Education and Subjective Health in the Changing Society of Taiwan

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The association between education and health is rarely studied in the non-Western societies experiencing rapid social change. Drawing on data from the 1995 and 2000 Taiwan Social Change Survey (3,762 respondents, ages 20 to 75), this research establishes the basic understanding of this phenomenon in Taiwan. First of all, this study identifies that education significantly associates with subjective health in Taiwan. Subsequently, this study ascertains the generalizability of three theoretical pathways between education and health. The work and economic pathway is empirically supported. Self-employment demonstrates notably effects. The interpersonal and social-psychological pathway does not mediate educational effects on health. The human capital pathway is partly supported. Finally, this research manifests that education-health patterns vary across four birth cohorts with distinct opportunity structure of education (the 1920-40, the 1941-55, the 1956-66, and the 1967-79 birth cohort). Educational effects on health are more salient within the older birth cohorts. The plausible reasons may be attributed to cohort effects or aging effects.

Keywords: Taiwan, Education, Subjective Health, Opportunity Structure of Education, Birth Cohorts

Introduction

The beneficial impacts of education on various health-related outcomes such as subjective health, psychological distress, chronic disease, physical impairment, and mortality have been clearly demonstrated by an abundance of empirical studies in the United States. Researchers have elaborated that education fosters health by improving work and economic conditions, developing stable interpersonal and social-psychological resources, and providing individuals with internal human capital to control and enable health behaviors (Elo and Preston 1996; House 2001; Link and Phelan 1995; Mirowsky and Ross 1998, 2003a; Pappas et al. 1993; Ross and Mirowsky 1999; Ross and Van Willigen 1997; Ross and Wu 1995, 1996; Williams 1990). Although the patterns and pathways between education and health have been well established in the U.S., much less is known about these relationships in a newly industrialized Asian society such as Taiwan. Exploring the education-health patterns to Taiwan is hence an essential way to broaden the knowledge of health studies. More importantly, it establishes the basic understandings of social causes of health in Taiwan.

Three core research themes are designed. First, this research intends to clarify whether education positively and significantly associates with health in Taiwan. Education has been deeply accredited as the most equitable and efficient way to improve upward social mobility for Taiwanese people ever since their settled ancestors established schools and implemented the imperial examination system in 1666 (Hsu 1990; Tsurumi 1977). Taiwanese people pursue education intensely. Moreover, the well-educated ones usually acquire highly ranked occupations or elevated social prestige. Nevertheless, most Taiwanese scholars and citizens mainly focus on the positive effects of education on social hierarchy. Little attention has been given to whether education fosters health (Beckett et al. 2002; Hsieh and Lin 1997; Liu et al. 1998; Tung and Mutran 2005; Zimmer et al. 2002; Zimmer et al. 1998). Accordingly, the education-health relationship is worthwhile to be systematically examined. If education positively correlates to health in Taiwan after adjusting socio-demographic characteristics and other mediating factors, then it will demonstrate the influence of social factors on health in Taiwan and reinforce

the argument that modern education is the fundamental cause for one's health whatever social or cultural backgrounds to which she or he belongs.

Subsequently, this research reconsiders whether the education-health pathways derived from Western societies extend to the Taiwanese population, including the work and economic pathway, the interpersonal and social-psychological pathway, and the human capital pathway. With consideration of the distinctive economic development and cultural background in Taiwan, three intervening links are specially noticed. First of all, self-employment is highly pervasive in Taiwan (Shieh 1992, 1997) and possibly provides particular impacts on health because of its health-promoting work characteristics: high level of autonomy and creativity at work. Next, social support is barely viewed as the link between education and health. Due to the family-orientated culture, providing social support is an obligated behavior or an unquestionable norm regardless of educational levels. Third, the sense of control, the individualistic belief that one can control or alter one's own outcome, may not be a primary health determinant in a collectivist society such as Taiwan (Sastry and Ross 1998).

The third objective of this research intends to reevaluate the education-health association and its explanations by considering rapid social change in Taiwan. Over the last century, Taiwan has undergone dramatic economic development, rapid educational transformation, numerous political regime substitutions, and speedy demographic transition. For instance, in socioeconomic terms, the per capita gross national product (GNP)[1] has been increased from 443 USD to 14,118 USD between 1970 and 2000. And in demographic aspects, life expectancy has increased from 51 years to 74 years between 1949 and 1988 (Hermalin et al. 1994). Such rapid and extensive social transformations may led to differences in the educational impacts on health across birth cohorts that represent diverse educational backgrounds and social circumstances. This research hence investigates the education-health association and three theoretical pathways on four successive birth cohorts with dissimilar "opportunity structures of education"[2], including those born before 1940, between 1941 and 1955, between 1956 and 1966, and after 1967.

[1] The GNP statistics are cited from the website of Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.

This strategy provides an opportunity to ascertain the universality of education-health association in the changing society and to identify whether different components of pathways confer dissimilar health benefits across birth cohorts.

Literature Review

(1) EDUCATION ACCOMPANIES HEALTH: EVIDENCE IN THE U.S. AND TAIWAN

Education is the most stable SES (socioeconomic status) predictor of higher levels of subjective health, physical functioning, and active life expectancy, and lower levels of chronic diseases, psychological distress, and mortality (Beckett 2000; Blau and Duncan 2000; Elo and Preston 1996; Liu et al. 1998; Mirowsky and Ross 2003a; Williams and Collins 1995; Winkleby et al. 1992; Zimmer et al. 1998). More importantly, the well educated tend to utilize resources to postpone the occurrence of health problems. Education increases health-enhancing resources that accumulate throughout the life course, which produce more inequality in health among older generations than younger ones (Beckett 2000; House et al. 1990; House et al. 1994; Lauderdale 2001; Mustard et al. 1997; Ross and Wu 1996; Rowe and Kahn 1997). Rowe and Kahn (1997) even indicate that education is a crucial indicator of successful aging, which is a combination of low probability of disease and disability, high cognitive and physical functional capacity, and active engagement with interpersonal relations and productive activities. Furthermore, "the social causation hypothesis", which argues that better SES (including education) nourishes good health, has been substantially supported (House 2001; House et al. 1990; House et al. 1994; Link et al. 1993; Link and Phelan 1995; Mirowsky and Ross 2003b; Mulatu and Schooler 2002; Ross and Wu 1995; Williams 1990; Williams and Collins 1995; Winkleby et al. 1992). Some scholars thus argue social conditions as the fundamental cause of the inequality in health (Link and Phelan 1995).

Although the relationship between education and health is rarely investigated in Taiwan, a few empirical studies have utilized *The Survey of Health and Living Status of*

[2] The concept of "opportunity structure of education" is further discussed.

the Elderly in Taiwan to elaborate the beneficial influences of education on various health domains of Taiwanese elders. First of all, research has indicated that higher education is the primary means of preventing morbidity and delaying the onset of disability (Tung and Mutran 2005; Zimmer et al. 2004; Zimmer et al. 1998). The elder's own education also associates with the existence of functional limitations and those with the well-educated adult children are less likely to have serious limitations (Zimmer et al. 2002). Furthermore, education not only predicts the current self-rated health of elders but also prevents the adverse transitions of health over time (Tung and Mutran 2005). Third, education correlates to lower relative risks of dying (Beckett et al. 2002). Research has clarified that the 83% total effects of education on mortality are conveyed through health status such as self-rated health and functional status, social relationships such as emotional support and social participation, and health behaviors such as smoking and drinking (Liu et al.1998). Fourth, Hsieh and Lin (1997) have indicated that the well-educated elders have more ability in acquiring health information that increases the application of preventative health care.

(2) CONCEPTUAL FRAMEWORK: HOW EDUCATION FOSTERS HEALTH?

Several prominent studies (House 2001; Mirowsky and Ross 1998; Ross and Van Willigen 1997; Ross and Wu 1995; Williams 1990; Winkleby et al. 1992) have established the work and economic pathway, the interpersonal and social-psychological pathway, and the human capital pathway to explain the extensive education-health associations. These links mediate the consequential parts of the association. Moreover, these mediators themselves demonstrate more important effects on health than medical care and health check-ups (Ross and Wu 1995; Williams 1990).

1. The Work and Economic Pathway

Education determines income, employment, and work in the modern society (Blau and Duncan 2000). First, income is one of the most important links between education and health (Elo and Preston 1996; Lantz et al. 1998). The impacts of income on health are the greatest among persons who have the lowest amounts of income and who deeply

suffer from economic hardship such as having difficulty in paying bills or purchasing goods and services that a household needs (Williams and Collins 1995). Moreover, a lack of education and economic hardship usually amplify each other. The poorly educated are commonly unable to minimize or decelerate the adverse impacts of economic deprivation. In contrast, the well educated are generally able to find substitution resources to make their economic difficulty less damaging and less harmful (Mirowsky and Ross 2003a).

Second, employment connects education and health. Persons who are full-time employed are healthier than persons who are unemployed, retired, or housewives (Kasl and Jones 2000; Ross and Mirowsky 1995). Employment improves physical and mental health by improving economic independence and the sense of control; while unemployment tends to cause economic hardship and erode the sense of control, both of which are correlated to poor health (Link et al. 1993; Ross and Bird 1994; Ross and Mirowsky 1992, 1995). In addition, the impacts of employment on health are contingent on the autonomy and creativity at work. Autonomous work enables workers to decide their own actions and plans. Creative work provides employees opportunities to challenge their mind and develop imagination. Both of them make work a productive accomplishment with sense of fulfillment, which ultimately leads to higher sense of control and better psychological well-being (Mirowsky and Ross 2003a, 2003b; Ross and Mirowsky 1992). Nevertheless, housewife is a distinct working activity that simultaneously involves high autonomy and low creativity resulted from routine work. The impacts of keeping house on health and the sense of control are probably inconclusive (Bird and Ross 1993; Lennon 1994).

