion of children with: (College or higher)[1]					
Middle school or lower	0.90(0.19)**	0.70(0.20)**	0.66(0.21)**	0.68(0.20)**	0.64(0.21)**
High school	0.61(0.18)**	0.47(0.18)*	0.44(0.19)*	0.47(0.18)*	0.44(0.19)*
Number of sons	-0.00(0.05)	0.00(0.05)	0.00(0.05)	-0.03(0.05)	-0.03(0.05)
Number of daughters	-0.07(0.04)+	-0.07(0.04)+	-0.07(0.04)+	-0.10(0.04)*	-0.10(0.04)*
Parents' characteristics					
Parent's education (Middle school or higher)					
No formal education		0.24(0.20)	0.22(0.20)	0.21(0.20)	0.20(0.20)
Elementary school		0.19(0.19)	0.20(0.19)	0.17(0.19)	0.18(0.19)
Partner's education (Middle school or higher)					
No formal education		0.03(0.23)	0.01(0.23)	0.03(0.23)	0.01(0.23)
Elementary school		0.00(0.20)	-0.01(0.19)	-0.01(0.19)	-0.02(0.19)
No spouse		0.11(0.17)	0.10(0.17)	0.13(0.17)	0.12(0.17)
Household income (1st quartile)					
2nd quartile		0.01(0.13)	0.01(0.13)	-0.01(0.13)	-0.01(0.13)
3rd quartile		-0.17(0.16)	-0.17(0.16)	-0.16(0.16)	-0.15(0.16)
4th quartile		-0.16(0.16)	-0.16(0.16)	-0.11(0.16)	-0.11(0.16)
Health behaviors					
Exercise(No exercise)			-0.12(0.14)		-0.10(0.14)
Regular health examination(No health examination)			-0.22(0.11)*		-0.22(0.11)*
Drinking (Barely drinking)			-0.07(0.16)		-0.05(0.16)
Frequency of contact				-0.09(0.03)**	-0.09(0.03)**

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership and region of residence are controlled for in models 2-4. [1]Omitted category is in parenthesis. Numbers in parentheses are standard errors.

Table 2.5. Coefficients from Cox survival Model Predicting Risk of Death as a Function of Sons' and Daughters' Education of Mothers (N= 3,837)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Children's characteristics					
Proportion of sons with: (College or higher)[1]					
Middle school or lower	0.61(0.19)**	0.52(0.19)**	0.49(0.19)*	0.53(0.19)**	0.51(0.20)*
High school	0.31(0.15)*	0.25(0.16)	0.23(0.16)	0.26(0.16)	0.24(0.16)
No son	0.49(0.23)*	0.40(0.23)+	0.41(0.23)+	0.46(0.24)+	0.47(0.23)*
Proportion of daughters with: (College or higher)					
Middle school or lower	0.41(0.22)+	0.30(0.22)	0.28(0.22)	0.24(0.22)	0.23(0.22)
High school	0.30(0.20)	0.21(0.20)	0.18(0.20)	0.18(0.20)	0.16(0.20)
No daughter	0.31(0.20)	0.22(0.20)	0.20(0.20)	0.29(0.20)	0.26(0.20)
Parents' characteristics					
Parent's education (Middle school or higher)					
No formal education		0.25(0.20)	0.23(0.20)	0.22(0.20)	0.20(0.20)
Elementary school		0.23(0.19)	0.23(0.19)	0.21(0.19)	0.21(0.19)
Household income (1st quartile)					
2nd quartile		0.01(0.13)	0.01(0.13)	-0.00(0.13)	0.00(0.13)
3rd quartile		-0.16(0.16)	-0.16(0.16)	-0.14(0.16)	-0.14(0.16)
4th quartile		-0.15(0.16)	-0.15(0.16)	-0.11(0.16)	-0.11(0.16)
Health behaviors					
Exercise(No exercise)			-0.13(0.14)		-0.11(0.14)
Regular health examination(No health examination)			-0.22(0.11)*		-0.22(0.11)*
Drinking (Barely drinking)			-0.07(0.16)		-0.07(0.16)
Frequency of contact				-0.08(0.03)*	-0.07(0.03)*

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership, parents' partners' education, region of residence are controlled for in models 2-4. [1]Omitted category is in parenthesis. Numbers in parentheses are standard errors.

CHAPTER 3: Does Context Matter? Literacy Disparities in Self-Rated Health Using Evidence from 17 Countries

Introduction

Literacy skills refer to an individual's capacity to understand, use, and apply information obtained from various forms of materials in everyday life. As such, "[l]iteracy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society (Organization for Economic Co-operation and Development 2012, n.d., para. 2)." Among many outcomes, adult literacy has been found to be positively associated with health, improving how people access and understand health-related information and promoting people's motivation to engage in healthier lifestyles (Parker et al. 1995, van der Heide et al. 2013). Literacy also decreases barriers to health care services and facilitates communications with medical specialists (Wagner and Niles 2005). People with higher literacy tend to have higher occupational status, higher wages, and better health insurance from employers, advantages that may result in improved access to advanced medical care and technology (Dahlgren and Whitehead 2007). Literacy is also known to be closely linked with responsiveness to health education, the use of disease prevention services, and self-management of disease (DeWalt and Hink 2009).

There are several reasons why the relationship between literacy skills and health warrant closer attention. As the means to accessing health care services and medical information are becoming increasingly diversified and complex, the role of

literacy skills is becoming increasingly crucial. In technologically advanced societies, having literacy skills to process massive amounts of information seems to be strongly associated with better health and provides explanations for emerging health inequalities (Hayward, Hummer and Sasson 2015). With increasing life expectancy and awareness of health, e.g., knowledge about risk factors of chronic diseases, individuals with higher literacy are better equipped to utilize new health-related knowledge, which amplifies the link between literacy skills and health in developed countries. Furthermore, in many developed societies where inequalities in formal educational credentials have been reduced over time (Breen et al. 2009), disparities in cognitive abilities/skills remain important for predicting health status beyond educational credentials (van der Heide et al. 2013). Poor literacy skills among adults are surprisingly common in many developed countries. Estimates of the proportion of the population in Organization for Economic Co-operation and Development (OECD) countries lacking functional literacy skills ranged from 7% to 47% (UNDP 2007). According to the European health literacy survey in 2011, around 12% of the population of Europe lacked proper health literacy and 35% of them showed limited literacy skills (Sørensen et al. 2015). Another study using data from the United States found that nearly half of the adult population appear to have insufficient literacy to put health information into practice (Nielsen-Bohlman et al. 2004). However, less is known about the relationship between adult literacy skills and health beyond educational credentials and what contextual factors may explain this relationship in developed countries (Baker et al. 2011).

Considering the increasingly important role of adult literacy skills in improving health in many countries, I contribute to literature with a cross-national study of literacy gradients in self-reported health status. Although the size of

educational inequalities in health has been shown to vary by country (Huisman, Kunst and Mackenbach 2003, Silventoinen and Lahelma 2002), there has been a lack of research about whether the relationship between adult literacy and health varies by context. Given that comparison of different types of societies can provide new insights into the sensitivity of literacy-related health disparities among heterogeneous populations, comparative analysis is necessary to extend previous research that focused on a single country. For this purpose, I use cross-national data on adults aged 25-65 in 17 countries, drawn from the Programme for the International Assessment of Adult Competencies (PIAAC) collected in 2012 (Sellar and Lingard 2013). The PIAAC administered standardized tests to measure individuals' literacy skills, offering a unique opportunity to compare the size of the association between literacy and health across countries. I examine the extent to which the relationship between adult literacy skills and self-rated health varies across countries, controlling for other individual-level factors, e.g., educational attainment, and country-level heterogeneity.

In addition to assessing cross-national variation in the relationship between literacy and self-rated health, I investigate whether the cross-national variation in the relationship is accounted for by two important country-level variables intimately related with both health and literacy: public expenditures on health care (% of total health care expenditures) and the level of educational standardization. The contextual variable of public health expenditure refers to the direct government spending to improve the health status of the public and/or the distribution of preventive and curative health care services, family planning services, and nutrition supplementation within the population (OECD, 2010). Referring to the "degree to which the quality of education meets the same standards nationwide" (Allmendinger 1989: 233p), the level of educational standardization measures the extent to which individuals within the

same country are exposed to different quality of schooling during K-12. I assess whether countries show the varying relationship between literacy and self-related health depending on these two contextual factors – public health expenditure and educational standardization.

Background

Literacy Skills and Health

According to previous literature, literacy is associated with better health status by (1) providing health knowledge, and (2) motivating people to use proper primary and preventive health care services (Cho et al. 2008, Levy and Janke 2016, Sørensen et al. 2012). Literacy also promotes health by (3) facilitating the interaction with health care specialists, and (4) increasing efficiency in self-care (DeWalt and Hink 2009, Ishikawa and Yano 2008, Paasche-Orlow and Wolf 2007).

People with high literacy skills have more health-related knowledge, and thus they are more likely to be informed about prevention and treatment of diseases than their counterparts with low literacy (Levy and Janke 2016, Paasche-Orlow and Wolf 2007). Highly literate people are likely to apply health-related information in a manner necessary to successfully function in everyday life and to utilize health care services and medical technology more properly (Franzen et al. 2014, Terraneo 2015). Additionally, they are better at understanding medication dosage requirements and advice by health care providers to prevent chronic diseases such as smoking cessation, prostate cancer screening and mammography screening (Bostock and Steptoe 2012, Dutta-Bergman 2004). Literacy skills are particularly important when people need to navigate their way through the trajectory of complex health systems. People with limited literacy report unfamiliarity with the medical system and have problems in

understanding insurance application and referral processes to see specialists, all of which cause delay in treatment (Ferguson and Pawlak 2011, Schillinger et al. 2003). People who lack literacy are less likely to notice the symptoms of diseases which delays searching for preventive screening measures and medical consultation at primary care (Macdonald et al. 2006). According to a study by Scott, Gazmararian, Williams, and Baker (2002) that focused on people who enrolled in Medicare, health literacy was positively associated with health care utilization (Scott et al. 2002). Another study of healthcare in the United States also found that people with lower literacy skills were less likely to have regular primary care visits or other resources associated with routine health care (Sudore et al. 2006).

Patients with inadequate literacy skills have poor interaction with medical experts, more distrust in their doctors, and appear pessimistic about quality of care (Mancuso and Rincon 2006). They are likely to be less responsive to doctors' questions and provide inaccurate descriptions of medical problems and information about their medical histories (Baker et al. 2002). In addition, patients with limited literacy tend to have worse mental health functioning than highly literate patients, which harms interaction between patient and doctor and leads to poor quality of communication (Galletly et al. 2012, Lincoln et al. 2006).

Literacy is known to predict problem solving abilities and motivation for self-care including monitoring health condition, engaging in recommended health behaviors, and medication adherence (Cho et al. 2008, Ngoh 2009). Previous studies have documented that patients with limited literacy skills experience difficulties in understanding medical instructions and thus may be less motivated to engage in complicated therapy (Berkman et al. 2011, Gazmararian et al. 2006, Von Wagner et

al. 2009). For example, among patients at risk of cardiovascular diseases people who lack adequate literacy were 1.4 times more likely to ignore medication instructions than people with higher literacy skills (Gazmararian et al. 2006). Other medical studies found that individuals with limited literacy reported psychological difficulties in performing specific health behaviors, e.g., diabetes self-care, cancer screening, and antiretroviral regimen (Ishikawa, Takeuchi and Yano 2008, Von Wagner et al. 2009, Wolf et al. 2007).

Although higher level of literacy tends to be closely related with better health outcomes in many societies it remains to be unanswered to what extent the relationship between literacy and health actually varies across countries. Is the relationship stronger in some countries than others? What contextual factors may explain such cross-national variation in the relationship? Despite growing interest in literacy skills in relation to health outcomes, most studies have focused on the relationship within a country, leaving unexplored whether and how the relationship between literacy skills and health varies by social context. In this study, I extend existing literature by exploring how countries differ in the way in which literacy is associated with self-rated health and assessing whether such cross-national variations in the literacy-health relationship are systematically related to between-country differences in health financing and educational systems. Identifying social contexts under which literacy significantly influences health outcomes will help understand the roles of literacy in improving health outcomes.

Context Matters: Public Health Expenditures and Educational Standardization

Among various contexts that may shape the relationship between literacy and health, in this study I focus on two contextual variables: public expenditure on health

and standardization of educational systems. The share of public expenditure in total health spending (e.g., general government expenditures on health care services, family planning services, health education, and health administration) contributes to enhancing health facilities and increasing efficiency of health system operations (Berger and Messer 2002). Thus, it would be particularly crucial for those with low literacy in facilitating the establishment of health behaviors, increasing the use of preventive health care utilization, and decreasing the amount of expensive inappropriate hospitalization (Escobar, Griffin and Shaw 2011, Martin, Rice and Smith 2008). Evidence from some cross-national studies suggests that government health expenditures are positively associated with accessibility of medical service utilization in general, e.g., cancer screening rates in many countries (Anderson and Frogner 2008, Bradley et al. 2011). Conversely, less government health expenditure and more private health expenditure may amplify health disadvantages of people who have lower literacy since they are more likely to be exposed to health risk factors and have limited ability to use needed health care services than those with higher literacy. Health financing systems that force people to pay more from their own pockets may have negative consequences for people who lack the ability to maneuver through complicated health systems while pushing them into poverty due to health costs (Bidani and Ravallion 1997). Public spending on health contributes to reducing health inequalities and improving population health because disadvantaged people would benefit more from additional government health expenditures that reduce out-of-pocket health costs (Farahani, Subramanian and Canning 2010, Gupta, Verhoeven and Tiongson 2003, Martin, Rice and Smith 2008). Researchers provided evidence supporting the idea that vulnerable populations may rely more on public spending for enhancing health than people who are better off and can afford private health care

services (Ibid). Given these findings, government health expenditures are expected to make health care more affordable and empower human agency while strengthening the self-efficacy to cope with stressful events (Layte and Whelan 2003, Petticrew et al. 2004). Therefore, it is expected that higher levels of share of government health spending provide better access to health resources to groups who face informational barriers, which should weaken the association between literacy skills and health.

Educational environment may also play an important role in determining adult literacy skills. Differences across countries in the way in which school systems structure students' learning opportunities may account for cross-national differences in the distributions of literacy skills across populations. Among structural features of educational systems that affect student learning, educational standardization refers to the extent to which course contents, textbooks, and course offerings are made uniform by a central authority, meaning that individual schools have limited control over the inputs of education (Bol et al. 2014). Therefore, standardization is known to reduce educational inequalities between individuals originating from different social backgrounds and promote inter-class similarity (Ibid). A standardized curriculum may be particularly helpful for improving academic achievement of students from lower class, who are more likely to rely on the school system for learning than middle or high class students who have more family resources (Park 2008, Van de Werfhorst and Mijs 2010). In this sense, many studies have documented that a higher level of national standardization of educational systems is related to a lower level of inequality in educational attainment and is likely to weaken the effect of social origins on academic achievement (Gamoran 1996, Horn 2009, Park 2008, Reed and Rowan 2013, Van de Werfhorst and Mijs 2010). Within the standardized educational system, students are likely to be exposed to similar schooling experiences to meet the

established standards. This means that individuals with the same level of educational credentials would have similar level of skills throughout the country (Shavit and Muller 1998). On the other hand, in the absence of a standardized curriculum, greater variation in academic achievement between schools have been identified, with family background playing an important role in creating differences in learning processes between schools (Ibid). In other words, a higher level of school autonomy to organize educational resources contributes to increasing disparities in skills between advantaged and disadvantaged students. Given that school experiences have resulted in disparities in adult skills and abilities in the long term (Park and Kyei 2011), educational institutional characteristics may be closely associated with health stratification that is shaped by adult literacy skills. i.e., a larger inequality in levels of literacy skills can be correlated with larger disparities in self-reported health status.

Recent research has argued that there is a need to reveal whether contextual factors may affect the individual level relationship between literacy skills and health status (Moon et al. 2015). International survey data provide a new source for investigating whether and how literacy is linked to self-rated health inequalities across social contexts. No previous study has explicitly compared whether literacy skills are associated with health outcomes across nations with different health financing systems and different educational systems. In this study, I consider country-level factors including the percentage of total health expenditures that come from government support and level of educational standardization to see whether these country-level characteristics moderate the association between literacy skills and self-rated health in 17 developed countries. In addition, individual-level factors, including demographic characteristics (age, gender, marital status), and socioeconomic characteristics (respondent's education, parental education, occupational status) are

controlled for to investigate the link between literacy and people's self-rated health by using a country-level fixed effects approach.

Hypotheses

Literacy will be a strong predictor of self-rated health. Literacy is likely to be positively associated with better self-rated health in most countries. However, the strength of the relationship between literacy and self-rated health may vary across nations (Hypothesis 1). Cross-national variation in the relationship between literacy and health is evaluated by examining how countries differ in the partial effect of literacy skills on self-rated health, controlling for educational attainment and other individual-level characteristics

Public health expenditures as a percentage of total health expenditure may contribute to reducing health inequalities by literacy skills. In a country with less public spending and more private spending on health, such as in the United States, the literacy gap in self-rated health is expected to be more pronounced than in publicly financed health systems, such as in Japan and Scandinavian countries (Hypothesis 2). In other words, the size of the literacy gap in self-rated health decreases with the degree of government health expenditures.

Under the highly standardized educational system, students receive relatively similar quality of education with nationally uniform curricular, and therefore, literacy disparities among individuals are expected to be narrower than literacy disparities in non-standardized educational systems. Narrower disparities in literacy skills, in turn, may reduce the influence of literacy skills on health. I expect literacy skills to have a relatively weaker relationship with self-rated health in more standardized educational

systems of such countries as Japan and South Korea than in less standardized systems of such countries as the United States (Hypothesis 3).

Data and Methods

Data for this study come from the survey of Programme for the International Assessment of Adult Competencies (PIAAC) conducted in 2012. The PIAAC is an international survey of adults aged 16-65 in 24 countries, to assess key cognitive and workplace skills needed for people to participate successfully in societies and economies. In the current study, I use data only from 17 countries after dropping 7 countries that lack the data on self-rated health, literacy skills or country-level characteristics. I restrict the study sample to adults ages 25 and older in order to include only individuals who have likely completed their formal education. The oldest age in the survey was 65. I also exclude 9.8% of respondents who were non-native speaking immigrants who may have a language barrier. I further exclude from the analysis respondents who have missing information on the dependent and the key independent variables. Around 1.1% of data were deleted and the percentage of missing data did not vary by countries. A total of 73,806 respondents were included in the analysis who were living in 17 countries: Belgium (n= 3,665), the Czech Republic (n= 4,396), Denmark (n= 4,884), Finland (n= 4,358), France (n= 5,031), England (n= 6,590), Germany (n= 3,723), Ireland (n= 4,164), Italy (n= 3,663), Japan (n= 4,121), South Korea (hereafter, Korea) (n= 5,481), Netherlands (n= 3,771), Poland (n= 4,836), Slovakia (n= 4,408), Spain (n= 4,273), Sweden (n= 2,951), and the United States (n= 3,491).

Measures

Individual-Level Variables

The outcome of interest is self-rated health. Respondents were asked: "In general, would you say your health is excellent, very good, good, fair, or poor?" (1: poor, 2: fair, 3: good, 4: very good, 5: excellent). The scale of self-rated health was transformed into a standardized value across countries (*Mean*: 0, *S.D*: 1) with a higher value indicating better self-rated health.[3] Self-rated health is known to be an inclusive, comprehensive and feasible indicator of health outcomes internationally (Idler and Benyamini 1997, Jylhä 2009). As this study focuses on the relationship between literacy and self-rated health, a key independent variable of interest is the respondents' scores on the literacy tests. PIAAC administered three different types of cognitive skill tests: literacy, numeracy, and problem solving skills. Among the three, the current study focuses only on the literacy skill test, which mainly evaluated participants' prose literacy, document literacy and skills of managing advanced communication technologies. The literacy domain in PIAAC includes distinct tasks such as reading and understanding a drug label or a brief newspaper article. In addition, there are tasks that involve digital media, such as reading an online job posting and understanding the delivery of healthcare services through internet devices. For each type of test, PIAAC provides ten plausible values (Co-operation and Development 2013). Plausible values are derived from multiple imputations based on "a posteriori distribution by combining the Item Response Theory scaling of the cognitive items with a latent regression model using information in a population model (Yamamoto, Khorramdel and Davier 2013, Chapter 14, page 1)". In other

[3] I performed a sensitivity analysis using the self-rated health variable without standardizing and the result was similar.

words, instead of a single test score, each respondent has ten 'plausible' scores that likely reflect their true, latent ability. Plausible values on the tests are scaled to have an average score of 271 and a standard deviation of 46 across all individuals of OECD countries participating in PIAAC. In this study, I average ten plausible scores for each respondent to make a single measure for one's literacy skills. I also examine non-linearity of literacy using logged literacy as well as squared term of literacy to see whether the variable transformation would improve the model fit.

The relationship between literacy skills and self-rated health is assessed after controlling for other individual-level characteristics. Educational attainment refers to one's highest level of education completed and is grouped into three categories: 1. middle school or less, 2. high school, 3. some college or more. Other control variables include age (categorized in 5-year age groups; continuous variable of age was not available in the public use file), gender (male, female), whether the respondent was living with a spouse or a partner, and current employment status (no job, manual jobs, service/sales/clerks, and professional jobs). In addition to the respondents' own characteristics, I additionally take into account a measure for social origin: parental education. Based on both father's and mother's educational attainment, I construct the variable of parental education: neither parent has attained high school level education, at least one parent has attained high school (but not college) level education, at least one parent has attained some college level education, and missing category. Table 3.1 presents un-weighted descriptive statistics by country of origin for each individual-level variable.

Country-Level Variables

Two country-level variables are included as discussed above : public health spending as a share of total health expenditures (i.e., the percentage of government spending of the sum of government and private health expenditures), and index of educational standardization. Public health expenditures specifically consist of recurrent and capital spending from government (central, state, and local) funding, and social health insurance funds. Health spending represents consumption of health care services related with "personal health care (curative care, rehabilitative care, long-term care, ancillary services and medical goods) and collective services (prevention and public health services as well as health administration), but excluding spending on investments (Organization for Economic Co-operation and Development, n.d., para. 1)." The share of public health expenditures for each country comes from 2012 OECD health spending data, available at https://data.oecd.org/healthres/health-spending.htm.

Information on the level of educational standardization at the country level is based on reports by middle school principals in three international surveys conducted in earlier periods: The First International Science Study (FISS) in 1968-1972, Second International Science Study (SISS) in 1982-1986, and Third International Mathematics and Science Study (TIMSS) in 1995 (and some in 1999). The three data include representative samples of middle school students, teachers, and principals in countries of PIAAC. Among the 17 countries of the current study, 5 countries - Finland, Italy, Japan, the Netherlands, and the United States - participated in all three FISS, SISS, and TIMSS surveys: Other 3 countries - Belgium, Germany, and Sweden - participated in FISS and TIMSS surveys. England participated in FISS and SISS.

Among the countries that did not participate in FISS, Korea and Poland participated in SISS and TIMSS. For the remaining countries that did not participate in FISS and SISS, including the Czech Republic, Slovakia, Denmark, France, Ireland, and Spain, measures of school-level standardization indicators draw on the TIMSS.

The level of standardization measures the extent to which schools can decide by themselves what they teach. In FISS, SISS, and TIMSS, school principals were asked about authority for two items closely related with the curricular standardization: textbooks and course content. When schools decide textbooks and course content there will be higher dissimilarities in students' skills in different schools. School principals' answers were dichotomized into central authority and school's own authority. Using school principals' answers, I first calculated the proportion of school principals within each country who answered that school's textbooks were determined by central authority. Similarly, I also calculated the corresponding proportion for course contents. Then, I averaged the two proportions within each country to create a single measure showing the degree of educational standardization.

Note that I use all three datasets of FISS, SISS, and TIMSS as long as they are available for a country. Therefore, I could calculate the average proportion between schools' textbooks and course contents in each of the three datasets for countries that participated in all three surveys of FISS, SISS, and TIMSS. For those countries that have three values, I took the median value among the three proportions available from each of the three dataset. For countries that participated in two out of the three surveys, I simply averaged the two proportions from each of the two data. If a country has only one proportion from the FISS, SISS, or TIMSS, the value was used as an indicator of the level of educational standardization.

Statistical Methods

Given the hierarchical nature of the data, with individuals living in countries, and to avoid possible problems related with multilevel models with a small number of country-level units such that only a small number of country-level covariates can be adjusted for due to the low number of degrees of freedom, I use fixed effect models (Allison 2009). The fixed effect approach controls for country-level heterogeneity so that it can take account the country-level omitted characteristics that may affect self-rated health such as Gross Domestic Product (GDP). The country-level fixed effects can be estimated "if the focus is on cross-level interaction terms because the main effects of country-level variables cannot be included in the model. The cross-level interaction effects estimate potential non-linearities in the effects of individual-level variables (Bol. et al 2014, 1552p)."