2. The Interpersonal and Socio-Psychological Pathway

Education enhances health by increasing the likelihood of supportive marriage and interpersonal relationships, and by decreasing the adverse effect resulted from negative interactions. First of all, the well educated are more likely to be married and less likely to be divorced, widowed, or remarried. The well educated also tend to have more supportive and satisfying marriage because they commonly marry later in adulthood

under more stable economic conditions and have better cognitive capacities to understand and negotiate with their mates adequately when facing marital risks (Mirowsky and Ross 2003a; Ross and Van Willigen 1997). The beneficial effects of marriage on health are attributed to several reasons. Marriage increases financial well-being with higher household income and decreases risks of economic hardship by sharing household goods and services. The married usually live more regulated lives, have lower level of alcohol and cigarette consumption, and engage in less risk-taking behaviors such as fast driving. Additionally, married people usually have greater social support although it is not guaranteed (Mirowsky and Ross 2003a, 2003b; Ross 1991; Ross and Mirowsky 2002; Ross et al. 1990; Ross and Van Willigen 1997; Umberson 1987, 1992; Waite 1995). Furthermore, social support represents the resources that people can use to cope with life problems and health crises. Social support includes instrumental support such as providing transportation, and emotional support such as being cared about, loved, esteemed, and valued as a person (Cornman et al. 2003; House 2001; Mirowsky and Ross 2003a; Pearlin 1989; Ross and Mirowsky 2002; Ross et al. 1990; Rowe and Kahn 1997). Supportive interpersonal relationship decreases depression, anxiety and malaise, which in turn promote psychological well-being, physical health, subjective health, and subjective life expectancy. In addition, social support monitors life habits and increases protective health behaviors such as balanced eating behaviors, both of which result in good health (Ross and Mirowsky 2002; Ross and Van Willigen 1997; Umberson 1987).

On the other hand, the poor educated are less likely to maintain supportive relationships than their well-educated counterparts (Mirowsky and Ross 1998). Lower level of education is associated with unemployment and economic hardship, both of which in turn undermine the sense of perceived social support and provoke the possibility of negative interactions within families. Although levels of exposure to negative interactions are not always greater for low-educated elders, research argues that a lack of the sense of control and coping resources may make elders with poor education more vulnerable to the adverse effect of negative interactions on health (Krause and Rook 2003; Krause and Shaw 2002). Specifically, negative interactions refer to unpleasant encounters such as criticism, daily hassle, or excessive demands. Negative interactions

deteriorate psychological distress by eroding feelings of self worth and offsetting the benefits of social support (Krause and Rook 2003; Krause and Shaw 2002).

3. The Human Capital Pathway

Education instills the internal human capital that augments the sense of control into people, which in turn enables a wholesome lifestyle and conveys a considerable part of educational effect on health. According to Mirowsky and Ross (1998, 2003a), through education people gradually develop the inalienable internal ability to learn and think rationally, communicate effectively, analyze data, solve problems, implement plans, organize resources, and integrate information. Moreover, during the process of education pursuit, assignments or exams people encounter are progressively complex or difficult. The more years of schooling people attend, the more difficult challenges people eventually accomplish. Therefore, the well educated accumulate more successful experiences of difficult problem solving, develop greater cognitive ability, and establish higher confidence, habits and motivation to resolve problems. More importantly, these inherent cognitive abilities and values boost the well educated higher levels of sense of control, which refers to the higher learned belief that individual can master or alter one's own outcomes. Higher levels of sense of control enable people to achieve effective means toward a health-enhancing lifestyle and create new ways to ameliorate or overcome any health crises. In contrast, low educated people tend to have lower sense of control because they may meet continued failures from the previous educational frustration and the following restricted socioeconomic circumstances (Coleman 1988; Mirowsky and Ross 1998, 2003a; Ross and Mirowsky 1999; Ross and Wu 1995; Rowe and Kahn 1997; Schultz 2000; Seeman and Lewis 1995; Sen 1997; Winkleby et al. 1992).

With higher sense of control, the well educated are more likely to have healthy lifestyle such as exercising, balanced eating, moderate drinking, and are less likely to have unhealthy behaviors such as drinking heavily, smoking, being overweight, sleeping insufficiently, and being physical inactive. Healthy behaviors are so called "primary preventive behaviors" because they successfully avoid the onset of disease and disability. Health lifestyle transmits a large part of educational effect on health and account for half

of the annual number of deaths in the United States (Lantz et al. 1998; Mulatu and Schooler 2002; Ross and Wu 1995; Umberson 1987, 1992; Williams and Collins 1995; Winkleby et al. 1992). The positive and negative effects of health behaviors have both been well recognized (Ross and Wu 1995; Wen et al. 2005). On the one hand, exercise improves health by reducing cardiovascular risk, osteoporosis, atherosclerosis, obesity, high blood pressure, varicose veins, and adult onset diabetes. Exercise also associates with better subjective health and psychological well-being. On the other hand, drinking is correlated with cirrhosis of the liver, although moderate drinking is actually associated with lower risks of coronary heart disease, stroke, and hypertension. Moreover, smoking harms health extensively. Smoking associates not only with higher overall mortality risk but also with higher risk of heart disease, stroke, cancer, emphysema, atherosclerosis, aneurysms, lung cancers, and liver diseases. Besides, smoking correlates to poor self-reported health and higher rates of motor accidents and non-motor injuries.

(3) THE APPLICABILITY OF THREE THEORETICAL PATHWAYS IN TAIWAN

The three theoretical pathways between education and health are generally applicable in Taiwan (Beckett et al. 2002; Tung and Mutran 2005; Wen et al. 2004; Zimmer et al. 2002; Zimmer et al. 2005). First, education strongly differentiates people's positions in the Taiwan labor market, which in turn influences whether people have accesses to economic resources that improve health and other aspects of life. Second, the well educated have more ability to maintain stable interpersonal relationships. Supportive and harmonious relationships are the values highlighted in a collectivist culture such as Taiwan. Restrained social support for one's family is a norm violation that usually leads to public censures or disdain. Moreover, Taiwanese people tend to suppress their discontent to avoid negative interactions unless they are driven beyond forbearance. Negative interactions therefore tremendously affect psychological health. Lastly, education decreases the likelihood of unhealthy behaviors such as smoking. The effects of health lifestyle on human body are generally universal. No matter what race, ethnicity or nationality people are, those who are able to maintain health behaviors tend be healthier than their counterparts with unhealthy behaviors.

However, with consideration of the unique economic development and the Asian cultural background in Taiwan, three specific phenomena are noteworthy, including the particular association between self-employment and health, the tenuous association between education and social support, and the ambiguous association between the sense of control and health. These special phenomena provide an exceptional perspective to study education-health association.

1. The Particular Mediator: Self-Employment

Self-employment is the work mediator that provides particularly strong impacts on health in Taiwan. The rapid expansion of export-oriented light industry from 1960s to 1980s leads to the ubiquity of self-employed petty bosses on this island. This type of industrialization is characterized by high divisibility of production and by the subcontracting network consists of a variety of small manufacturing units. Both characteristics spawn numerous opportunities for people regardless of education levels to start their own middle-to-small sized manufacturing enterprises. In order to overcome the rapid saturated rate of light industrial products and continue producing a highly profitable product at the right time to create the niche, these micro-entrepreneurships utilize the vibrant grass-roots R&D to refine their skills efficiently, emulate other company's products successfully, and innovate new products frequently (Shieh 1992, 1997). As a consequence, self-employed Taiwanese are the boss of their own macro-enterprise and enjoy high work autonomy. With the grass-roots R&D experiences, self-employed people also make work full of creativity, productivity, and a sense of fulfillment. Because high levels of autonomy and creativity at work settings are two of most important characteristics that enhance health, self-employment is the specific employment status that unintentionally fosters health.

2. Does Education Determine Social Support?

Social support may not be the significant link between education and health in Taiwan, although social support itself protects mental health (Cornman et al. 2003). Previous research has suggested that the correlation between education and social

relationship (emotional support and social participation) is relatively low in Taiwan (Liu et al. 1998). Because of the entrenched family-orientated culture, Taiwanese people are socialized or encouraged to provide social support and show consideration for their family members. Moreover, due to high rates of co-residence and high prevalence of extended households, it is common for family members to involve with each other's life and provide any kind of needed instrumental or emotional support (Zimmer et al. 2002). As a result, giving and receiving social support are inherent and prevalent behaviors for Taiwanese people regardless of education levels.

3. Education, the Sense of Control and Health

The positive association between education and the sense of control is manifest in Taiwan. The Asian educational system is famous for its early tracking and competitive entrance examinations for high schools and colleges (Chang 1992; Hsieh et al. 1999; Sakamoto and Powers 1995; Tsai 2004). This educational dimension constitutes a suitable environment to augment the sense of control for the well educated— those who have numerous successful experiences in various competitive educational transitions. Nevertheless, whether the sense of control mediates the effects of education on health is inconclusive. The sense of control stresses that outcomes are contingent on one's choices and actions (Mirowsky and Ross 2003a). The above definition of the sense of control is intrinsically individualistic and perfectly compatible to the internal spirits of American society such as self-achievement, self-reliance and autonomy. It is reasonable that the sense of control is the most preeminent factor that enables American to solve health problems and adopt healthy behaviors. However, the sense of control is probably not a core value that determines or motivates people's behaviors in an Asian collectivist society that emphasizes subordination to family. Pursuing self-interest may easily lead to a norm violation (Sastry and Ross 1998). This argument is supported by empirical findings: Asian Americans and Asians in Asia both have lower levels of personal control than non-Asians. Moreover, the impacts of sense of control on psychological distress are slighter for Asians than non-Asians. In sum, the sense of control may not be a core