I estimate four ordinary linear regression models with country-level fixed effects predicting self-rated health. Model 1 only includes country-level fixed effects to show how the average level of self-rated health differs across countries. The percentage of variance due to differences across countries can be calculated from adjusted R square. Model 2 adds the key independent variable (literacy skills) and individual-level covariates. Model 3 assesses if the shape and strength of the association between literacy and self-rated health varies across countries by adding interaction terms between literacy and the country dummies. Model 4 adds the cross-level interaction effects, i.e. interactions between individual-level literacy and country-level variables, i.e., the share of public expenditure in total health spending and the level of educational standardization. The interaction terms reveal whether each of the two contextual factors acts as a moderator of the relationship between

adult literacy skills and self-rated health. The equation for the country-level fixed effect model (Model 4) is as follows:

$$Y_i = \beta_{0i} + \beta_1 \text{age} + \beta_2 \text{gender} + \beta_3 \text{marital} + \beta_4 \text{education} + \beta_5 \text{occupation} + \\ + \beta_6 \text{parental education} + \beta_7 \text{literacy} + \sum_{k=k-1} \beta_x C_k + \beta_9 \text{literacy} * \\ \text{publich health spending}_i + \beta_{10} \text{literacy} * \text{standardization}_i + \varepsilon_i \quad (1)$$

In equation 1, Y_i is the standardized self-rated health score for individual *i*; β_1 to β_7 include the individual-level variables; β_x measures the fixed effects for countries by adding country dummies (dummy C for country number *k*); β_9 and β_{10} indicate cross-level interaction effects between literacy skills and the country-level covariates; and ε_i indicates the error term. If the result is consistent with hypotheses expecting that literacy is positively related with self-rated health, and the share of public health spending and educational standardization may reduce health disparities related to literacy skills, β_9 and/or β_{10} should be negative.

Results

As seen in Table 3.1, there are significant differences in literacy skills across countries ranging from a low of 250.6 in Italy to high of 296.5 in Japan. Along with Japan, Scandinavian countries and the Netherlands are at the higher end of literacy score while Spain and Poland rank near the bottom. Specifically, the average literacy score is 289.1 and 287.9 for Finland and the Netherlands, respectively, whereas the average literacy score is 253.2 and 263.9 for Spain and Poland. Countries with higher literacy scores tend to show higher levels of self-rated health in general, except for

Japan and Korea where literacy scores are high and slightly below average but self-rated health scores are very low. Germany and Ireland show the highest level of self-rated health, although they do not have the highest literacy scores.

Model 1 in Table 3.2 shows that the country fixed effects account for around 7.8 percent of the total variation in individuals' self-rated health. Denmark, Germany, Ireland, and Sweden show higher levels of self-rated health than the United States (the reference country). In Model 2, individuals' scores on the literacy test and other individual-level covariates (gender, age, marital status, respondents' educational attainment, current occupational status, and parental educational attainment) are included. The percentage of variance explained increases to 20.8% and the model fit is significantly improved over Model 1. Lower levels of educational attainment are associated with worse self-rated health. Respondents who have professional jobs are more likely to report better health, whereas people who are manual workers or not in a job market are more likely to report worse self-rated health than people with sales/service/clerical jobs. People having parents with college level education are more likely to have better health than people with parents neither of whom completed high school level education. The effect of literacy skills on self-rated health is statistically significant even after controlling for educational attainment and other individual covariates. Note that in Table 3.2, the coefficient of literacy skills refers to the change in self-rated health per 100-point increase in the literacy test score. Therefore, the coefficient of 0.264 indicates the increase of self-rated health by 0.264 standard deviations per 100-point increase in the literacy test score. A supplementary statistical test (not shown) indicated that the relationship between literacy and self-rated health is linear.

Model 3 includes interaction terms between the country dummies and literacy skills. These interaction effects allow examining whether the effect of literacy varies across countries. Because the reference country is United States, a coefficient of 0.498 for literacy skills indicates that the average health score in the United States increases by 0.498 standard deviations per 100-point increase in the literacy score. Interaction effects between each country dummy variable and the literacy variable show how the relationship between literacy and self-rated health in a given country deviates from the relationship in the United States. All coefficients of interaction terms are negative and statistically significant (additional test was performed using *'testparm'*, which showed that the overall interaction was statistically significant). This means that the slope of literacy on self-rated health is steepest in the United States than in any other country. In other words, the relationship between literacy and self-rated health is more pronounced in the United States than in the other 16 countries examined in the current study.

Model 4 includes interaction effects between literacy skills and each of the two contextual variables. It tests whether the relationship between literacy skills and self-rated health is contingent on public health expenditures and educational standardization. The two cross-level interactions are statistically significant and negative, indicating that the relationship between literacy and self-rated health becomes increasingly weaker as the levels of public health expenditures and educational standardization increase. In other words, literacy matters increasingly less for self-fated health along with increased public health expenditures and educational standardization.

To facilitate interpretation of the interaction terms, I present Figure 1 showing how the estimated slope of literacy on self-rated health for each country changes according to a country's public health spending (% of total health spending). Specifically, using the coefficients of interaction terms between literacy and country dummies in Model 3, along with the coefficient of literacy in the reference country, the Unites States, I can calculate the slope of literacy on self-rated health, which is presented in the Y-axis. The X-axis in Figure 1 presents countries' levels of public health spending. The correlation between the country literacy effect and the country′s share of public spending illustrates how the relationship between literacy and self-rated health in each country varies according to the public health financing system (*coeff.* =-0.82). In more public oriented financing systems, weaker literacy effects on health are found.

Figure 2 plots the correlation between the country literacy effect and the level of educational standardization, based on the coefficients of interaction terms in Model 3. The correlation between countries' levels of educational standardization and the country literacy effect on health is high (*coeff.* =-0.77).

Discussion

As information-rich environments emerged and healthcare delivery system has become complicated across the industrialized world, skills to gain information from multiple sources and process information properly play an important role in dealing with diseases or catastrophic health events (Suka et al. 2015). Literacy skills provide knowledge, enhance health care utilization, and protect individuals from various health risk factors. The relationship between adult literacy skills and health should be paid attention to address health disparities.

Despite the strong correlation between literacy skills and educational attainment, literacy skills may vary within the same level of educational credentials (Van de Werfhorst 2011). There is a lack of research about how strongly literacy skills are associated with self-rated health after accounting for formal educational degrees, as many researchers have assumed that educational attainment credentials reflect the level of literacy skills quite accurately (Smith-Greenaway 2015). According to a study that investigated the reading skills of patients in an outpatient clinic who enrolled in Medicaid and Medicare in the United States, literacy skills were often well below the patients' highest grade completed, which shed light on the importance of disentangling literacy skills from educational qualifications particularly when it comes to disadvantaged people (Andrus and Roth 2002). To extend previous research current study focused on the relationship between adult literacy skills and self-rated health beyond educational attainment in 17 developed countries aiming to reveal how a country′s systems of health financing and education shape the relationship using a country-level fixed effect approach.

The main finding of this study is consistent with the expectation in that literacy is positively associated with self-rated health. After adjusting for individual's educational attainment and other socioeconomic characteristics, literacy remains a significant predictor of health, with individuals with higher levels of literacy reporting better self-rated health. People with limited health literacy may be less able to access health-related information and more likely to have barriers to use health care services (Berkman, Davis and McCormack 2010). They would have worse health behaviors, less preventive care, fewer physician visits, and poorer compliance with medications.

In this sense, promoting equity in skills/abilities is an important step to promote population health.

The results also confirm hypothesis 1: the strength of the relationship between adult literacy skills and self-rated health may vary across nations. Particularly, literacy in the United States appeared to be more important to self-rated health than in other nations in survey. In contrast, literacy skills in Japan seemed to be less important to self-rated health compared with other countries. Country differences in health financing system partially account for the country variation in the literacy-related health disparities. The strength of the relationship between literacy skills and self-rated health is attenuated in countries with higher public share of health expenditures. In other words, the share of public expenditures on health contributes to reducing the health inequalities as it may improve health of disadvantaged people for whom the amount of out-of-pocket health care spending is limited. Government expenditures on health care services may be better at addressing the needs of vulnerable individuals who are more likely to have limited literacy skills (Parker 2000, Parker et al. 1995).

The finding also supports that health disparities across literacy skills are less pronounced in educational systems with curriculum that are nationally standardized compared to educational systems where schools have authority to organize educational contents. Previous studies have found that children from disadvantaged families benefit more from the school resources than children from well-off families (Park 2008, Van de Werfhorst and Mijs 2010). In this context, curriculum standardization contributes to reducing inequalities in skills and knowledge obtained through schooling across individuals with different social origins while promoting key literacy skills particularly among the disadvantaged group members. This results in

less literacy-related inequalities in self-rated health in adulthood in society. It is also plausible that in countries with standardized school curriculum, educational credentials may be a better proxy for obtained skills. Thus, after controlling for formal educational attainment, health disparities related with literacy skills would be much smaller in countries where educational systems are more highly standardized.

In conclusion, literacy skills are strongly and positively associated with better self-rated health in 17 OECD countries although the association varies by countries. Structural-level contextual factors of health care financing systems and the level of educational standardization are significantly related with this variation. For example, Japan has higher share of public health spending of total health expenditure and higher level of educational standardization while the United States has the lowest share of public health spending of total health expenditure and less standardized school curriculum.

This study has several limitations to be addressed in future research. The results are based on cross-sectional data and hence do not allow causal inference. Studies with longitudinal data are strongly recommended to confirm causal relationship between literacy and health. Future study also needs to consider other potentially important country-level differences related to both literacy skills and self-rated health such as the effectiveness of health and education related policies, quality of primary health care, and the mean time a physician spends with a patient (Nutbeam 2000, St Leger 2001).

Although self-rated health can capture general health condition that may not be captured by more detailed health indicators it is unclear which aspects of health are specifically considered by individuals when they rate their health. In addition, there is

likely to be cultural variations in the reporting of self-rated health (Quesnel–Vallée 2007). Given that self-rated health can be a cultural specific measurement, comparisons of self-rated health across nations should be based on assumption of each country's context-specific relevance and validity. Therefore, interpretations based on self-reported health should be made with caution when it comes to a cross-national study (Jylhä et al. 1998). Additional studies can examine the relationship between literacy and health using more objective health-related indices and health behaviors.

Tables

Table 3.1. Descriptive Statistics of Variables in 17 Countries, Distribution (%) or Mean (SD), Programme for the International Assessment of Adult Competencies (PIAAC) 2012

Country	Mean score of literacy (Min: 74.5-Max:415.6)	Mean self-rated health (1(poor)-5(good))	Female (%)	Middle school or lower (%)	High school (%)	College or higher (%)	No job (%)	Manual (%)	Service/ Sales/ Clerk (%)	Professional (%)
Belgium	276.9(42.6)	3.4(1.0)	49.5	17.0	43.3	39.8	12.9	22.9	34.5	29.7
Czech Rep.	272.9(37.8)	3.4(0.9)	50	7.2	73.1	19.7	10	35.3	37.2	17.6
Denmark	274.6(41.6)	3.6(1.1)	49.6	18.8	41.1	40.2	8.2	24.9	34.4	32.5
Finland	289.1(45.2)	3.3(1.0)	50.3	14.1	60.0	25.9	8.8	27.3	40.5	23.5
France	264.8(43.7)	3.3(1.1)	50.9	6.9	59.6	33.5	12.5	29.1	37.9	20.5
Germany	272.9(43.2)	3.7(1.0)	48.8	7.9	56.8	35.3	9.1	27.4	42	21.5
Ireland	266.7(44.6)	3.7(1.1)	51.1	29.1	36.6	34.3	15.8	26.6	33.5	24.1
Italy	250.6(40.6)	3.3(1.1)	50.9	55.5	32	12.5	22.8	31.3	33.4	12.5
Japan	296.5(37.1)	3.0(1.0)	49.5	10.5	44.6	44.9	12.3	23.2	44.8	19.7
Korea	269.0(38.7)	2.5(0.9)	50.3	21.4	40.8	37.8	15.5	29.3	40.7	14.6
Netherland	287.9(42.5)	3.4(1.0)	49.4	29.2	35.7	35.1	12.6	15.9	37.3	34.2
Poland	263.9(45.2)	3.1(0.9)	51.4	11.1	62.8	26.1	20.2	33.1	25.1	21.6
Slovakia	273.8(36.9)	3.2(1.0)	50.3	16.5	63.6	19.9	15.1	32.2	31.5	21.2
Spain	253.2(45.7)	3.2(1.0)	49.8	47.1	21.4	31.5	14.5	31.9	35	18.7
Sweden	288.4(39.9)	3.6(1.1)	49.4	15.9	50.3	33.7	7.2	23.4	39.9	29.6
England	277.3(44.2)	3.5(1.1)	51	22.6	35.3	42.1	11.5	20.7	40.2	27.7
US	275.6(44.2)	3.6(1.1)	52.2	9.2	49.3	41.5	9.8	21	38.7	30.5

Note: Standard deviations are in the parentheses.

Table 3.1. (Continued) Descriptive Statistics of Variables in 17 Countries, Distribution (%) or Mean (SD), Programme for the International Assessment of Adult Competencies (PIAAC) 2012

Country	Married (%)	Parents' Education[1] (%)	Parents' Education[2] (%)	Parents' Education[3] (%)	Parents' Education[4] (%)	Public health expenditure (% health exp.)	Educational standardization score
Belgium	82.1	43.1	31.8	20.9	4.2	77.6	0.3
Czech Rep.	72.8	11	72.6	12.4	4.1	83.7	0.2
Denmark	73.7	33.6	38.9	26.6	1.0	85	0.2
Finland	73.1	46.9	36.7	14.6	1.9	75.7	0.4
France	73.2	40.4	28.6	13.0	18.1	78.2	0.4
Germany	76	7.9	53.2	31.3	7,7	83.5	0.3
Ireland	72.3	58.2	23.6	13.9	4.3	69.8	0.3
Italy	72.7	78.4	16.6	4.6	0.4	77	0.4
Japan	75.5	26.0	40.7	27.4	6.0	84	0.6
Korea	75	59.7	25.7	13.6	1.0	57.1	0.5
Netherland	77.8	52.4	25.1	20.8	1.8	81.8	0.1
Poland	75.3	32.1	53.5	11.3	3.1	70	0.6
Slovakia	76.9	32.0	56.9	10.4	0.7	72	0.2
Spain	76.7	74.7	11.9	10.3	3.1	71.9	0.0
Sweden	74.1	44.5	20.8	29.7	5.0	83.6	0.3
England	72.1	25.5	35.7	16.6	22.2	81.8	0.0
US	72.2	13.8	46.7	34.8	4.7	48.2	0.1

Notes: [1] Coding of parental education: 1. neither parent has attained high school level education, 2. at least one parent has attained high school level education, 3. at least one parent has attained some college level education, and 4. missing.

Table 3.2. Estimated Coefficients from Fixed Effects Models on Self-Rated Health

	Model 1	Model 2	Model 3	Model 4
Country Fixed effects				
Belgium	-0.159(0.02)**	-0.115(0.04)**	1.201(0.26)**	0.776(0.06)**
Czech Republic	-0.105(0.02) **	-0.106(0.03) **	0.528(0.21)*	0.772(0.06)**
Denmark	0.048(0.02)*	0.044 (0.04)	0.830(0.28)**	0.951(0.07)**
Finland	-0.200(0.02) **	-0.199(0.04) **	0.636(0.27) *	0.801(0.06)**
France	-0.208(0.02) **	-0.133(0.01) **	0.851(0.09) **	0.830(0.05) **
Germany	0.128(0.02) **	0.126(0.01) **	0.900(0.08) **	1.105(0.05) **
Ireland	0.140(0.02) **	0.230(0.05) **	1.700(0.30) **	0.906(0.06) **
Italy	-0.219 (0.02) **	0.028 (0.02)	1.163(0.09)**	0.982(0.05)**
Japan	-0.513 (0.02) **	-0.554 (0.01) **	0.956(0.08) **	0.778(0.06) **
Korea	-0.974 (0.02) **	-0.887 (0.01) **	0.324(0.10) **	-0.211(0.05) **
Netherland	-0.126 (0.02) **	-0.133 (0.03) **	0.911(0.17) **	0.649(0.06) **
Poland	-0.345(0.02) **	-0.364(0.02) **	0.369(0.09) **	0.691(0.06) **
Slovakia	-0.343 (0.02) **	-0.267 (0.04) **	0.396(0.29)	0.368(0.05)**
Spain	-0.366 (0.02) **	-0.189 (0.02) **	0.555(0.09) **	0.263(0.04) **
Sweden	0.078(0.02) **	0.012(0.03)	1.218(0.25)**	1.070(0.06)**
England	-0.064(0.02) **	0.049(0.02)**	0.820(0.10)**	0.678(0.06)**
United States	Ref	Ref	Ref	Ref
Literacy Skills		0.264 (0.02)**	0.498 (0.01)**	0.891(0.04)**
Educational Attainment				
Middle school or less		-0.227 (0.01)**	-0.251 (0.01)**	-0.236 (0.01)**
High school		-0.114 (0.01)**	-0.114 (0.01)**	-0.113 (0.01)**
College or more		Ref	Ref	Ref
Parental education				
Neither high school		Ref	Ref	Ref
High school		0.031(0.01)**	0.037(0.01)**	0.035(0.01)**
Some college		0.090(0.01) **	0.083(0.01) **	0.084(0.01) **
Missing		-0.040 (0.01)*	-0.033(0.01)*	-0.037(0.02)*
Gender: Female		-0.007(0.01)	-0.012(0.01)+	-0.010(0.01)
Living with a spouse		0.136(0.01)**	0.127(0.01)**	0.130(0.01)**
Occupational status				
Professional		0.106 (0.01)**	0.093(0.01)**	0.096(0.01)**
Service/Sales/Clerk		Ref.	Ref.	Ref.
Manual		-0.045(0.01)**	-0.051(0.01)**	-0.051(0.01)**
No job		-0.400(0.01)**	-0.393(0.01)**	-0.400(0.01)**
Literacy-Country effect interactions				
Belgium			-0.475 (0.09) **	
Czech Republic			-0.231 (0.08) **	
Denmark			-0.284 (0.10) **	
Finland			-0.299 (0.09) **	
France			-0.363 (0.03) **	
Germany			-0.282 (0.03) **	
Ireland			-0.306 (0.11) **	
Italy			-0.426 (0.03) **	
Japan			-0.526 (0.03) **	
Korea			-0.445 (0.04) **	
Netherland			-0.370 (0.06) **	
Poland			-0.269 (0.03) **	
Slovakia			-0.241 (0.11) *	
Spain			-0.270 (0.03) **	
Sweden			-0.427 (0.09) **	
England			-0.279 (0.03) **	
United States			Ref	

Table 3.2.(Continued) Estimated Coefficients from Fixed Effects Models on Self-Rated Health

	Model 1	Model 2	Model 3	Model 4
Cross-Level Interactions				
Literacy Standardization*				-0.400(0.04)**
Literacy %Public health expenditu*				-0.781(0.06)**
Constant	0.208(0.02)**	-0.246(0.03)**	-0.870 (0.04)**	-0.826(0.04)**
Observations	73806	73806	73806	73806
Adjust R2	0.078	0.21	0.21	0.22

Notes: p-value **< 0.01; * < 0.05; + < 0.10. Age is controlled for in all models. Standard errors are in parentheses.

Figures

Figure 3.1. The y-axis gives the estimated association between literacy and populations' self-rated health, where larger values indicate that literacy skills have a larger effect on health. These values are plotted by a country's level of public health expenditures.

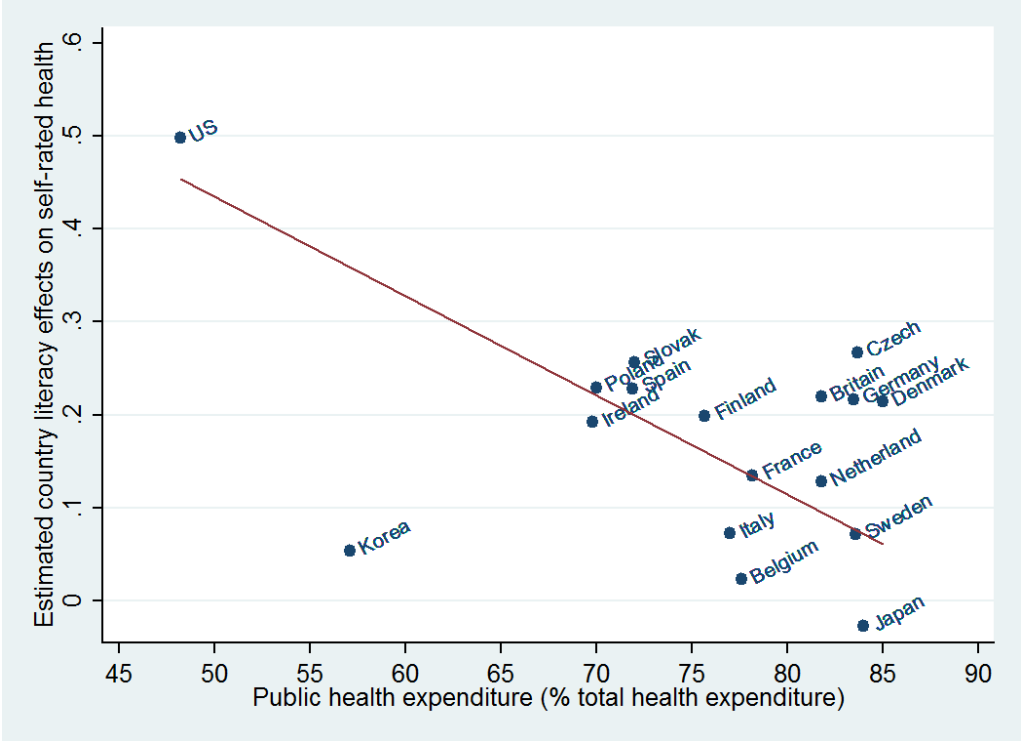
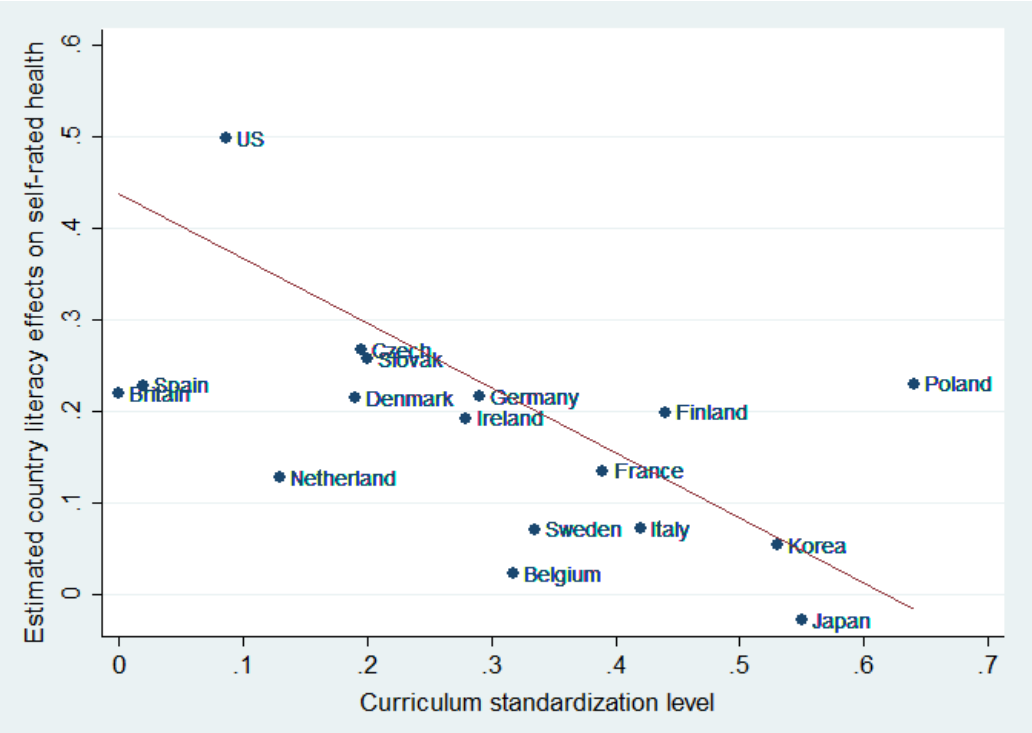


Fig 3.2. The y-axis gives the estimated association between literacy and populations' self-rated health, where larger values indicate that literacy skills have a larger effect on health. These values are plotted by a country's score on educational standardization index.