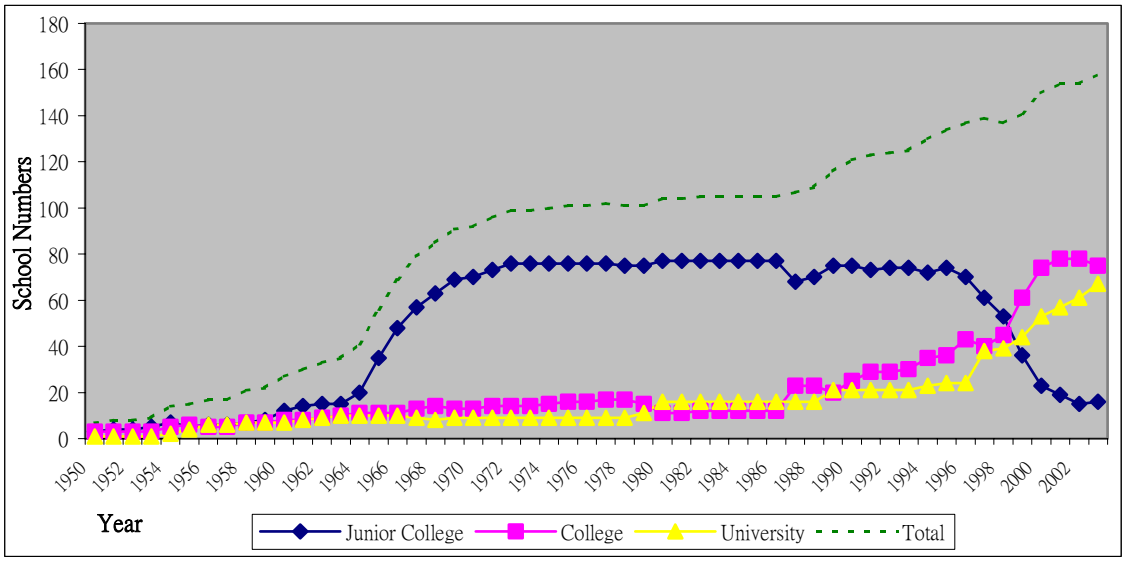
indicator of health in Taiwan and its impacts perhaps differ across respondents with different levels of Asian traditional values.

Table 1 Education Attainments by Birth Cohorts in Taiwan. (Unit: %)

Birth Cohort	Illiterate	Junior High and Lower level Schools	Senior High School and Vocational School	Junior College and Above
1935 and prior	24.9	59.5	8.4	7.1
1936-40	13.4	71.7	8.4	6.5
1941-45	7.6	69.6	12.9	10.0
1946-50	2.7	63.5	18.0	15.7
1951-55	1.2	55.0	25.1	18.6
1956-60	0.5	44.7	33.5	21.3
1961-65	0.2	34.8	38.7	26.3
1966-70	0.1	22.9	43.7	33.3
1971-75	0.1	16.4	41.2	42.4
1976-80	0.1	12.8	39.7	47.4
1981-85	0.0	15.4	68.7	15.9
Total Percentage	4.0	37.7	33.9	24.4
Total Number (1000 person)	700	6530	5878	4227

Source: 2000 Population and Housing Census.

Figure 1 Higher Education Expansion in Taiwan.



Source: The information of school numbers are drawn from the website of The Ministry of Education in Taiwan. The figure is made up by the author.

(4) EDUCATION-HEALTH ASSOCIATIONS ACROSS BIRTH COHORTS IN TAIWAN

1. Opportunity Structure of Education

Over the last six decades, the extensive social, economic, political, demographic, and educational transitions have led to the immense differences of social circumstances across Taiwanese cohorts. For instance, in educational aspects, the proportion[3] of population aged 15 and over receiving at least junior college degree has expanded from 5.5 % to 24.4% between 1970 and 2000; in economic aspects, per capita GNP[4] has increased from 443 USD to 14,118 USD at the same period; and in political aspects, Taiwan has transformed from an autocratic society to a democratic country. With consideration of such rapid and extensive social change, perhaps the effects of education on health are dynamic and vary across successive cohorts.

In order to identify generations that distinctly represent diverse educational and social circumstances, this research distinguishes successive birth cohorts according to the "opportunity structure of education", rather than the commonly used age cohorts with fixed-interval of age. The concept of "opportunity structure of education" is adopted from Elder and his colleagues' arguments (Elder 1998; Shanahan et al. 1997): opportunity structure of school and work constrain and enable life trajectories to achievements for people. In other words, life developments of individuals are contingent on historical moments they experience over their life course. Since different birth years refer to diverse historical moments with changing structures of opportunities, people of different birth cohorts have different life experiences (Elder 1998; Shanahan et al. 1997). According to this perspective, the effects of education on health are at least partly contingent on the opportunity structure of education and are different among birth cohorts. Specifically, within the cohorts without the compulsory primary education, only a few people are able to develop health-enhancing resources that education constitutes such as higher sense of control. In contrast, within the cohorts with highly accessible opportunities of higher

[3] The statistics are drawn from the *2000 Population and Housing Census in Taiwan*.
[4] The GNP statistics are from the website of Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.

education, people prevalently access education and generally benefit form the advantages that education provides.

2. The Characteristics of Four Birth Cohorts

In order to investigate the education-health association in the cohort perspective, this research considers the census data on the proportions of educational attainments by birth cohorts (Table 1), the information about the expansion of numbers of higher education schools (Figure 1), and Tsai's (2004) design of birth cohorts[5], so as to divide[6] the Taiwanese population into four birth cohorts that represent diverse opportunity structure of education.

The birth cohort born before 1940: it is the birth cohort who had received formal education prior to the termination of World War Two, which was a particular historical event that completely changed life trajectories of Taiwanese people. The extremely different life experiences across ethnic groups of this cohort merit further attention. On the one hand, Holos, Hakkas, and Aborigines had received easily accessible elementary education under the Japan colonialism era from 1895 to 1945, despite the limitations of secondary and higher education opportunities (Tsurumi 1977). For instance, the enrollment rates of the Taiwanese elementary school-aged population in 1944 stood at 81.17%, the highest in Asia, although the total numbers of Taiwanese college students in Taihoku Imperial University (the antecedent of the National Taiwan University) from 1928 to 1944 were only 786 persons. The limited higher education opportunities led many Taiwanese to Japan to pursue higher education, as indicated by the estimated numbers of 2277 Taiwanese students in Japan in 1942 (Huang 2000; Tsai et al. 1994; Tsurumi 1977). After the war, these Taiwanese had been forced to change their citizenship from "Japanese" to "Chinese" in the new post-war society ruled by Chiang

[5] In order to investigate effects of higher education expansion on inequality of educational opportunity, Tsai (2004) establishes the design of three birth cohorts that represents the distinctive post-war experiences in Taiwan, including the 1946-55, the 1955-66, and the 1967-79 cohort.

[6] This division is an arbitrary ideal type based on the time when people attend school. People are assumed to enter elementary school, junior high school, senior high school and college at 6, 12, 15, and 18, respectively. This division is expected to roughly grasp the historical experiences for each birth cohort, but it is unable to represent every individual's real life experiences.

Kai-shek's Chinese government (Hsiau 1997; Luoh 2001). On the other hand, about one and a half million Mainlanders were the involuntary immigrants that retreated from China to Taiwan after Chiang Kai-shek lost the Chinese Civil war to the Communists in 1949. Many mainlanders were original civil servants of Ghiang Kai-shek government or the well-educated elites, but the others of this demographic influx were low educated soldiers (Hsiau 1997; Luoh 2001). Taken together, the well educated of this cohort are highly selected elites because their most counterparts only received primary education. Moreover, no matter what ethnic groups people are, well-educated people of this cohort are expected to have higher sense of control and more abilities and resources to adjust and survive in the most chaotic time after war. As a result, the effects of education on health are tremendous within this birth cohort.

The 1941[7]*- 55 birth cohort*: it is the birth cohort that had received education in the post-war period. Although secondary education was still limited, the primary education had been accessible. Moreover, when this birth cohort turned 18 years old between 1959 and 1973, higher education was significantly expanded (Figure 1). It is noteworthy that people of this cohort launched their work careers in the era of miraculously booming economy between 1960 and 1980 in Taiwan. Regardless of educational levels, people tended to easily accumulate substantial fortune during this period. Moreover, compared to the well educated who remained in the schools for higher education, persons who failed to pass educational transitions entered the prosperous labor market quickly and probably take the initiative to develop their economic achievement in the peak time of the flourishing economy. The less educated were thus able to access work and economic resources that benefit health. Therefore, although the effects of educational impacts on health are still important within this cohort with limited secondary education, the educational effects are probably attenuated substantially after adjusting the economic factors.

The 1955-66 birth cohort: when people born in 1956 turned 12 years old in 1968, they became the first birth group eligible for "9-years national compulsory education"

[7] Some persons were born before the end of war (1941-45). However, when they entered the elementary school at 6, the war was actually over. The division is based on their educational experiences.

(Chang 1992), which marks the major educational differences between this cohort and the 1941-55 birth cohort. However, when people of this cohort turned 18 years old between 1974 and 1984, they met the stagnation period of higher education expansion resulted from the prohibitions on the establishment of new private colleges (Figure 1). The demand of increasing student population was over the supply of higher education opportunities. Because of the stagnated increase of higher education opportunities, the variation of levels of education and the significant impacts of education on health are obvious within this cohort. Moreover, compared to the 1941-55 cohort, educational impacts are not considerably attenuated by economic factors. When the persons of this cohort entered their prime time between 1980 and 2000, the labor market had been well established. Although the total economic development was still thriving, people had less opportunity to create their own business or to start the less-developed industry. Instead, people usually became the paid employees of the macro-sized enterprises or their micro-sized family businesses. As a result, assessing the economic resources that foster health was much difficult for the low educated of this cohort than their counterparts of previous cohorts.

The birth cohort born after 1967: it is the birth cohort that receives higher education after the 1985 deregulation of restrictions of private institutions establishment. Different from the 1956 - 66 birth cohort, the birth cohort born after 1967 received more opportunities for higher education. For instance, Table 1 demonstrates that the proportions of completing junior college degree or above mark the highest at 47.4% for those born between 1976 and 1980, and followed by 42.4% of those born between 1971 and 1975. Additionally, higher education has been expanded with the quantity of institutions increasing from 4 schools in 1945 to 150 schools in 2000 (Tsai 2004). Because the higher education has become prevalent and the variation of educational levels has been reduced within this birth cohort, the educational effects on health may not be as critical as it was.