Appendix

Chapter 2

Table A1. Coefficients from Cox survival model predicting risk of death of fathers (n= 2,592)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Highest level of children's education (College or higher)[1]					
Middle school or lower	0.23(0.29)	0.11(0.30)	0.10(0.29)	0.11(0.30)	0.09(0.29)
High school	0.20(0.11)+	0.12(0.11)	0.09(0.12)	0.12(0.11)	0.09(0.12)
Number of sons	0.05(0.05)	0.02(0.05)	0.02(0.05)	0.03(0.05)	0.02(0.05)
Number of daughters	0.01(0.04)	-0.01(0.04)	-0.00(0.04)	-0.01(0.04)	-0.00(0.04)
Parents' characteristics					
Parent's education (Middle school or higher)					
No formal education		-0.06(0.17)	-0.09(0.17)	-0.07(0.17)	-0.10(0.17)
Elementary school		0.02(0.12)	0.00(0.12)	0.02(0.12)	0.00(0.12)
Partner's education (Middle school or higher)					
No formal education		0.33(0.17)+	0.30(0.17)+	0.34(0.17)+	0.31(0.18)
Elementary school		0.18(0.14)	0.18(0.14)	0.18(0.14)	0.17(0.14)
No spouse		0.36(0.19)+	0.34(0.19)+	0.36(0.19)+	0.35(0.19)
Household income (1st quartile)					
2nd quartile		-0.07(0.12)	-0.09(0.12)	-0.07(0.12)	-0.10(0.12)
3rd quartile		-0.31(0.15)*	-0.32(0.15)*	-0.31(0.15)*	-0.32(0.15)*
4th quartile		-0.11(0.15)	-0.12(0.15)	-0.12(0.15)	-0.12(0.15)
Health behaviors					
Exercise(No exercise)			-0.09(0.12)		-0.09(0.12)
Regular health examination(No health examination)			-0.22(0.10)*		-0.22(0.10)*
Current smoker (Non smoker)			0.27(0.10)**		0.27(0.10)**
Drinking (Barely drinking)			-0.30(0.10)**		-0.30(0.10)**
Frequency of contact				0.01(0.03)	0.01(0.03)

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership and region of residence are controlled for in models 2-4. [1]Omitted category is in parentheses. Numbers in parentheses are standard errors.

Table A2. Coefficients from Cox survival model predicting risk of death of fathers (n= 2,592)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Education of the oldest child (College or higher)[1]					
Middle school or lower	0.41(0.14)**	0.33(0.16)*	0.26(0.16)	0.32(0.16)*	0.26(0.16)
High school	0.33(0.11)**	0.28(0.12)*	0.25(0.12)*	0.28(0.12)*	0.25(0.12)*
Number of sons	0.02(0.05)	0.01(0.05)	0.01(0.05)	0.01(0.05)	0.01(0.05)
Number of daughters	-0.02(0.04)	-0.03(0.04)	-0.02(0.04)	-0.03(0.04)	-0.02(0.04)
Parents' characteristics					
Parent's education (Middle school or lower)					
No formal education		-0.11(0.17)	-0.13(0.17)	-0.11(0.17)	-0.13(0.17)
Elementary school		0.00(0.12)	-0.02(0.12)	0.00(0.12)	-0.02(0.12)
Partner's education (Middle school or lower)					
No formal education		0.27(0.18)	0.25(0.18)	0.27(0.18)	0.26(0.18)
Elementary school		0.13(0.15)	0.12(0.15)	0.13(0.15)	0.12(0.15)
No spouse		0.31(0.20)	0.30(0.20)	0.32(0.20)	0.30(0.20)
Household income (1st quartile)					
2nd quartile		-0.09(0.12)	-0.10(0.12)	-0.09(0.12)	-0.10(0.12)
3rd quartile		-0.31(0.15)*	-0.32(0.15)*	-0.31(0.15)*	-0.32(0.15)*
4th quartile		-0.11(0.15)	-0.12(0.15)	-0.12(0.15)	-0.13(0.15)
Health behaviors					
Exercise(No exercise)			-0.08(0.12)		-0.08(0.12)
Regular health examination(No health examination)			-0.21(0.10)*		-0.21(0.10)*
Current smoker (Non smoker)			0.26(0.10)*		0.26(0.10)*
Drinking (Barely drinking)			-0.30(0.10)**		-0.30(0.10)**
Frequency of contact				0.01(0.03)	0.01(0.03)

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership and region of residence are controlled for in models 2-4. [1]Omitted category is in parentheses. Numbers in parentheses are standard errors.

Table A3. Coefficients from Cox survival model predicting risk of death of mothers (n= 3,837)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Highest level of children's education (College or higher)[1]					
Middle school or lower	0.66(0.17)**	0.51(0.18)**	0.48(0.18)*	0.48(0.19)*	0.46(0.19)*
High school	0.54(0.12)**	0.44(0.12)**	0.42(0.12)**	0.44(0.12)**	0.42(0.12)**
Number of sons	0.02(0.05)	0.02(0.05)	0.02(0.05)	-0.01(0.05)	-0.02(0.05)
Number of daughters	-0.03(0.03)	-0.04(0.04)	-0.04(0.04)	-0.07(0.04)*	-0.07(0.04)*
Parents' characteristics					
Parent's education (Middle school or higher)					
No formal education		0.31(0.20)	0.29(0.20)	0.28(0.20)	0.26(0.20)
Elementary school		0.24(0.19)	0.24(0.19)	0.22(0.19)	0.22(0.19)
Partner's education (Middle school or higher)					
No formal education		0.03(0.23)	0.01(0.23)	0.03(0.23)	0.01(0.23)
Elementary school		0.01(0.19)	-0.00(0.19)	0.01(0.19)	-0.01(0.19)
No spouse		0.11(0.17)	0.10(0.17)	0.13(0.17)	0.13(0.17)
Household income (1st quartile)					
2nd quartile		0.01(0.13)	0.02(0.13)	-0.00(0.13)	0.00(0.13)
3rd quartile		-0.17(0.16)	-0.16(0.16)	-0.15(0.16)	-0.15(0.16)
4th quartile		-0.16(0.16)	-0.16(0.16)	-0.11(0.16)	-0.11(0.16)
Health behaviors					
Exercise(No exercise)			-0.12(0.14)		-0.10(0.14)
Regular health examination(No health examination)			-0.22(0.11)*		-0.22(0.11)*
Drinking (Barely drinking)			-0.06(0.16)		-0.05(0.16)
Frequency of contact				-0.09(0.03)**	-0.09(0.03)**

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership and region of residence are controlled for in models 2-4. [1]Omitted category is in parentheses. Numbers in parentheses are standard errors.

Table A4. Coefficients from Cox survival model predicting risk of death of mothers (n= 3,837)

Characteristics	Model 1	Model 2 (Model 1+ Parental SES)	Model 3a (Model 2+ Parental health behaviors)	Model 3b (Model2+ Frequency of contact)	Model 4 (Model2+ Health behaviors+ contact
Education of the oldest child (College or higher)[1]					
Middle school or lower	0.67(0.15)**	0.50(0.16)**	0.47(0.16)**	0.48(0.16)**	0.46(0.16)**
High school	0.40(0.14)**	0.29(0.14)*	0.26(0.14)+	0.28(0.14)*	0.26(0.14)+
Number of sons	-0.02(0.04)	-0.01(0.05)	-0.01(0.05)	-0.04(0.05)	-0.04(0.05)
Number of daughters	-0.08(0.04)*	-0.07(0.04)+	-0.07(0.04)+	-0.10(0.04)*	-0.10(0.04)*
Parents' characteristics					
Parent's education (Middle school or higher)					
No formal education		0.29(0.20)	0.27(0.20)	0.27(0.20)	0.24(0.20)
Elementary school		0.23(0.19)	0.23(0.19)	0.21(0.19)	0.21(0.19)
Partner's education (Middle school or higher)					
No formal education		0.05(0.23)	0.03(0.23)	0.05(0.23)	0.03(0.23)
Elementary school		0.02(0.19)	0.00(0.19)	0.01(0.19)	-0.00(0.19)
No spouse		0.14(0.17)	0.13(0.17)	0.17(0.17)	0.15(0.17)
Household income (1st quartile)					
2nd quartile		0.00(0.13)	0.00(0.13)	-0.02(0.13)	-0.02(0.13)
3rd quartile		-0.18(0.16)	-0.18(0.16)	-0.16(0.16)	-0.16(0.16)
4th quartile		-0.19(0.16)	-0.18(0.16)	-0.14(0.16)	-0.13(0.16)
Health behaviors					
Exercise(No exercise)			-0.13(0.14)		-0.12(0.14)
Regular health examination(No health examination)			-0.23(0.11)*		-0.23(0.11)*
Drinking (Barely drinking)			-0.06(0.16)		-0.04(0.16)
Frequency of contact				-0.09(0.03)**	-0.09(0.03)**

Notes: p-value **< 0.01; * < 0.05; +<0.10. Age at baseline is controlled for in all models. Home ownership and region of residence are controlled for in models 2-4. [1]Omitted category is in parentheses. Numbers in parentheses are standard errors.

Bibliography

Chapter 1

Abel, Thomas. 2008. "Cultural Capital and Social Inequality in Health." *Journal of epidemiology and community health* 62(7):e13-e13.

Adams, Jean and Martin White. 2009. "Time Perspective in Socioeconomic Inequalities in Smoking and Body Mass Index." *Health Psychology* 28(1):83.

Aitsi-Selmi, Amina, Ruth Bell, Martin J Shipley and Michael G Marmot. 2014. "Education Modifies the Association of Wealth with Obesity in Women in Middle-Income but Not Low-Income Countries: An Interaction Study Using Seven National Datasets, 2005-2010." *PloS one* 9(3):e90403.

Atlantis, E, EH Barnes and K Ball. 2008. "Weight Status and Perception Barriers to Healthy Physical Activity and Diet Behavior." *International journal of obesity* 32(2):343-52.

Bordo, Susan. 1993. "Feminism, Foucault and the Politics of the Body1." *Up against Foucault: Explorations of some tensions between Foucault and feminism*:179.

Bordo, Susan. 2004. *Unbearable Weight: Feminism, Western Culture, and the Body*: Univ of California Press.

Bourdieu, Pierre. 1984. *Distinction: A Social Critique of the Judgement of Taste*: Harvard University Press.

Brewis, Alexandra A. 2011. *Obesity: Cultural and Biocultural Perspectives*: Rutgers University Press.

Brinton, Mary C. 1988. "The Social-Institutional Bases of Gender Stratification: Japan as an Illustrative Case." *American Journal of Sociology*:300-34.

Brinton, Mary C. 2001. *Women's Working Lives in East Asia*: Stanford University Press.

Buss, David M. 1998. "The Psychology of Human Mate Selection: Exploring the Complexity of the Strategic Repertoire." *Handbook of evolutionary psychology: Ideas, issues, and applications*:405-29.

Caliendo, Marco and Wang-Sheng Lee. 2013. "Fat Chance! Obesity and the Transition from Unemployment to Employment." *Economics & Human Biology* 11(2):121-33.

Caprio, Sonia, Stephen R Daniels, Adam Drewnowski, Francine R Kaufman, Lawrence A Palinkas, Arlan L Rosenbloom and Jeffrey B Schwimmer. 2008. "Influence of Race, Ethnicity, and Culture on Childhood Obesity: Implications for Prevention and Treatment a Consensus Statement of Shaping America's Health and the Obesity Society." *Diabetes care* 31(11):2211-21.

Case, Anne and Alicia Menendez. 2009. "Sex Differences in Obesity Rates in Poor Countries: Evidence from South Africa." *Economics & Human Biology* 7(3):271-82.

Cawley, John. 2004. "The Impact of Obesity on Wages." *Journal of Human Resources* 39(2):451-74.