To sum up, the separate empirical investigation on four birth cohorts with diverse opportunity structures of education provides a unique opportunity to explore the education-health association in cohort perspectives. If the patterns of education-health

associations are all similar among birth cohorts, then it will reconfirm the universal impacts of education on health. However, if the patterns are inconsistent across birth cohorts, then it might indicate that the impacts of education on health are dynamic in the rapidly changing society of Taiwan.

Data, Measurement, and Analytic Strategy

(1) Data

The samples are drawn from the 1995 (the third wave's first survey) and 2000 (the fourth wave's first survey) Taiwan Social Change Survey (hereafter called TSCS), which are the cross-sectional face-to-face interviews conducted by the Institute of Sociology, Academia Sinica, and sponsored by the National Science Council, Taiwan. The multi-staged stratified random sampling scheme is incorporated. The total 359 township/districts of Taiwan are divided into 10 strata according to the degree of urbanization and geographic locations[8]. Administrative neighborhood and individuals in each stratum are in turn randomly selected based on "probability proportional to their size " method. The 1995 and 2000[9] sample respectively yields 1,977 and 1,785 respondents who aged from 20 to 75 and provided complete information on all variables used in the following analyses. These two cross-sectional samples are merged[10] to constitute a larger sample size for each birth cohort. Finally, a total of 3,762 respondents (729 of 1920-40 birth cohort[11], 1,063 of 1941-55 birth cohort, 1,223 of 1956-66 birth cohort, and 747 of 1967-79 birth cohort) are used.

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[8] Such as mountain town type, industrial, city, commercial city type, Taipei City, etc.

[9] The target population for 2000 sample is people aged over 20 and without upper limit. The original 2000 sample includes respondents ranging in age from 20 to 91; however, 55 respondents who aged 76 and older are dropped in the following analysis. The reason is that the process of human survival tends to select out unhealthier persons among the low SES groups. As a result, it is possible that the Taiwanese who aged 76 and over are selected survivors.

[10] Survey year is adjusted in the following regression models (1 for "the 2000 sample").

[11] However, over 20,000 Holos, Hakkas, and Aboriginals, most were young elites and high school students, were randomly and premeditated massacred, imprisoned or had their education curtailed by Chiang Kai-shek government on February 28, 1947, and on the following suppressions through the 1950s. Education might actually deteriorate their health and threaten their survival (Tsai 1994).

TSCS contains comprehensive and detailed data that permit this research to investigate the fundamental patterns and pathways between education and health. However, due to the limitation of the cross-sectional design, this study is unable to observe the causal relationship between education and health in Taiwan.

(2) MEASUREMENT

1. Dependent Variable: Subjective Health

Subjective Health is measured as "respondent's subjective assessment of his or her general health in recent two weeks" (1 = very poor, 2 = poor, 3 = good, 4 = very good). Subjective health, also called perceived health or self-assessment health, is regarded as the best measurement of health because it efficiently reflects various aspects of health, such as diagnoses of acute or chronic disease, levels of physical functioning, psychological well-being, and mortality (Beckett et al. 2002; Mechanic and Hansell 1987; Ross and Mirowsky 1999). It is a more holistic view of health that represents the definition of health by World Health Organization: as a state of physical, mental, and social well-being, and not simply the absence of disease (Mirowsky and Ross 2003a). However, whether the interpretation of subjective health varies across cultures or societies is still inconclusive (Zimmer et al. 2000).

2. Independent Variables

Education is coded ordinally in years according to the highest educational level reported (0 = none, 3 = self studied, 6 = elementary school, 9 = junior high school or junior vocational school, 12 = senior high school, senior vocational school, or sergeant school, 14 = 5-years junior college, 2–years junior college, military or police junior college, the open junior college, or Japan short-term college, 15 = 3-years junior college, 16 = college and military or police college, 19 = graduate school). This measurement represents quantity of a person's education, which is suitable for the assumption of human capital theory: the more years of schooling, the more human capital acquired.

Three background variables are included. *Age* is computed by the survey year minus the birth year reported. *Sex* is coded as 1 for males and 0 for females. *Ethnicity* is coded as 1 for “Mainlanders” and 0 for “Holo, Hakka, and Aboriginals”. The ethnic categories of Mainlanders and other ethnic groups are meaningful social labels in Taiwan (Tung and Mutran 2005). The empirical results reveal that the Mainlander is the ethnic group who benefits from Taiwan educational systems (Chang 1992; Luoh 2001, 2002, 2003; Tsai 2004; Tsai et al. 1994). Moreover, empirical researches indicate that Mainlanders have higher survival (Zimmer et al. 2005) and Mainlander female elders are more likely to be healthier (Beckett et al. 2002) than other Taiwanese. Work and economic mediating variables include household income and employment status. *Household Income* is an ordinal variable measured according to the question “what is your nearly household income per month? “ and coded as follows: 0 = no income, 0.5 = less than Taiwan Dollar (TWD) 10,000, 1.5 = TWD 10,000 to TWD 20,000, , (…), 19.5 = TWD 190,000 to TWD 200,000, 25 = more than TWD 200,000, and missing data are coded as mean income of each survey. *Employment Status* is measured according to the question “where do you work currently? For whom?” A series of 7 categorical variables is constructed, including self-employed, paid employed, unpaid family-employed, unemployed, retired, housewife, and students.

Social-psychological mediating variables include married status, social support, and negative interaction. *Married Status* is a dichotomous variable contrasting those currently married (coded as 1) with those who are single, divorced/separated, or widowed (coded as 0). *Social Support*[12] is measured by responses to three questions: “I can get satisfying help from my family when I have trouble and worry", "I am very satisfied with my family who discuss and share problems with me", and "I am very satisfied with my family who concern and care my moods: happy, angry, sad and joyous" (0 = seldom, 1 = sometimes, 2 = always, and the missing case of each question is eliminated). The social support index is the mean response to the three questions (alpha reliability = .826). *Negative Interaction* is measured according to the question “During the past year, did the

following situation happened in your family 1) cold war between family members, 2) arguments or quarrel, 3) crash or throw things, and 4) fight." Responses to each item are counted. The negative interaction index is scored as the total frequencies of responses reported.

Human capital mediating variables include the sense of control and health behaviors. *The Sense of Control* is measured by the question "Do you agree or disagree the following statement: unless good luck, it is difficult for people to 'get promotion or make fortune'". Responses are coded as follows: 3 = strongly disagree, 2 = disagree, 1 = slightly disagree, 0 = no opinion, -1 = slightly agree, -2 = agree, and –3 = strongly agree. This measurement is suitable for representing the extent of "denying control over good outcomes". High scores indicate high levels of sense of control. *Exercising* is an ordinal variable measured according to the question "how often you participate in the following activities: exercising, hiking, camping or fishing" (0 = never, 1= not very often, 2 = fairly often, 3 = very often). *Drinking* is a series of 3 dichotomous variables which are based on the question" how often do you drink", including abstain from drinking (the reference category in the regression analyses), moderate drinking (respondents who report 'not very often'), and heavy drinking (respondents who report 'drink often, but seldom drunken' or 'drink and drunken often'). *Smoking* is measured by the question "Do you smoke? If yes, how many do you usually smoke?" and coded as follows: 1 for respondents who report "never" or "one or two once in a while", 2 for respondents who report "less than a half package per day" or "about a half package per day", 3 for respondents who report "about one package per day", and 4 for those who report "about two packages per day" or "more than two packages per day".

(3) ANALYTIC STRATEGY

The following empirical analyses are conducted in the following four stages. First, the association between education and three sets of theoretical pathways— work and economic resources, interpersonal and socio-psychological resources, and human

[12] Only the 2000 sample provides questions about social support. As a result, this research set one subsidiary Equation that only includes the 2000 sample to investigate the effects of social support on health. The details are provided in Appendix 1.

capital resources— are investigated by comparing the means and proportions of these variables at three educational levels[13]: junior high school and less, senior high school, and junior college and above. The variables demonstrating the significant association with education are viewed as the mediators in the following multiple regression analysis.

Subsequently, the effects of education on subjective health are examined by using ordinary least squares (OLS) regression analysis and progressive adjustment approach. This technique demonstrates whether the association between education and health is lessened or eliminated with the addition of these mediating and moderating variables. The magnitudes of explanations of three theoretical pathways are illustrated. Additionally, the interaction term of sex and smoking and the interaction term of sex and age are added. The interaction term of sex and smoking demonstrates the sex-related effects of smoking on health. The interaction term of sex and age indicates whether the health disparity between sexes shortens with age in a patriarchal society of Taiwan.

Third, OLS regression analyses and progressive adjustment are used separately for each birth cohort with distinct opportunity structure of education. This approach demonstrates the magnitude of education-health association and the effectiveness of three theoretical pathways for each birth cohort.

Lastly, the interaction term of age and education is examined. This technique clarifies whether the impacts of education on health are conditional on age. The positive and significant interaction indicates that the positive impacts of education on health increase with age. The negative and significant interaction shows that the positive impacts of education on health decrease with age. Nevertheless, the insignificant interaction reveals that the positive effects of education on health are identical in all models. With this strategy, this research is able to discern whether the differences of educational impacts across birth cohorts are partly attributed to aging effects.

[13] These educational categories are only used here, not in the following regression analysis.

Empirical Results

(1) DESCRIPTIVE STATISTICS

Table 2[14] demonstrates means and proportions for health and three sets of mediators at three educational levels: junior high schools and less, senior high schools, and junior colleges and above. Descriptive results support hypotheses that education positively associates with work and economic resources and human capital mediators. Education is significantly associated with subjective health, household income, paid-employment, the sense of control, exercising, and moderate drinking. In contrast, education is inversely associated with unemployment, self-employment, unpaid family employment, housewives, abstainer, heavy drinking and smoking.

Furthermore, Table 2 indicates that levels of social support are insignificantly different at three educational categories, regardless of birth cohorts. In fact, only respondents who had received junior college education and above within the 1920-40 birth cohort and respondents who had received senior high school education within the 1967-79 birth cohort are slightly higher levels of social support ($p < .10$) than their counterparts who had received junior high school education and less. As a result, social support[15] is hardly considered as the link between education and health in Taiwan.