Chang, Virginia W and Nicholas A Christakis. 2003. "Self-Perception of Weight

Appropriateness in the United States." *American journal of preventive medicine* 24(4):332-39.
Cho, Loo-Hyun. 2009. "Neoliberal Governmentality at Work: Post-Imf Korean Society and the Construction of Neoliberal Women." *Korea Journal* 49(3):15-43.
Chou, Shin-Yi, Michael Grossman and Henry Saffer. 2004. "An Economic Analysis of Adult Obesity: Results from the Behavioral Risk Factor Surveillance System." *Journal of health economics* 23(3):565-87.
Cleland, Verity J, Kylie Ball, Costan Magnussen, Terence Dwyer and Alison Venn. 2009. "Socioeconomic Position and the Tracking of Physical Activity and Cardiorespiratory Fitness from Childhood to Adulthood." *American Journal of Epidemiology* 170(9):1069-77.
Cockerham, William C. 2000. "Health Lifestyles in Russia." *Social Science & Medicine* 51(9):1313-24.
Cockerham, William C. 2005. "Health Lifestyle Theory and the Convergence of Agency and Structure." *Journal of health and social behavior* 46(1):51-67.
Cutler, David M and Adriana Lleras-Muney. 2006. "Education and Health: Evaluating Theories and Evidence." Vol.: National Bureau of Economic Research.
Cutler, David M and Adriana Lleras-Muney. 2010. "Understanding Differences in Health Behaviors by Education." *Journal of health economics* 29(1):1-28.
Davis, Esa M, Stephen J Zyzanski, Christine M Olson, Kurt C Stange and Ralph I Horwitz. 2009. "Racial, Ethnic, and Socioeconomic Differences in the Incidence of Obesity Related to Childbirth." *American Journal of Public Health* 99(2):294-99.
Devaux, Marion and Franco Sassi. 2013. "Social Inequalities in Obesity and Overweight in 11 Oecd Countries." *The European Journal of Public Health* 23(3):464-69.
Dunning, John H and Changsu Kim. 2007. "The Cultural Roots of Guanxi: An Exploratory Study." *The World Economy* 30(2):329-41.
Elo, Irma T. 2009. "Social Class Differentials in Health and Mortality: Patterns and Explanations in Comparative Perspective." *Annual Review of Sociology* 35:553-72.
French, Michael T. 2002. "Physical Appearance and Earnings: Further Evidence." *Applied Economics* 34(5):569-72.
Gangwisch, James E, Dolores Malaspina, Bernadette Boden-Albala and Steven B Heymsfield. 2005. "Inadequate Sleep as a Risk Factor for Obesity: Analyses of the Nhanes I." *SLEEP-NEW YORK THEN WESTCHESTER-* 28(10):1289.
Garawi, F, K Devries, N Thorogood and R Uauy. 2014. "Global Differences between Women and Men in the Prevalence of Obesity: Is There an Association with Gender Inequality&Quest." *European journal of clinical nutrition* 68(10):1101-06.
Hermann, Silke, Sabine Rohrmann, Jakob Linseisen, Anne M May, Anton Kunst, Herve Besson, Dora Romaguera, Noemie Travier, Maria-Jose Tormo and Esther Molina. 2011. "The Association of Education with Body Mass Index and Waist Circumference in the Epic-Panacea Study." *BMC Public Health* 11(1):169.
Holliday, Ruth and Joanna Elfving-Hwang. 2012. "Gender, Globalization and Aesthetic Surgery in South Korea." *Body & Society* 18(2):58-81.
Hubbard, Van S. 2000. "Defining Overweight and Obesity: What Are the Issues?". *The*

American journal of clinical nutrition 72(5):1067-68.
Hyun, Mi-Yeul, Young-Eun Jung, Moon-Doo Kim, Young-Sook Kwak, Sung-Chul Hong, Won-Myong Bahk, Bo-Hyun Yoon, Hye Won Yoon and Bora Yoo. 2014. "Factors Associated with Body Image Distortion in Korean Adolescents." *Neuropsychiatric disease and treatment* 10:797.
Iwamoto, Derek Kenji, Aylin Kaya, Margaux Grivel and Lauren Clinton. 2016. "Under-Researched Demographics: Heavy Episodic Drinking and Alcohol-Related Problems among Asian Americans." *Alcohol research: current reviews* 38(1):17.
Jeffery, Robert W, Susan A Adlis and Jean L Forster. 1991. "Prevalence of Dieting among Working Men and Women: The Healthy Worker Project." *Health Psychology* 10(4):274.
Joh, H-K, Juhwan Oh, H-J Lee and Ichiro Kawachi. 2013. "Gender and Socioeconomic Status in Relation to Weight Perception and Weight Control Behavior in Korean Adults." *Obesity facts* 6(1):17-27.
Joh, Hee-Kyung, Juhwan Oh, Hae-Jeung Lee and Ichiro Kawachi. 2012. "Gender and Socioeconomic Status in Relation to Weight Perception and Weight Control Behavior in Korean Adults." *Obesity facts* 6(1):17-27.
Kanter, Rebecca and Benjamin Caballero. 2012. "Global Gender Disparities in Obesity: A Review." *Advances in Nutrition: An International Review Journal* 3(4):491-98.
Kemptner, Daniel, Hendrik Jürges and Steffen Reinhold. 2011. "Changes in Compulsory Schooling and the Causal Effect of Education on Health: Evidence from Germany." *Journal of health economics* 30(2):340-54.
Khang, Young-Ho and Sung-Cheol Yun. 2010. "Trends in General and Abdominal Obesity among Korean Adults: Findings from 1998, 2001, 2005, and 2007 Korea National Health and Nutrition Examination Surveys." *Journal of Korean medical science* 25(11):1582-88.
Kim, Jihye, Shreela V Sharma and Sung Kyun Park. 2014. "Association between Socioeconomic Status and Obesity in Adults: Evidence from the 2001 to 2009 Korea National Health and Nutrition Examination Survey." *Journal of Preventive Medicine and Public Health* 47(2):94-103.
Kim, Soowon, Soojae Moon and Barry M Popkin. 2000. "The Nutrition Transition in South Korea." *The American journal of clinical nutrition* 71(1):44-53.
Koenker, Roger. 2005. *Quantile Regression*: Cambridge university press.
Lantz, Paula M, James S House, James M Lepkowski, David R Williams, Richard P Mero and Jieming Chen. 1998. "Socioeconomic Factors, Health Behaviors, and Mortality: Results from a Nationally Representative Prospective Study of Us Adults." *Jama* 279(21):1703-08.
Lee, Dong Wook, Hee Sun Park, Tai Sik Lee, Mi Kyoung Kim and Young Hyun Kim. 2007. "Functions of Social Gatherings Involving Alcohol Consumption with Coworkers in Korea." *Asian Journal of Communication* 17(3):266-85.
Lee, Jonathan C. 2005. "Guidelines for Effective Negotiations with Korean Managers: A Conceptual Analysis." *International Journal of Management* 22(1):11.
Lee, Soo-Kyung and Jeffery Sobal. 2003. "Socio-Economic, Dietary, Activity, Nutrition and Body Weight Transitions in South Korea." *Public health nutrition* 6(07):665-74.

McClintock, Elizabeth Aura. 2014. "Beauty and Status the Illusion of Exchange in Partner Selection?". *American sociological review*:0003122414536391.
McLaren, Lindsay and Diana Kuh. 2004. "Women's Body Dissatisfaction, Social Class, and Social Mobility." *Social Science & Medicine* 58(9):1575-84.
McLaren, Lindsay. 2007. "Socioeconomic Status and Obesity." *Epidemiologic reviews* 29(1):29-48.
Meyer, Caroline, Jackie Blissett and Claire Oldfield. 2001. "Sexual Orientation and Eating Psychopathology: The Role of Masculinity and Femininity." *International Journal of Eating Disorders* 29(3):314-18.
Mirowsky, John and Catherine E Ross. 2003. *Education, Social Status, and Health*: Transaction Publishers.
Mobius, Markus M and Tanya S Rosenblat. 2006. "Why Beauty Matters." *The American Economic Review*:222-35.
Molarius, Anu, Fredrik Granstrom, Inna Feldman, Marina Kalander Blomqvist, Helena Pettersson and Sirkka Elo. 2012. "Can Financial Insecurity and Condescending Treatment Explain the Higher Prevalence of Poor Self-Rated Health in Women Than in Men? A Population-Based Cross-Sectional Study in Sweden." *Int J Equity Health* 11:50.
Monteiro, Carlos A, Erly C Moura, Wolney L Conde and Barry M Popkin. 2004. "Socioeconomic Status and Obesity in Adult Populations of Developing Countries: A Review." *Bulletin of the World Health Organization* 82(12):940-46.
Mullahy, John and Stephanie A Robert. 2008. "No Time to Lose? Time Constraints and Physical Activity." Vol.: National Bureau of Economic Research.
Murnen, SK and R Seabrook. 2012. "Feminist Perspectives on Body Image and Physical Appearance." *Encyclopedia of body image and human appearance* 1:438-43.
Nissen, Nina Konstantin and Lotte Holm. 2015. "Literature Review: Perceptions and Management of Body Size among Normal Weight and Moderately Overweight People." *Obesity Reviews* 16(2):150-60.
Pampel, Fred C, Justin T Denney and Patrick M Krueger. 2012. "Obesity, Ses, and Economic Development: A Test of the Reversal Hypothesis." *Social Science & Medicine* 74(7):1073-81.
Park, Hyunjoon and James M Raymo. 2013. "Divorce in Korea: Trends and Educational Differentials." *Journal of Marriage and Family* 75(1):110-26.
Park, Hyunjoon and Jae Kyung Lee. 2014. "Growing Educational Differentials in the Retreat from Marriage among Korean Men."
Phelan, Jo C, Bruce G Link and Parisa Tehranifar. 2010. "Social Conditions as Fundamental Causes of Health Inequalities Theory, Evidence, and Policy Implications." *Journal of health and social behavior* 51(1 suppl):S28-S40.
Philipson, Tomas J and Richard A Posner. 2008. "Is the Obesity Epidemic a Public Health Problem? A Review of Zoltan J. Acs and Alan Lyles's" Obesity, Business and Public Policy"." *Journal of Economic Literature*:974-82.
Popkin, Barry M and Penny Gordon-Larsen. 2004. "The Nutrition Transition: Worldwide Obesity Dynamics and Their Determinants." *International journal of obesity* 28:S2-S9.
Popkin, Barry M. 2006. "Global Nutrition Dynamics: The World Is Shifting Rapidly

toward a Diet Linked with Noncommunicable Diseases." *The American journal of clinical nutrition* 84(2):289-98.
Powell, Lisa M, Sandy Slater, Frank J Chaloupka and Deborah Harper. 2006. "Availability of Physical Activity-Related Facilities and Neighborhood Demographic and Socioeconomic Characteristics: A National Study." *American Journal of Public Health* 96(9):1676-80.
Power, Michael L and Jay Schulkin. 2008. "Sex Differences in Fat Storage, Fat Metabolism, and the Health Risks from Obesity: Possible Evolutionary Origins." *British Journal of Nutrition* 99(05):931-40.
Puhl, Rebecca M and Chelsea A Heuer. 2009. "The Stigma of Obesity: A Review and Update." *Obesity* 17(5):941-64.
Read, Jen'nan Ghazal and Bridget K Gorman. 2010. "Gender and Health Inequality." *Annual Review of Sociology* 36:371-86.
Ross, Catherine E and Chia-ling Wu. 1995. "The Links between Education and Health." *American sociological review*:719-45.
Ross, Catherine E and John Mirowsky. 2006. "Sex Differences in the Effect of Education on Depression: Resource Multiplication or Resource Substitution?". *Social Science & Medicine* 63(5):1400-13.
Sayer, Liana C. 2005. "Gender, Time and Inequality: Trends in Women's and Men's Paid Work, Unpaid Work and Free Time." *Social Forces* 84(1):285-303.
Snijder, MB, RM Van Dam, M Visser and JC Seidell. 2006. "What Aspects of Body Fat Are Particularly Hazardous and How Do We Measure Them?". *International Journal of epidemiology* 35(1):83-92.
Sobal, Jeffery. 2001. "Social and Cultural Influences on Obesity." *International textbook of obesity*:305-22.
Villareal, Dennis T, Caroline M Apovian, Robert F Kushner and Samuel Klein. 2005. "Obesity in Older Adults: Technical Review and Position Statement of the American Society for Nutrition and Naaso, the Obesity Society." *Obesity research* 13(11):1849-63.
Wardle, Jane and J Griffith. 2001. "Socioeconomic Status and Weight Control Practices in British Adults." *Journal of epidemiology and community health* 55(3):185-90.
Wardle, Jane, Jo Waller and Martin J Jarvis. 2002. "Sex Differences in the Association of Socioeconomic Status with Obesity." *American Journal of Public Health* 92(8):1299-304.
Wells, Jonathan CK, Akanksha A Marphatia, Tim J Cole and David McCoy. 2012. "Associations of Economic and Gender Inequality with Global Obesity Prevalence: Understanding the Female Excess." *Social Science & Medicine* 75(3):482-90.
WHO, Expert Consultation. 2004. "Appropriate Body-Mass Index for Asian Populations and Its Implications for Policy and Intervention Strategies." *Lancet* 363(9403):157.
Williams, Lauren, John Germov and Anne Young. 2011. "The Effect of Social Class on Mid-Age Women's Weight Control Practices and Weight Gain| Nova. The University of Newcastle's Digital Repository."
Won, Sook-yeon. 2006. "Who Cares? Political Motherhood and Its Gendered

Implications in Korea."
Yeh, Hsiu-Jen. 2015. "Job Demands, Job Resources, and Job Satisfaction in East Asia." *Social indicators research* 121(1):47-60.
Yoo, Sunmi, Hong-Jun Cho and Young-Ho Khang. 2010. "General and Abdominal Obesity in South Korea, 1998–2007: Gender and Socioeconomic Differences." *Preventive medicine* 51(6):460-65.
Yoon, Kun-Ho, Jin-Hee Lee, Ji-Won Kim, Jae Hyoung Cho, Yoon-Hee Choi, Seung-Hyun Ko, Paul Zimmet and Ho-Young Son. 2006. "Epidemic Obesity and Type 2 Diabetes in Asia." *The Lancet* 368(9548):1681-88.
Yoon, Yeong Sook, Sang Woo Oh and Hye Soon Park. 2006. "Socioeconomic Status in Relation to Obesity and Abdominal Obesity in Korean Adults: A Focus on Sex Differences." *Obesity* 14(5):909-19.
Zhang, Qi and Youfa Wang. 2004. "Socioeconomic Inequality of Obesity in the United States: Do Gender, Age, and Ethnicity Matter?". *Social Science & Medicine* 58(6):1171-80.

Chapter 2

Allison, Paul D. 2010. *Survival Analysis Using Sas: A Practical Guide*: Sas Institute.

Baek, Sun-Hee, Eunsoo Sung and Sung Hee Lee. 2011. "The Current Coordinates of the Korean Care Regime." *Journal of Comparative Social Welfare* 27(2):143-54.

Bloom, David E, David Canning and Jocelyn E Finlay. 2010. "Population Aging and Economic Growth in Asia." Pp. 61-89 in *The Economic Consequences of Demographic Change in East Asia, Nber-Ease Volume 19*: University of Chicago Press.

Bonsang, Eric. 2007. "How Do Middle-Aged Children Allocate Time and Money Transfers to Their Older Parents in Europe?". *Empirica* 34(2):171-88.

Brinton, Mary C. 2001. *Women's Working Lives in East Asia*: Stanford University Press.

Butcher, Kristin F and Anne Case. 1994. "The Effect of Sibling Sex Composition on Women's Education and Earnings." *The Quarterly Journal of Economics*:531-63.

Cohen, Sheldon, Denise Janicki-Deverts, Edith Chen and Karen A Matthews. 2010. "Childhood Socioeconomic Status and Adult Health." *Annals of the New York Academy of Sciences* 1186(1):37-55.

Deindl, Christian and Martina Brandt. 2011. "Financial Support and Practical Help between Older Parents and Their Middle-Aged Children in Europe." *Ageing and Society* 31(04):645-62.

Fingerman, Karen L. 2003. *Mothers and Their Adult Daughters: Mixed Emotions, Enduring Bonds*: Prometheus Books.

Frankenberg, Elizabeth, Lee Lillard and Robert J Willis. 2002. "Patterns of Intergenerational Transfers in Southeast Asia." *Journal of Marriage and Family* 64(3):627-41.

Friedman, Esther M and Robert D Mare. 2014. "The Schooling of Offspring and the Survival of Parents." *Demography* 51(4):1271-93.

Hayward, Mark D, Robert A Hummer and Isaac Sasson. 2015. "Trends and Group Differences in the Association between Educational Attainment and Us Adult Mortality: Implications for Understanding Education's Causal Influence." *Social Science & Medicine* 127:8-18.

Hermalin, Albert I. 1997. "Drawing Policy Lessons for Asia from Research on Ageing." *Asia-Pacific Population Journal* 12(4):89-102.

House, James S, James M Lepkowski, Ann M Kinney, Richard P Mero, Ronald C Kessler and A Regula Herzog. 1994. "The Social Stratification of Aging and Health." *Journal of health and social behavior*:213-34.

Ikkink, Karen Klein, Theo Van Tilburg and Kees CPM Knipscheer. 1999. "Perceived Instrumental Support Exchanges in Relationships between Elderly Parents and Their Adult Children: Normative and Structural Explanations." *Journal of Marriage and the Family*:831-44.

Jeon, Gyeong-Suk, Soong-Nang Jang, Dong-Sik Kim and Sung-Il Cho. 2013. "Widowhood and Depressive Symptoms among Korean Elders: The Role of Social Ties." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 68(6):963-73.

Kalmijn, Matthijs. 2006. "Educational Inequality and Family Relationships: Influences on Contact and Proximity." *European sociological review* 22(1):1-16.
Kim, Erin Hye-Won. 2015. "Public Transfers and Living Alone among the Elderly: A Case Study of Korea's New Income Support Program." *Demographic Research* 32:1383-408.
Kim, Hisam. 2010. "Intergenerational Transfers and Old-Age Security in Korea." Pp. 227-78 in *The Economic Consequences of Demographic Change in East Asia, Nber-Ease Volume 19*: University of Chicago Press.
Lee, Yean-Ju, William L Parish and Robert J Willis. 1994. "Sons, Daughters, and Intergenerational Support in Taiwan." *American Journal of Sociology*:1010-41.
Osler, Merete, Anne-Marie Nybo Andersen, Rikke Lund and Bjørn Holstein. 2005. "Effect of Grandparent's and Parent's Socioeconomic Position on Mortality among Danish Men Born in 1953." *The European Journal of Public Health* 15(6):647-51.
Park, Cheolsung and Changhui Kang. 2008. "Does Education Induce Healthy Lifestyle?". *Journal of health economics* 27(6):1516-31.
Park, Hong-Jae. 2015. "Legislating for Filial Piety: An Indirect Approach to Promoting Family Support and Responsibility for Older People in Korea." *Journal of aging & social policy* (just-accepted).
Park, Hyunjoon. 2007a. "South Korea: Educational Expansion and Inequality of Opportunity for Higher Education." *Stratification in higher education: A comparative study*:87-112.
Park, Hyunjoon. 2007b. "South Korea: Educational Expansion and Inequality of Opportunity in Higher Education."
Park, Hyunjoon and James M Raymo. 2013. "Divorce in Korea: Trends and Educational Differentials." *Journal of Marriage and Family* 75(1):110-26.
Park, Hyunjoon and Jae Kyung Lee. 2014. "Growing Educational Differentials in the Retreat from Marriage among Korean Men."
Rhee, Jong Chul, Nicolae Done and Gerard F Anderson. 2015. "Considering Long-Term Care Insurance for Middle-Income Countries: Comparing South Korea with Japan and Germany." *Health Policy*.
Sandefur, Gary D and Hyunjoon Park. 2007. "Educational Expansion and Changes in Occupational Returns to Education in Korea." *Research in Social Stratification and Mobility* 25(4):306-22.
Silverstein, Merril, Stephen J Conroy, Haitao Wang, Roseann Giarrusso and Vern L Bengtson. 2002. "Reciprocity in Parent–Child Relations over the Adult Life Course." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 57(1):S3-S13.
Silverstein, Merril, Daphna Gans and Frances M Yang. 2006. "Intergenerational Support to Aging Parents the Role of Norms and Needs." *Journal of Family Issues* 27(8):1068-84.
Sloan, Frank A, Harold H Zhang and Jingshu Wang. 2002. "Upstream Intergenerational Transfers." *Southern Economic Journal*:363-80.
Takagi, Emiko and Merril Silverstein. 2006. "Intergenerational Coresidence of the Japanese Elderly Are Cultural Norms Proactive or Reactive?". *Research on Aging* 28(4):473-92.

Torssander, Jenny. 2013. "From Child to Parent? The Significance of Children's Education for Their Parents' Longevity." *Demography* 50(2):637-59.

Torssander, Jenny. 2014. "Adult Children's Socioeconomic Positions and Their Parents' Mortality: A Comparison of Education, Occupational Class, and Income." *Social Science & Medicine* 122:148-56.

Won, Sook-yeon. 2006. "Who Cares? Political Motherhood and Its Gendered Implications in Korea."

Wong, Rebeca and Deborah S DeGraff. 2009. "Old-Age Wealth in Mexico: The Role of Reproductive, Human Capital, and Employment Decisions." *Research on Aging*.

Yang, Seungmi, Young-Ho Khang, Heeran Chun, Sam Harper and John Lynch. 2012. "The Changing Gender Differences in Life Expectancy in Korea 1970–2005." *Social Science & Medicine* 75(7):1280-87.

Yoon, Hyun-Sook. 2013. "Korea: Balancing Economic Growth and Social Protection for Older Adults." *The Gerontologist*:gnt018.

Zimmer, Zachary, Albert I Hermalin and Hui-Sheng Lin. 2002. "Whose Education Counts? The Added Impact of Adult-Child Education on Physical Functioning of Older Taiwanese." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 57(1):S23-S32.

Zimmer, Zachary, Linda G Martin, Mary Beth Ofstedal and Yi-Li Chuang. 2007. "Education of Adult Children and Mortality of Their Elderly Parents in Taiwan." *Demography* 44(2):289-305.

Chapter 3

Allison, Paul D. 2009. *Fixed Effects Regression Models*, Vol. 160: SAGE publications.

Allmendinger, Jutta. 1989. "Educational Systems and Labor Market Outcomes." *European sociological review* 5(3):231-50.

Anderson, Gerard F and Bianca K Frogner. 2008. "Health Spending in Oecd Countries: Obtaining Value Per Dollar." *Health Affairs* 27(6):1718-27.

Andrus, Miranda R and Mary T Roth. 2002. "Health Literacy: A Review." *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy* 22(3):282-302.

Baker, David P, Juan Leon, Emily G Smith Greenaway, John Collins and Marcela Movit. 2011. "The Education Effect on Population Health: A Reassessment." *Population and Development Review* 37(2):307-32.

Baker, David W, Julie A Gazmararian, Mark V Williams, Tracy Scott, Ruth M Parker, Diane Green, Junling Ren and Jennifer Peel. 2002. "Functional Health Literacy and the Risk of Hospital Admission among Medicare Managed Care Enrollees." *American Journal of Public Health* 92(8):1278-83.

Berger, Mark C and Jodi Messer. 2002. "Public Financing of Health Expenditures, Insurance, and Health Outcomes." *Applied Economics* 34(17):2105-13.

Berkman, Nancy D, Terry C Davis and Lauren McCormack. 2010. "Health Literacy: What Is It?". *Journal of Health Communication* 15(S2):9-19.

Berkman, Nancy D, Stacey L Sheridan, Katrina E Donahue, David J Halpern and Karen Crotty. 2011. "Low Health Literacy and Health Outcomes: An Updated Systematic Review." *Annals of internal medicine* 155(2):97-107.

Bidani, Benu and Martin Ravallion. 1997. "Decomposing Social Indicators Using Distributional Data." *Journal of econometrics* 77(1):125-39.

Bol, Thijs, Jacqueline Witschge, Herman G Van de Werfhorst and Jaap Dronkers. 2014. "Curricular Tracking and Central Examinations: Counterbalancing the Impact of Social Background on Student Achievement in 36 Countries." *Social Forces*:sou003.

Bostock, Sophie and Andrew Steptoe. 2012. "Association between Low Functional Health Literacy and Mortality in Older Adults: Longitudinal Cohort Study." *Bmj* 344:e1602.

Bradley, Elizabeth H, Benjamin R Elkins, Jeph Herrin and Brian Elbel. 2011. "Health and Social Services Expenditures: Associations with Health Outcomes." *BMJ quality & safety*:bmjqs. 2010.048363.

Breen, Richard, Ruud Luijkx, Walter Müller and Reinhard Pollak. 2009. "Nonpersistent Inequality in Educational Attainment: Evidence from Eight European Countries1." *American Journal of Sociology* 114(5):1475-521.

Cho, Young Ik, Shoou-Yih D Lee, Ahsan M Arozullah and Kathleen S Crittenden. 2008. "Effects of Health Literacy on Health Status and Health Service Utilization Amongst the Elderly." *Social Science & Medicine* 66(8):1809-16.