The other two mediators of the interpersonal and socio-psychological pathway display unanticipated results. First, education seems *inversely* associates with marriage. People with junior college degree or above are *least* likely to be married. However, the marriage pattern differs across birth cohorts: the well-educated among the 1920-40 birth cohort are *more* likely to be married, while the well-educated among the 1967-70 birth cohort have the extremely *lower* proportion of being married (25.2%). This situation is probably due to that well-educated Taiwanese tend to marry *late* (Thornton and Lin 1994). In other words, education positively associates with being married while inversely

[14] Generally speaking, associations between education and three sets of mediators are consistent across birth cohorts. As a result, descriptive statistics by four birth cohorts are only demonstrated for variable showing particular cohort differences in Table 2.

with the age of the first marriage. Since the positive association between education and marriage is not demonstrated in this cross-sectional data, the following analyses regard married status as the control variable instead of the mediator between education and health.

Second, as education increases, negative interactions *increase*. Although this phenomenon is insignificant within the 1941-55 and 1956-66 birth cohorts, it contradicts the original assumption: the well educated are less likely to have negative interactions in the family. Therefore, the negative interaction is not a mediator that conveys the *positive* association between education and health; instead, it is an adjustment that regulates the strength of the education-health association.

(2) MULTIVARIATE ANALYSES

Does education foster health in Taiwan? The education coefficient in Equation 1 of Table 3 demonstrates that a year's increase in education is associated with better subjective health, adjusting for age, sex, ethnicity, and marital status. Additionally, respondents who are males or who are married report significantly better subjective health. In contrast, age[16] is inversely associated with subjective health. Unexpectedly, Mainlanders report insignificantly worse subjective health.

Adjustments for work and economic mediators are added in Equation 2 of Table 3. Adjusting work and economic mediators diminishes about 23 % of the magnitude of education coefficient ([.0135-.0104] / .0135 = .23). Among work and economic mediators, household income coefficient is positively associated with subjective health (significant at $p< .01$). People who are paid-employed, self-employed, unpaid family employed, retired, and housewives all report better health than the unemployed. Particularly, the extents of significant coefficients of self-employment and housewives on subjective health are both greater than that of paid-employment.

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[15] In a supplementary analysis, this research finds the correlation between education and social support is .0101. The OLS regression result also shows that education insignificantly associates with social support ($t=0.13$; $R^2=.0000$).

[16] Age^2 is tested in an unshown supplementary analysis, but its effect is also insignificant.

Table 2 Means and Standard Deviations for Variables at Three Levels of Education.

Variables	Junior High School and Less (1)	Senior High School (2)	Junior College and Above (3)	Sig. at p< .05 (two-tailed test)
Health				
Subjective Health	3.053 (.706)	3.182 (.668)	3.207 (.636)	1-2; 1-3
Psychological Distress	6.088 (4.731)	5.672 (4.724)	5.275 (4.108)	1-2; 1-3; 2-3
Sociodemographic Characteristics				
Age	49.917 (13.510)	36.970 (10.632)	37.307 (12.066)	1-2; 1-3
Male	.474 (.500)	.502 (.500)	.587 (.493)	1-3; 2-3
Mainlander	.089 (.284)	.148 (.355)	.274 (.446)	1-2; 1-3; 2-3
Work and Economic Resources				
Household income	4.503 (3.341)	6.967 (4.515)	9.376 (5.521)	1-2; 1-3; 2-3
Self employed	.235 (.424)	.252 (.434)	.149 (.357)	1-3, 2-3
Paid employed	.252 (.434)	.488 (.500)	.616 (.487)	1-2; 1-3; 2-3
Unpaid family employed	.102 (.303)	.050 (.218)	.015 (.122)	1-2; 1-3; 2-3
Unemployed	.084 (.277)	.035 (.184)	.043 (.203)	1-2; 1-3
Retired	.097 (.296)	.027 (.163)	.047 (.212)	1-2; 1-3; 2-3
Housewife	.233 (.421)	.144 (.352)	.046 (.210)	1-2; 1-3; 2-3
Students	.000 (.000)	.004 (.062)	.084 (.277)	1-2; 1-3; 2-3
Socio-Psychological Resources				
Married	.786 (.411)	.726 (.446)	.642 (.480)	1-2; 1-3; 2-3
1920-40 Birth Cohort	.702 (.458)	.857 (.353)	.862 (.348)	1-2; 1-3
1941-55 Birth Cohort	.861 (.346)	.901 (.300)	.897 (.305)	
1956-66 Birth Cohort	.864 (.344)	.847 (.361)	.818 (.387)	1-3[a]
1967-79 Birth Cohort	.504 (.502)	.406 (.492)	.253 (.436)	1-2[a]; 1-3; 2-3
Social Support *b*	1.202 (.651)	1.213 (.624)	1.191 (.566)	
1920-40 Birth Cohort	1.245 (.673)	1.417 (.672)	1.500 (.629)	1-3[a]
1941-55 Birth Cohort	1.221 (.649)	1.349 (.579)	1.280 (.563)	
1956-66 Birth Cohort	1.187 (.637)	1.180 (.665)	1.228 (.544)	
1967-79 Birth Cohort	1.006 (.599)	1.167 (.582)	1.085 (.556)	1-2[a]
Negative interaction	.360 (.607)	.575 (.692)	.606 (.659)	1-2; 1-3
1920-40 Birth Cohort	.196 (.455)	.179 (.431)	.185 (.429)	
1941-55 Birth Cohort	.347 (.618)	.401 (.588)	.542 (.654)	1-3; 2-3
1956-66 Birth Cohort	.506 (.674)	.625 (.706)	.635 (.649)	1-2; 1-3
1967-79 Birth Cohort	.748 (.673)	.695 (.729)	.701 (.677)	
Human Capital Pathway				
Sense of control	-.089 (1.721)	.269 (1.804)	.635 (1.652)	1-2; 1-3; 2-3
1920-40 Birth Cohort	-.239 (1.663)	.429 (1.788)	.754 (1.611)	1-2; 1-3
1941-55 Birth Cohort	-.125 (1.730)	.387 (1.853)	.946 (1.608)	1-2; 1-3; 2-3
1956-66 Birth Cohort	.102 (1.757)	.253 (1.798)	.585 (1.667)	1-3; 2-3
1967-79 Birth Cohort	.191 (1.757)	.182 (1.783)	.469 (1.649)	2-3
Exercising	1.402 (1.134)	1.697 (.961)	1.802 (.921)	1-2; 1-3; 2-3
Never Drinking	.636 (.481)	.529 (.499)	.467 (.499)	1-2; 1-3; 2-3
Moderate drinker	.281 (.449)	.395 (.489)	.496 (.500)	1-2; 1-3; 2-3
Heavy drinker	.084 (.277)	.076 (.265)	.038 (.190)	1-3; 2-3
Smoking	1.494 (.849)	1.461 (.820)	1.274 (.640)	1-3; 2-3
N	1804	1026	932	

Note: a: sig. at p < .10; b: only 2000 sample includes social support; N at 3 ed lev. are 709, 481, and 478.

Table 3 Unstandardized Coefficients from OLS Regression on Subjective Health (N = 3762).

Variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
Education Years	.014 ***	.010 **	.011 **	.011 **	.010 **	.011 **
	(4.46)	(3.18)	(3.40)	(3.24)	(2.90)	(3.19)
Sociodemographic Characteristics						
Age	-.004 ***	-.003 **	-.005 ***	-.005 ***	-.005 ***	-.003 +
	(3.92)	(2.96)	(4.08)	(4.08)	(4.13)	(1.86)
Male	.172 ***	.177 ***	.173 ***	.173 ***	.147 ***	.226 *
	(7.67)	(7.07)	(6.92)	(6.93)	(5.07)	(2.19)
Mainlander	-.003	-.003	-.001	-.001	.005	.009
	(0.29)	(0.08)	(0.04)	(0.04)	(0.15)	(0.31)
Married	.103 ***	.078 **	.087 **	.086 **	.083 **	.091 **
	(4.05)	(2.92)	(3.24)	(3.20)	(3.12)	(3.35)
Work and Economic Resources						
Household income		.007 **	.008 **	.008 **	.007 **	.007 *
		(2.80)	(3.00)	(2.91)	(2.76)	(2.58)
Self employed [1]		.168 **	.160 **	.160 **	.153 **	.149 **
		(3.23)	(3.10)	(3.09)	(2.97)	(2.89)
Paid employed [1]		.146 **	.137 **	.137 **	.128 *	.120 *
		(2.93)	(2.76)	(2.76)	(2.58)	(2.42)
Unpaid family employed [1]		.148 *	.134 *	.133 *	.135 *	.132 *
		(2.37)	(2.15)	(2.14)	(2.17)	(2.12)
Retired [1]		.112 +	.108 +	.106	.104	.119 +
		(1.73)	(1.67)	(1.64)	(1.61)	(1.84)
Housewife [1]		.164 **	.154 **	.153 **	.143 *	.125 *
		(2.95)	(2.78)	(2.77)	(2.58)	(2.23)
Students [1]		.134	.124	.122	.119	.114
		(1.48)	(1.37)	(1.35)	(1.32)	(1.26)
Socio-Psychological Resources						
Negative interaction			-.108 ***	-.107 ***	-.107 ***	-.106 ***
			(6.18)	(6.12)	(6.11)	(6.06)
Human Capital Pathway						
Sense of control				.006	.004	.005
				(0.87)	(0.66)	(0.76)
Exercising					.040 ***	.038 ***
					(3.70)	(3.53)
Moderate drinker [2]					-.008	-.006
					(0.31)	(0.24)
Heavy drinker [2]					-.004	-.002
					(0.08)	(0.04)
Smoking					.025	-.039
					(1.50)	(0.65)
Interaction						
Sex*Smoking						.069
						(1.10)
Sex*Age						-.004 *
						(2.24)
Data Year (2000 = 1)	.008	.005	.022	.023	.027	.024
	(0.36)	(0.20)	(1.01)	(1.02)	(1.19)	(1.05)
Constant	2.992	2.824	2.917	2.922	2.862	2.845
R-squared	.0402	.0454	.0550	.0552	.0592	.0608

Note: + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$; |t| in parentheses; Ref Group: 1: Unemployed; 2: Never Drinking.