Co-operation, Organisation for Economic and Development. 2013. *Oecd Skills Outlook 2013: First Results from the Survey of Adult Skills*: OECD, Paris, France.

Dahlgren, Göran and Margaret Whitehead. 2007. "A Framework for Assessing Health Systems from the Public's Perspective: The Alps Approach." *International Journal of Health Services* 37(2):363-78.

DeWalt, Darren A and Ashley Hink. 2009. "Health Literacy and Child Health Outcomes: A Systematic Review of the Literature." *Pediatrics* 124(Supplement 3):S265-S74.

Dutta-Bergman, Mohan J. 2004. "Primary Sources of Health Information: Comparisons in the Domain of Health Attitudes, Health Cognitions, and Health Behaviors." *Health communication* 16(3):273-88.

Escobar, Maria-Luisa, Charles C Griffin and R Paul Shaw. 2011. *The Impact of Health Insurance in Low-and Middle-Income Countries*: Brookings Institution Press.

Farahani, Mansour, SV Subramanian and David Canning. 2010. "Effects of State-Level Public Spending on Health on the Mortality Probability in India." *Health economics* 19(11):1361-76.

Ferguson, Laurie Anne and Roberta Pawlak. 2011. "Health Literacy: The Road to Improved Health Outcomes." *The Journal for Nurse Practitioners* 7(2):123-29.

Franzen, Jasmin, Sarah Mantwill, Roland Rapold and Peter J Schulz. 2014. "The Relationship between Functional Health Literacy and the Use of the Health System by Diabetics in Switzerland." *The European Journal of Public Health* 24(6):997-1003.

Galletly, Cherrie, Aaron Neaves, Cassandra Burton, Dennis Liu and Linley A Denson. 2012. "Evaluating Health Literacy in People with Mental Illness Using the Test of Functional Health Literacy in Adults." *Nursing outlook* 60(5):316-21.

Gamoran, Adam. 1996. "Curriculum Standardization and Equality of Opportunity in Scottish Secondary Education: 1984-90." *Sociology of Education*:1-21.

Gazmararian, Julie A, Sunil Kripalani, Michael J Miller, Katharina V Echt, Junling Ren and Kimberly Rask. 2006. "Factors Associated with Medication Refill Adherence in Cardiovascular-Related Diseases: A Focus on Health Literacy." *Journal of General Internal Medicine* 21(12):1215-21.

Gupta, Sanjeev, Marijn Verhoeven and Erwin R Tiongson. 2003. "Public Spending on Health Care and the Poor." *Health economics* 12(8):685-96.

Hayward, Mark D, Robert A Hummer and Isaac Sasson. 2015. "Trends and Group Differences in the Association between Educational Attainment and Us Adult Mortality: Implications for Understanding Education's Causal Influence." *Social Science & Medicine* 127:8-18.

Horn, Daniel. 2009. "Age of Selection Counts: A Cross-Country Analysis of Educational Institutions." *Educational research and evaluation* 15(4):343-66.

Huisman, Martijn, Anton E Kunst and Johan P Mackenbach. 2003. "Socioeconomic Inequalities in Morbidity among the Elderly; a European Overview." *Social Science & Medicine* 57(5):861-73.

Idler, Ellen L and Yael Benyamini. 1997. "Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies." *Journal of health and social behavior*:21-37.

Ishikawa, Hirono, Takeaki Takeuchi and Eiji Yano. 2008. "Measuring Functional, Communicative, and Critical Health Literacy among Diabetic Patients." *Diabetes care* 31(5):874-79.

Ishikawa, Hirono and Eiji Yano. 2008. "Patient Health Literacy and Participation in the

Health-Care Process." *Health Expectations* 11(2):113-22.
Jylhä, Marja, Jack M Guralnik, Luigi Ferrucci, Jukka Jokela and Eino Heikkinen. 1998. "Is Self-Rated Health Comparable across Cultures and Genders?". *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 53(3):S144-S52.
Jylhä, Marja. 2009. "What Is Self-Rated Health and Why Does It Predict Mortality? Towards a Unified Conceptual Model." *Social Science & Medicine* 69(3):307-16.
Layte, Richard and Christopher Whelan. 2003. "Moving in and out of Poverty." *European Societies* 5(2):167-91.
Levy, Helen and Alex Janke. 2016. "Health Literacy and Access to Care." *Journal of Health Communication* 21(sup1):43-50.
Lincoln, Alisa, Michael K Paasche-Orlow, Debbie M Cheng, Christine Lloyd-Travaglini, Christine Caruso, Richard Saitz and Jeffrey H Samet. 2006. "Impact of Health Literacy on Depressive Symptoms and Mental Health-Related: Quality of Life among Adults with Addiction." *Journal of General Internal Medicine* 21(8):818-22.
Macdonald, S, U Macleod, NC Campbell, D Weller and E Mitchell. 2006. "Systematic Review of Factors Influencing Patient and Practitioner Delay in Diagnosis of Upper Gastrointestinal Cancer." *British journal of cancer* 94(9):1272-80.
Mancuso, Carol A and Melina Rincon. 2006. "Asthma Patients' Assessments of Health Care and Medical Decision Making: The Role of Health Literacy." *Journal of Asthma* 43(1):41-44.
Martin, Stephen, Nigel Rice and Peter C Smith. 2008. "Does Health Care Spending Improve Health Outcomes? Evidence from English Programme Budgeting Data." *Journal of health economics* 27(4):826-42.
Moon, Graham, Grant Aitken, Paul Roderick, Simon Fraser and Gill Rowlands. 2015. "Towards an Understanding of the Relationship of Functional Literacy and Numeracy to Geographical Health Inequalities." *Social Science & Medicine* 143:185-93.
Ngoh, Lucy Nkukuma. 2009. "Health Literacy: A Barrier to Pharmacist-Patient Communication and Medication Adherence." *Pharmacy today* 15(8):45-57.
Nielsen-Bohlman, LT, AM Panzer, B Hamlin and DA Kindig. 2004. "Institute of Medicine. Health Literacy: A Prescription to End Confusion. Committee on Health Literacy, Board on Neuroscience and Behavioral Health." Washington, DC: National Academies Press.
Nutbeam, Don. 2000. "Health Literacy as a Public Health Goal: A Challenge for Contemporary Health Education and Communication Strategies into the 21st Century." *Health Promotion International* 15(3):259-67.
Paasche-Orlow, Michael K and Michael S Wolf. 2007. "The Causal Pathways Linking Health Literacy to Health Outcomes." *American journal of health behavior* 31(Supplement 1):S19-S26.
Park, Hyunjoon. 2008. "The Varied Educational Effects of Parent-Child Communication: A Comparative Study of Fourteen Countries." *Comparative Education Review* 52(2):219-43.
Park, Hyunjoon and Pearl Kyei. 2011. "Literacy Gaps by Educational Attainment: A

Cross-National Analysis." *Social Forces* 89(3):879-904.
Parker, Ruth. 2000. "Health Literacy: A Challenge for American Patients and Their Health Care Providers." *Health Promotion International* 15(4):277-83.
Parker, Ruth M, David W Baker, Mark V Williams and Joanne R Nurss. 1995. "The Test of Functional Health Literacy in Adults." *Journal of General Internal Medicine* 10(10):537-41.
Petticrew, Mark, Margaret Whitehead, Sally J Macintyre, Hilary Graham and Matt Egan. 2004. "Evidence for Public Health Policy on Inequalities: 1: The Reality According to Policymakers." *Journal of epidemiology and community health* 58(10):811-16.
Quesnel–Vallée, Amélie. 2007. "Self-Rated Health: Caught in the Crossfire of the Quest for 'True'health?". *International Journal of epidemiology* 36(6):1161-64.
Reed, Erin J and Brian Rowan. 2013. "A New Viewpoint on the Relationship between Decentralization and Education Inequality."
Sørensen, Kristine, Stephan Van den Broucke, James Fullam, Gerardine Doyle, Jürgen Pelikan, Zofia Slonska and Helmut Brand. 2012. "Health Literacy and Public Health: A Systematic Review and Integration of Definitions and Models." *BMC Public Health* 12(1):1.
Sørensen, Kristine, Jürgen M Pelikan, Florian Röthlin, Kristin Ganahl, Zofia Slonska, Gerardine Doyle, James Fullam, Barbara Kondilis, Demosthenes Agrafiotis and Ellen Uiters. 2015. "Health Literacy in Europe: Comparative Results of the European Health Literacy Survey (Hls-Eu)." *The European Journal of Public Health*:ckv043.
Schillinger, Dean, John Piette, Kevin Grumbach, Frances Wang, Clifford Wilson, Carolyn Daher, Krishelle Leong-Grotz, Cesar Castro and Andrew B Bindman. 2003. "Closing the Loop: Physician Communication with Diabetic Patients Who Have Low Health Literacy." *Archives of internal medicine* 163(1):83-90.
Scott, Tracy L, Julie A Gazmararian, Mark V Williams and David W Baker. 2002. "Health Literacy and Preventive Health Care Use among Medicare Enrollees in a Managed Care Organization." *Medical care* 40(5):395-404.
Sellar, Sam and Bob Lingard. 2013. *Pisa and the Expanding Role of the Oecd in Global Educational Governance*: Oxford: Symposium Books.
Shavit, Yossi and Walter Muller. 1998. *From School to Work. A Comparative Study of Educational Qualifications and Occupational Destinations*: ERIC.
Silventoinen, Karri and Eero Lahelma. 2002. "Health Inequalities by Education and Age in Four Nordic Countries, 1986 and 1994." *Journal of epidemiology and community health* 56(4):253-58.
Smith-Greenaway, Emily. 2015. "Are Literacy Skills Associated with Young Adults' Health in Africa? Evidence from Malawi." *Social Science & Medicine* 127:124-33.
St Leger, Lawrence. 2001. "Schools, Health Literacy and Public Health: Possibilities and Challenges." *Health Promotion International* 16(2):197-205.
Sudore, Rebecca L, Kala M Mehta, Eleanor M Simonsick, Tamara B Harris, Anne B Newman, Suzanne Satterfield, Caterina Rosano, Ronica N Rooks, Susan M Rubin and Hilsa N Ayonayon. 2006. "Limited Literacy in Older People and Disparities in Health and Healthcare Access." *Journal of the American Geriatrics Society*

54(5):770-76.
Suka, Machi, Takeshi Odajima, Masako Okamoto, Masahiko Sumitani, Ataru Igarashi, Hirono Ishikawa, Makiko Kusama, Michiko Yamamoto, Takeo Nakayama and Hiroki Sugimori. 2015. "Relationship between Health Literacy, Health Information Access, Health Behavior, and Health Status in Japanese People." *Patient education and counseling* 98(5):660-68.
Terraneo, Marco. 2015. "Inequities in Health Care Utilization by People Aged 50+: Evidence from 12 European Countries." *Social Science & Medicine* 126:154-63.
Van de Werfhorst, Herman G and Jonathan JB Mijs. 2010. "Achievement Inequality and the Institutional Structure of Educational Systems: A Comparative Perspective." *Annual Review of Sociology* 36:407-28.
Van de Werfhorst, Herman G. 2011. "Skill and Education Effects on Earnings in 18 Countries: The Role of National Educational Institutions." *Social Science Research* 40(4):1078-90.
van der Heide, Iris, Jen Wang, Mariël Droomers, Peter Spreeuwenberg, Jany Rademakers and Ellen Uiters. 2013. "The Relationship between Health, Education, and Health Literacy: Results from the Dutch Adult Literacy and Life Skills Survey." *Journal of Health Communication* 18(sup1):172-84.
Von Wagner, Christian, Claudia Semmler, Anna Good and Jane Wardle. 2009. "Health Literacy and Self-Efficacy for Participating in Colorectal Cancer Screening: The Role of Information Processing." *Patient education and counseling* 75(3):352-57.
Wagner, Donna L and Kelly J Niles. 2005. *Looking into the Future of Family Caregiving in the Us: Proceedings from a White House Conference on Aging Mini-Conference; Convened June 15, 2005*: Metlife Incorporated.
Wolf, Michael S, Terry C Davis, Chandra Y Osborn, Silvia Skripkauskas, Charles L Bennett and Gregory Makoul. 2007. "Literacy, Self-Efficacy, and Hiv Medication Adherence." *Patient education and counseling* 65(2):253-60.
Yamamoto, Kentaro, Lale Khorramdel and M von Davier. 2013. "Scaling Piaac Cognitive Data." *Technical report of the survey of adult skills (PIAAC). Paris, France: OECD*.