The adjustment for interpersonal and psychological resources is added in Equation 3 of Table 3. Adjusting negative interaction *increases* the magnitude of education coefficient from .0104 (Equation 2) to .0111 (Equation 3), or by about 6.7 percent. It appears that negative interactions moderate the educational effects on subjective health. In addition, the negative interaction is negatively associated with subjective health (significant at $p < .001$).

The adjustment for the sense of control is added in Equation 4 of Table 3. Adjusting the sense of control decreases the magnitude of education coefficient from .0111 to .0107, or by about 3.6 percent. It seems that the sense of control slightly mediates the association between education and health. However, people with higher sense of control have *no* significant better subjective health. The sense of control is probably not a crucial factor on subjective health in Taiwan.

Adjustments for health behaviors mediators are added in Equation 5 of Table 3. Health behaviors mediators attenuate about 8.4 % of the magnitude of education coefficient ([.0107-.0098] / .0107 = .084). Exercising has a positive association with subjective health (significant at $p < .001$). Moderate and heavy drinker both report worse subjective health (but extremely insignificant). Uncommonly, smoking is positively (although insignificantly) associated with subjective health.

Adjustments for interaction terms are added in Equation 6 of Table 3. Although the coefficient of smoking and of the interaction term for sex and smoking are both insignificant, Equation 6 demonstrates that the effects of smoking on subjective health differentiate between males and females. Smoking increases subjective health for males (coefficient = -.039 + .069 = .30); whereas smoking decreases subjective health for females (coefficient = -.039). In addition, the effects of age on subjective health differentiate between males and females. The negative effects of age on subjective health (the interaction term of sex and age is significant at $p < .05$) is bigger for men (coefficient = -.003 - .004 = -.007) than for women (coefficient = -.003), which suggests that the

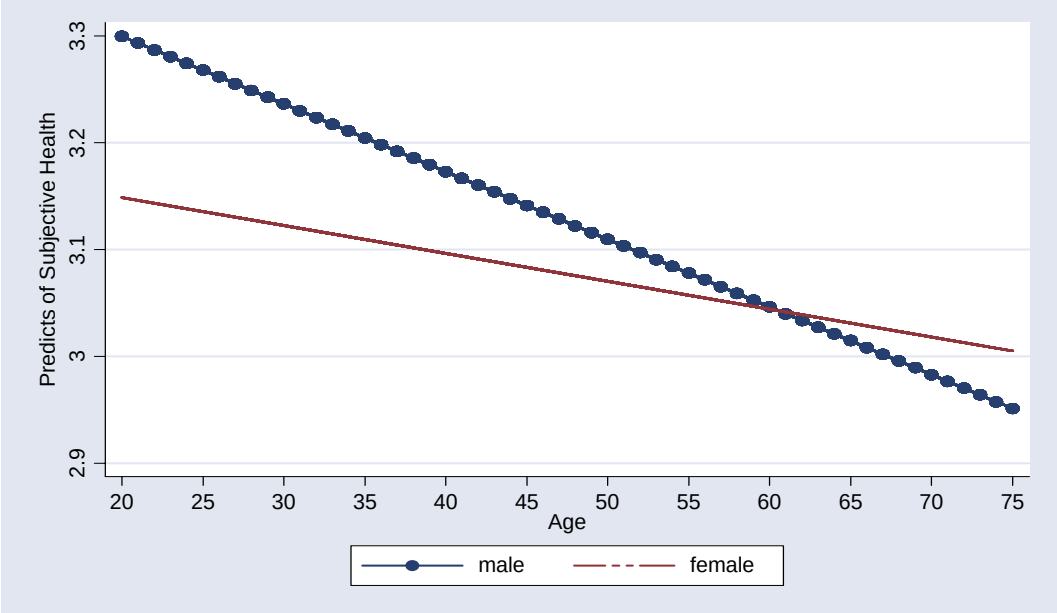
health inequality between sexes narrows with time. Specifically, the crossover age[17] at which female's health equals (and then surpasses) men's is 60.25 (-.225563/-.0037257).

All together, about 27.4 % ([.0135-.0098] / .0135 = .274; Equation 1 to Equation 5) of the total association between education and subjective health are mediated through work and economic resources, socio-psychological resources, and health behaviors.

(3) SUBJECTIVE HEALTH ACROSS FOUR BIRTH COHORTS:

This research further investigates the education-health association on four successive birth cohorts with diverse opportunity structures of education.

Figure 2 The Interaction of Sex and Age on Subjective Health.



Note: Equation 6 of Table 4, adjusting the mean level of all control variables

[17] This research adopt the Equationdeveloped by Ross and Bird (1994) to find the crossover age at which women's health's equals (and exceeds) men's. The equations are modeled through three steps. First, the Equationmodeling the age-related effect of sex on health is: $y = b0 + b_1(sex) + b_2(age) + b_3(age \times sex)$. Second, the Equationfor males (sex = 1) is $y_m = (b0 + b_1) + (b_2 + b_3)age$; while the Equationfor females is $y_f = b0 + b_2(age)$. Third, setting equations for men and women equals: $(b0 + b_1) + (b_2 + b_3)age = b0 + b_2(age)$. Then, the crossover point is $– b_1 / b_3 = age$.

Table 4 Unstandardized Coefficients from OLS Reg. on Subjective Health by Four Birth Cohorts.

	1920-40 (N = 729)		1941-55 (N=1063)		1956-66 (N = 1223)		1967-79 (N=747)	
Variables	E1	E2	E3	E4	E5	E6	E7	E8
Education Years	.018 **	.012 +	.017 **	.006	.006	.005	.008	.001
	(2.79)	(1.84)	(3.42)	(1.09)	(1.04)	(0.75)	(0.80)	(0.06)
Sociodemographic Characteristics								
Age	-.005	-.002	-.005	-.008	-.002	.000	-.002	.010
	(0.92)	(0.30)	(1.12)	(1.23)	(0.30)	(0.01)	(0.27)	(0.90)
Male	.071	.476	.140 **	-.123	.161 ***	.020	.291 ***	.875 *
	(1.21)	(0.67)	(3.29)	(0.30)	(4.27)	(0.05)	(5.74)	(2.38)
Mainlander	.074	.062	.064	.050	.030	.034	-.111 +	-.087
	(1.00)	(0.78)	(0.93)	(0.72)	(0.54)	(0.61)	(1.70)	(1.32)
Married	.133 *	.101	.104 +	.057	.043	.032	.097	.110 +
	(2.09)	(1.56)	(1.69)	(0.91)	(0.83)	(0.58)	(1.56)	(1.71)
Work and Economic Resources								
Household income		.010		.016 **		.003		.002
		(1.44)		(3.35)		(0.65)		(0.41)
Self employed [1]		.269 *		.245 *		.004		.071
		(2.51)		(2.49)		(0.03)		(0.62)
Paid employed [1]		.107		.231 *		.025		.001
		(0.91)		(2.37)		(0.20)		(0.01)
Unpaid family employed [1]		.230 +		.126		.083		.035
		(1.89)		(1.12)		(0.58)		(0.23)
Retired [1]		.136		.321 *		_		_
		(1.40)		(2.06)				
Housewife [1]		.171		.276 *		-.005		-.088
		(1.59)		(2.58)		(0.04)		(0.64)
Students [1]		_		_		_		.033
								(0.28)
Socio-Psychological Resources								
Negative interaction		-.126 *		-.063 +		-.110 ***		-.129 ***
		(2.08)		(1.94)		(3.95)		(3.60)
Human Capital Pathway								
Sense of control		.037 *		-.017		.019 +		-.020
		(2.22)		(1.40)		(1.81)		(1.43)
Exercising		.027		.049 *		.029		.034
		(1.17)		(2.52)		(1.51)		(1.22)
Moderate drinker [2]		.001		.087 +		-.020		-.118 *
		(0.01)		(1.83)		(0.48)		(2.24)
Heavy drinker [2]		.329 **		.035		-.077		-.250 *
		(2.75)		(0.42)		(0.92)		(2.32)
Smoking		.354 *		.275 *		-.304 *		-.209 +
		(2.01)		(2.53)		(2.49)		(1.94)
Interaction								
Sex*Smoking		-.335 +		-.231 *		.350 **		.208 +
		(1.86)		(2.06)		(2.82)		(1.87)
Sex*Age		.002		.004		-.007		-.031 *
		(0.16)		(0.54)		(0.72)		(2.37)
Data Year (2000 = 1)	.028	.048	.011	.024	-.030	.001	.048	.085
	(0.50)	(0.83)	(0.23)	(0.49)	(0.63)	(0.01)	(0.87)	(1.54)
Constant	3.042	2.329	3.083	2.642	3.059	3.300	2.940	3.009
R-squared	.0367	.0849	.0404	.0793	.0181	.0458	.0500	.1057

Note: + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$; | t | in parentheses; Ref.Group: 1:Unemployed, 2: Never Drinking

1. The 1920-40 Birth Cohort:

Within the 1920-40 birth cohort, Equation 2 of Table 4 illustrate that education is positively associated with subjective health (significant at $p < .10$). Age, sex, married, and ethnicity are insignificant indictors of health. Among three sets of theoretical mediators, expectedly, self-employment, negative interactions, and the sense of control significantly impacts subjective health. Surprisingly, heavy drinker reports better subjective health (significant at $p < .05$; 45 heavy drinkers within this cohort). Additionally, smoking also *improves* subjective health for males (coefficient = .354 - .339 = .019) and females (coefficient = .354; but only 8 females smoke within this cohort). All together, socio-demographic characteristics and three sets of mediators attenuate about 33% ([.018-.012]/ .018 = .33) of the total association between education and subjective health.

2. The 1941-55 Birth Cohort:

Within the 1941-55 birth cohort, the coefficient of education on subjective health become insignificant after adjusting all controlling variables. Work and economic variables have substantial effects on subjective health. Negative interactions also significantly and inversely associate with subjective health. The sense of control insignificantly associates with subjective health. Exercising and moderating drinking significantly associates with subjective health. Lastly, smoking significantly *improves* subjective health for males (coefficient = .275 - .231 = .044) and females (coefficient = .275; but only 12 females smoke within this cohort). All together, socio-demographic characteristics and three sets of mediators attenuate about 64.7 % ([.017-.006]/ .017 = .647) of the total association between education and subjective health.

3. The 1956-66 Birth Cohort:

Within the 1956-66 birth cohort, education is insignificantly with subjective health. Additionally, no socio-demographic characteristics display significant effects. Among three sets of theoretical mediators, negative interactions and the sense of control demonstrate significant effects. Besides, smoking is significantly and *positively*

associated with health for males (coefficient = -.304 + .350= .046 on subjective health) and is significantly and *negatively* associated with health for female (coefficient = -.304 on subjective health; but only 10 females smoke within this birth cohort).

4. The 1967-79 Birth Cohort:

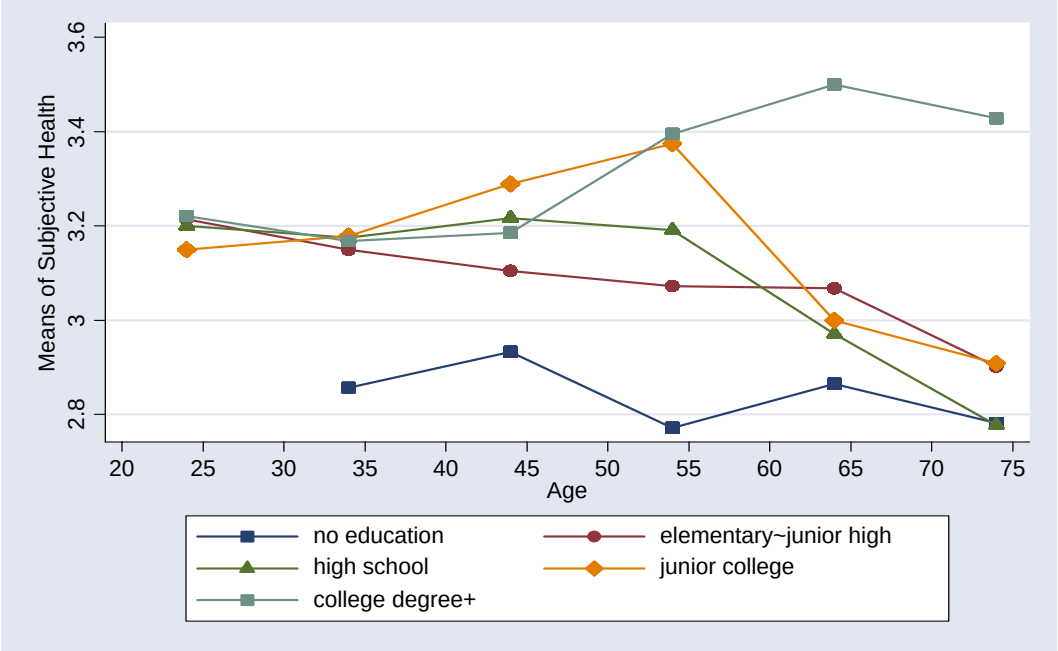
Within the 1956-66 birth cohort, education is insignificantly associated with subjective health. Additionally, only males and the married report significantly effects. Among three sets of theoretical mediators, negative interactions and heavy drinking significantly harms health. In addition, smoking significantly *decreases* subjective health for males (coefficient = -.209 - .208 = -.201) and females (coefficient = -.209; but only 22 females smoke). Moderately drinkers have significantly worse subjective health.

(4) AGING EFFECTS ON SUBJECTIVE HEALTH

Table 5 presents the effect of the interaction term for education and age on subjective health with the adjustments of all control variables and three sets of theoretical mediators (such as Equation 6 in the Table 3). For the total sample, the interaction term is significant and positive, which indicates that educational impacts on health increase with age. Nevertheless, the addition of the interaction term leads to the change of the coefficient of education from positive and significant (Equation1) to negative and insignificant (Equation2). Figure 4 further graphs the above result of Equation 2 and illustrates that the gap in subjective health increases with age. Although low-educated youngsters are slightly healthier than their counterparts in their early twenties, their subjective health decreases with age. Conversely, age does not decrease health for the well educated and even increases somewhat among those with a college degree. Additionally, Table 5 also demonstrates the interaction term for education and age is not significant within any birth cohort, even the oldest 1920-40 birth cohort. It seems that education differences on subjective health do not increase with age within birth cohorts.

Figure 3 Age and Subjective Health at Education Levels (The top panel graph the unadjusted means; the bottom panel graphs the Equation 1 of Table 5, solved at the mean level of control variables).

Means:



Predictions:

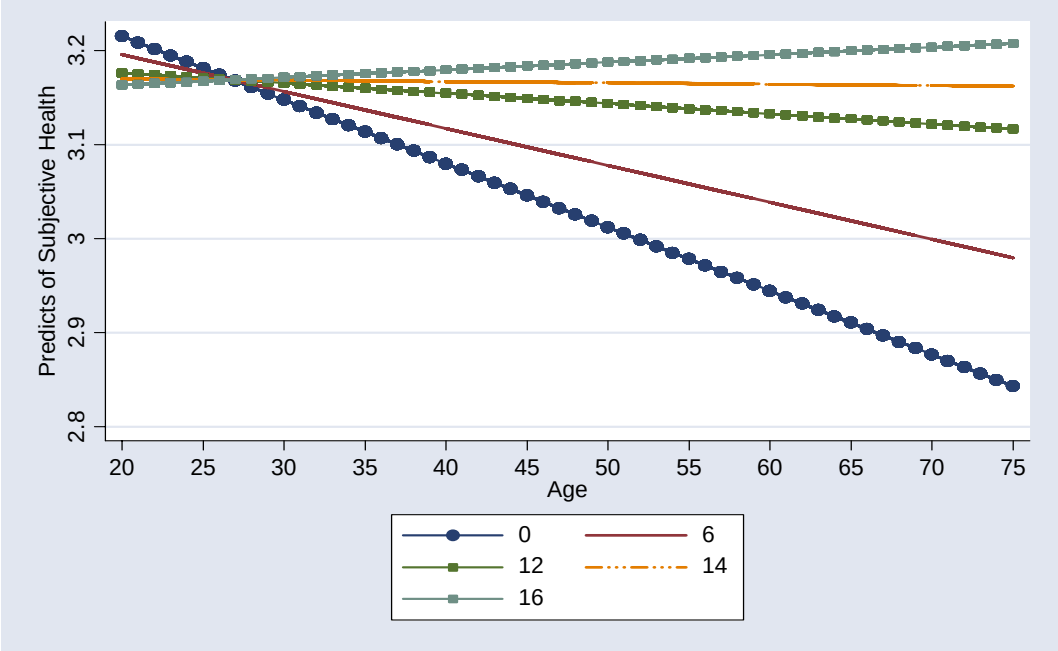


Table 5 Unstandardized Coefficient from OLS Regression on Subjective Health to Education X Age Interaction (The Coefficients of Other Control Variables Are Omitted in This Table).

	Total		1920-40		1941-55		1956-66		1967-79	
Variables	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
Education Years	.011 **	-.013	.012 +	.032	.006	-.049	.005	-.080	.001	.018
	(3.19)	(1.22)	(1.84)	(0.42)	(1.09)	(1.08)	(0.75)	(1.45)	(0.06)	(0.23)
Age	-.003 +	-.007 **	-.002	-.001	-.008	-.016	.000	-.027	.010	.017
	(1.86)	(3.03)	(0.30)	(0.15)	(1.23)	(1.23)	(0.01)	(1.42)	(0.90)	(0.47)
Interaction										
Ed*Age		.473 E-03*		-.297 E-03		.115 E-02		.231 E-02		-.632 E-03
		(2.40)		(0.26)		(1.23)		(1.55)		(0.22)
Constant	2.845	3.092	2.329	2.257	2.642	3.030	3.300	4.289	3.009	2.796
R-squared	.0608	.0622	.0849	.0850	.0793	.0807	.0458	.0477	.1057	.1057

Note: +p<.10; *p<.05; **p<.01; ***p<.001; |t| in parentheses

Discussion and Conclusion

(1) EDUCATION AND HEALTH: COHORT EFFECTS AND AGING EFFECTS

In the cross-sectional TSCS sample, well-educated Taiwanese significantly demonstrate better subjective health than their poor-educated counterparts. Furthermore, educational effects on health are not thoroughly mediated by socio-demographic characteristics and three sets of theoretical mediators. These findings identify the phenomenon that has been less ascertain in Taiwan: education associates with health, the personal asset accompanying people throughout their whole life. In other words, education plays a fundamental role in establishing health stratification in Taiwan.

This research further evaluates whether the extent of educational impacts on health vary across birth cohorts with distinct educational and social circumstances in the tremendous changing society of Taiwan. Comparative results manifest that significant effects of education are persistent within the older birth cohorts with limited educational opportunities; whereas educational effects are insignificant within the younger birth cohorts with highly prevalent educational opportunities. However, the above cross-sectional differences across birth cohorts are probably due to both cohort effects and aging effects.

In the cohort perspective, opportunity structures of education and specific historical backgrounds lead to the differences in education-health patterns across birth cohorts. First, the 1920-40 birth cohort faced the most limited educational opportunities and experienced the most chaotic post-war time in Taiwan. Since more than 70% of this cohort was less educated or uneducated, the well educated become those elites who monopolize rare health-enhancing resources to maintain health in this dramatically disordered society. The beneficial impacts of education are more salient within this cohort. Second, although the 1941-55 birth cohort faced the limited educational opportunities, they began their work careers in the era of miraculously booming economy between 1960 and 1980. Regardless of educational levels, people tended to benefit from this prosperous economy and easily access comprehensive work and economic resources that benefit health. Therefore, with the adjustment of work and economic resources, the educational impacts within this cohort are substantially[18] attenuated. Lastly, within the younger ones with highly accessible educational opportunities such as the 1956-66 and the 1967-79 birth cohorts, people prevalently benefit form the health-enhancing resources that education provides. Thus, educational effects become less influential

On the other hand, aging effects implicate that the age-related effects of education on health result in differences across cohorts. Aging effect indicates that educational disparity in health diverges with age. Among the younger 1967-79 birth cohort, most of them are healthy and have no large variation in resources that education improves. Education-based inequality in health is thus unobvious. However, with age, people are more and more likely to encounter the onset of chronic diseases or physical deterioration. Compared to people with little schooling, the well educated have more internal abilities and external resources to postpone the emergence of sickness or disability. Moreover, according to the cumulative advantage theory, resources associated with education accumulate over the life course (Mirowsky and Ross 2003a; Ross and Wu 1996). For instance, young people with balanced eating patterns tend to monitor their health

[18] The significant coefficient of education changes from .0144 (in the unshown equation with adjustment of socio-demographic characteristics, interpersonal resources and human behaviors) to the insignificant coefficient at .006 (in the equation with the addition of work and economic resources; such as Equation 4 of Table 4).

conditions well; while frequent junk food eaters are more likely to have more and more chronic diseases emerging in their middle ages and in turn deteriorate health in their older ages. Hence, education-based inequality in health diverges with time and is more significant within older cohorts such as the 1920-40 and 1941-55 cohorts.

Cohort effects and aging effects both partly explain the differences of education-health patterns across birth cohorts. Moreover, they may amply each other and constitute a double advantage to the well educated of the birth cohort with limited educational opportunities. In other words, compared to the less educated, the well-educated elders within the 1920-40 cohort not only acquire most health-enhancing resources when they were young but also accumulate these resources throughout their whole life. The educational impacts are thus momentous within this cohort.

(2) THREE THEORETICAL PATHWAYS

This study investigates the generalizability of three theoretical pathways between education and health in Taiwan. To begin with, work and economic resources substantially mediates the positive effects of education on health. In particular, the extents of self-employment on subjective health are larger than those of paid-employment. Strong impacts of self-employment may be due to its high profit and high autonomy and creativity unintentionally resulted from copious grass-roots R&D experiences. Similarly, being housewife is positively associated with health for the 1941-55 cohort. The reason is probably these housewives constitute “the invisible workshop” in the subcontracting economic system. For example, these housewives receive orders from upper subcontracting head to do some low skilled work at home such as sewing the ears for a toy bear (Shieh 1992, 1997). Although this kind of low-skilled work is rountinized and lacks creativity, housewives can get extra money to support their family, which decreases the potential risk of economic hardships that housewives typically suffer. However, because TSCS lacks the direct data of work fulfillment and grass-roots R&D experiences, the measurement of self-employment is an extremely crude proxy that symbolizes work fulfillment, autonomy, and creativity. The heterogeneity within self-

employment is also neglected. It is necessary for further research to use other data to clarify the association between self-employment, work characteristics, and health.

Subsequently, the mediating effects of interpersonal and social-psychological resources are not demonstrated in the TSCS sample. Education does not significantly associate with social support[19]. It is probably that Taiwanese people regardless of education levels are socialized or encouraged to provide social support or to show consideration for their family members. Additionally, well-educated "young people" report the lowest proportion of being married. This finding reflect that education "postpones" the age of the first marriage for those young well-educated Taiwanese (Thornton and Lin 1994). Longitudinal data is essential to clarify the dynamic association between education and marriage.

What is surprising is that the well educated report *more* negative interactions. This result contradicts the original assumption: the well educated are less likely to have a conflicting relationship in the family. Two possible justifications are inspired from Schieman's research (2000) on education and anger. First, well-educated Taiwanese tend to have occupations with more responsibilities, time commitments, and competitive environments, which constitute excessive work-related demands for time and energy. The conflicts between work-related demands and familial obligations usually provoke negative interactions in the family. Second, the well educated are more likely to perceive their negative interactions as the appropriate reactions to assert desired goals. In other words, well-educated Taiwanese have more courage and motivation to express their disagreements, which probably increases the occurrence of negative interactions. Conversely, less-educated Taiwanese tend to repress their discontent to reconcile conflicts or avoid negative interactions. Although well-educated Taiwanese report more negative interactions in the cross sectional TSCS sample, the well educated may have better communicative abilities or more resources than their counterparts to solve conflicts and ameliorate adverse effects from negative interactions. Longitudinal data is necessary

[19] Although social support is not a valid link between education and health, it significantly associates with better subjective health (refers to Appendix 1).

for future research to clarify whether education lightens the long-term detrimental effects of negative interactions on health.

Lastly, empirical results support the hypothesis that education augments the sense of control and healthy behaviors such as exercising, moderate drinking and avoiding smoking. Results also demonstrate that human capital resources mediate a partial part of the association between education and health. However, the effects of the sense of control and health behaviors on health are not consistent across four birth cohorts.

The sense of control significantly and positively associates with subjective health of the 1920-40 and 56-66 birth cohort, but inversely (statistical insignificantly) associates with subjective health of the 1941-55 and 67-79 birth cohort. It seems that the sense of control only enable some Taiwanese to achieve effective ways to good health. Moreover, since the sense of control indeed empirically associates with health for the 1920-40 birth cohort, which is the oldest group supposedly with strongest traditional values, the argument that the extent of effects of the sense of control is conditional on traditional Asian values is not supported. Nevertheless, because there is no interaction variable for the sense of control and Asian values in this study, further studies and samples are necessary to clarify this argument.

Among health behaviors, the positive effects of exercise are confirmed. However, the result that heavy drinkers of the 1920-40 birth cohort report significantly higher subjective health than moderate drinkers and abstainers is contradictory to normal expectations. This situation may be due to the selection effect. People with health problem may abstain from drinking earlier or become a moderate drinker before entering into their older ages. Therefore, elderly heavy drinkers may indeed have fine physical conditions.

Another particularly striking result is that smoking positively (insignificantly) associates with subjective health for Taiwanese “males”. This finding contradicts the well-recognized fact that smoking has a substantial negative effect on higher risks of mortality and serious chronic conditions such as liver cancer, lung cancer, cardiovascular diseases, respiratory diseases, chronic bronchitis, diabetes mellitus, liver cirrhosis, kidney disease etc. (Liaw and Chen 1998; Wen et al. 2005; Wen et al. 2004). Two plausible

reasons are provided. First, Wen and his colleagues (2005) find the ratio of smokers to ex-smokers decrease from 26.2 in the 20-29 years to 1.3 in the 70 years or older in Taiwan and argue that medical reasons are the major reasons for quitting smoking. Smokers who perceive worsening health and medical needs are more likely to reduce cigarettes consumption or to quit. The similar phenomenon is found in the research using British panel data (Clark and Etile 2002). The change of smoking behavior leads to the selection issue in the cross-sectional data. Taiwanese smokers who have not yet faced deteriorating health probably evaluate their own health as excellent or good. Conversely, smokers who have suffered from health problems or who have received medical treatments possibly rate their own health as not good or poor. Since these unhealthy smokers have decreased cigarettes consumption or quitted, they are plausibly regarded as the respondent with less smoking. Second, more than 50% of the total non-smoking population in Taiwan is exposed to environmental tobacco smoker exposure (ETS) at home, and about 40% at a daily basis (Wen et al. 2005). Those who report themselves as non-smokers in the study are still expose to the risk of passive smoking (Liaw and Chen 1998). Since Taiwanese people usually reside in smaller and more crowded homes, the extent of the adverse effect of ETS exposure on chronic diseases becomes serious (Wen et al. 2005). The negative effects of smoking are thus underestimated.

(3) LIMITATION

Several limitations of this study are noteworthy. First, this research investigates the differences in education-health association across four birth cohorts with diverse opportunity structure of education. However, this research fails to discern cohort effects and aging effects. If researches could compare the 1940-55 birth cohort when they are 50, with the 1956-66 birth cohort when they are 50, more evidences of cohort effects would probably be provided. Second, this study is unable to identify the causal relationship between education and health because of the limitation of the cross-sectional TSCS data. Longitudinal data are necessary for further research to clarify the causal effects of education on health and to explain the unanticipated findings found in this research. Third, this research lacks the valid measurements of physical functioning and chronic

diseases. Health is a multidimensional status. To better assess health requires more domains of health measurements. Moreover, cultural factors may influence the meaning, interpretation and awareness of “subjective” health. The measurements of “objective” physical functioning and chronic diseases are probably useful to ascertain the reliability of subjective health.

Appendix 1 Unstandardized Coefficients from OLS Regression on Social Support and Health (N = 1808).

Variables	Subjective Health
Education Years	.013 *
	(2.59)
Sociodemographic Characteristics	
Age	-.003 *
	(1.21)
Sex (male = 1)	.290 **
	(2.63)
Ethnicity (mainlander = 1)	-.016
	(0.34)
Marriage (married =1)	.010
	(0.25)
Work and Economic Resources	
Household income	.005
	(1.35)
Self employed [1]	.154 *
	(2.00)
Paid employed [1]	.127 +
	(1.70)
Unpaid family employed [1]	.134
	(1.38)
Retired [1]	.093
	(1.02)
Housewife [1]	.135
	(1.61)
Students [1]	.107
	(0.87)
Socio-Psychological Resources	
Negative interaction	-.079 **
	(3.34)
Social support	.077 **
	(2.87)
Sense of control	-.005
	(0.62)
Healthy Lifestyle	
Exercising	.042 **
	(2.70)
Moderate drinker [2]	-.008
	(0.22)
Heavy drinker [2]	.016
	(0.23)
Smoking	-.083
	(1.01)
Interaction	
Sex*Smoking	.119
	(1.39)
Sex*Age	-.003
	(1.43)
Data Year (2000 = 1)	_
Constant	2.754 ***
	(20.23)
R-squared	.0698

Note: + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$
1:Ref.: unemployed; 2: Ref. : never drinking

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