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# Social capital and preventive care use among the elderly under Taiwan's National Health Insurance

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ABSTRACT

*Objective:* The National Health Insurance (NHI) system in Taiwan provides free annual preventive care services and other disease-specific preventive care services under low copayments to people aged 65 and older, yet their utilization rates remain low ever since implementation. This study investigates whether social capital is associated with preventive care use among people aged 65 and older.

*Method:* Using the 2009 National Health Interview Study, this study measures social capital by the elderly's social network and social participation, and employs the logistic regressions to estimate the association between social capital and the odds of using a variety of preventive care services.

*Results:* The results show that social capital in terms of social network and social participation is significantly associated with the use of NHI general preventive care services. For disease-specific preventive care, it is social participation, rather than social network, that is related to the utilization rate.

*Conclusion:* The associations between social capital and different types of preventive care use found in our study could be considered as an important factor when making policies to promote the utilization of preventive care.

## 1. Introduction

Containing medical costs through prevention programs has become even more important as many countries' health care expenditures are high and continually growing. Prevention programs include a range of services such as vaccination, public sanitation and public health programs, preventive and screening services, and disease awareness and education programs. The above preventive measures help reduce medical costs by means of promoting healthy lifestyles, reducing the odds of becoming sick, treating diseases at early stages, and preventing medical complications (Kenkel, 2000). Individuals invest in their own health by adopting good lifestyle and using preventive care services to achieve and maintain the proper health. It is therefore imperative to understand the determinants of preventive care utilization from a broader perspective.

Economic variables as well as social factors affect the utilization of preventive care services. Among social factors, social capital plays a crucial role in health status, health care service utilization, and health behavior (Lochner, Kawachi, & Keenedy, 1999; Deri, 2005; Hawe & Shiell, 2000; Kim & Konrath, 2016). Researchers have defined and measured social capital in a variety of ways (Coleman, 1988; Macinko & Starfield, 2001; Putnam, 1993). Generally, social capital consists of certain features of social organizations, such as trust, norms, and networks. Some researchers focus on discussing community-level social capital, while others center on the exploration of individual-level social capital (Paldam, 2000).

There is a variety of channels through which social capital impacts individual health, health care service utilization, and lifestyle choices (Kawachi, Kennedy, & Glass, 1999). First, social capital facilitates access to health care services and health care delivery. Second, individuals obtain information via formal or informal networks, which may enhance people's ability to make healthy choices. Third, social capital improves individual health by enforcing or changing social norms.

### 1.1. Social capital and health

Many prior studies have empirically explored the relationship between social capital indicators and health-related variables such as health status, medical service utilization, and health behavior. Most found that social capital indicators are important determinants of physical health and psychological health. Using aggregate level data, Kawachi, Kennedy, Lochner, and Prothrow-Stith (1997) noted that lower investment in social capital is associated with higher mortality rates. Kawachi et al. (1999) showed that people living in areas with lower social capital are more likely to have self-reported poor health,

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after controlling for various socio-demographic variables. Rose (2000) used Russian data and presented that both social capital and human capital produce significant effects on physical health and emotional health. Using Taiwan data, Cheng and Chiang (2002) exhibited that a higher level of social capital is positively associated with health status and subjective happiness.

Using data of eight former Soviet republics, d'Hombres, Rocco, Suhrcke, and McKee (2006) supported the argument that social capital enhances individual health. Lindstrom and Mohseni (2009) examined political trust and psychological health in Sweden and reached the conclusion that a lower level of political trust is associated with worse mental health. Chang (2009) investigated the relationship between various forms of social capital and subjective happiness in Taiwan, finding that participating in civil groups, volunteering, participating in community activities, and the level of social trust all positively impact individual subjective happiness. Contrary to conclusions reached in most studies, Veenstra (2000) used Canadian individual-level data and found little evidence to support the argument that social capital enhances self-reported health.

Gray (2009) addressed the concept of social capital specifically for older people, defining social capital as "the array of social contacts that give access to social, emotional, and practical support". The author pointed out that in recent years the declining support from family increases elders' dependence on communities in the U.K., and found that frequent interaction with other people through informal tie provides rich support for older people. Empirical gerontological studies have confirmed that social capital is positively related to older people's physical health, mental health, well-being, and lower mortality rate (Ichida et al., 1997; Litwin & Shiovitz-Ezra, 2011; Pollack & von dem Knesebeck, 2004; Zamora-Macorra et al., 2017; de Brito et al., 2017). For instance, Pollack and von dem Knesebeck (2004) provided evidence that lack of social capital in terms of civic trust is associated with poorer self-rated health, depression, and functional limitations among Americans aged 60 and older. Litwin and Shiovitz-Ezra (2011) showed that more diverse social network is related to better well-being among Americans aged 65 and older. Ichida et al. (1997) provided evidence from an East-Asian country, showing that a higher level of social capital and a lower level of income inequality relate to better self-rated health among community residents aged 65 and older in Japan.

### 1.2. Social capital and medical service utilization

As for the effect of social capital on the utilization of medical services, several researchers showed that social capital is an important factor influencing demand for healthcare services. Social networks are one form of social capital and could change utilization in many directions mainly through dissemination of information. Using the Canadian National Population Health Survey, Deri (2005) noted that strong social networks have an effect on healthcare service utilization. Laporte et al. (2008) explored the relationship between community- and individual-level social capital and healthcare service utilization, using the 2001 Canadian Community Health Survey and the Canadian Census. The authors exhibited that social capital impacts physician visits, but not hospitalization services.

For the elderly population, Kim and Konrath (2016) examined the relationship between volunteering and health care use among American adults aged above 51. The authors found that volunteers compared to non-volunteers have a higher probability to utilize preventive services. In addition, volunteers spent fewer nights in a hospital. For Taiwan, using the 2005 National Health Interview Survey, Lin and Tsai (2013) focused on the elderly population and presented that social capital is positively associated with self-reported health and mental health. In addition, social network positively impacts the use of outpatient care services, but negatively affects the use of inpatient care services. Chu and Chen (2012) provided evidence that the implementation of National Health Insurance in Taiwan reduces the financial barrier to access health care and increases the role of informal social network in the utilization of health examinations among the elderly. They suggested that relatives and friends in the informal network improve the use of health examinations by providing related health information and enhancing the concept of health investment.

### 1.3. Social capital and health behavior

In the case of social capital and health-related behavior, Nollen, Catley, Davies, Hall, and Ahluwalia (2005) indicated that social support helps in the effort to quit smoking. Brown, Scheffler, Seo, and Reed (2006) contended that the proportion of community social capital attributable to religious groups is negatively and significantly related to consumers' tobacco consumption. Folland (2006) used Putnam's social capital index and state-level social capital to examine the relationship between social capital and risky health behaviors, such as smoking, binge drinking, and illicit drug consumption. Similar to findings in this line of research, the author found that social capital negatively impacts risky health behavior.

Using a sample of American aged 57–85, the study by Shiovitz-Ezra and Litwin (2012) indicated that older people with more resourceful social network are less likely to engage in risky health behavior such as alcohol abuse, more likely to participate in health-promoting activities such as walking and exercising, and more likely to seek alternative medicines such as acupuncture and massage therapies. Watt et al. (2014) presented similar results. Locher et al. (2005) found a positive relationship between social isolation and increased nutritional risk among all ethnic and gender groups of people aged 65 and older.

### 1.4. National Health Insurance (NHI) in Taiwan

Taiwan's NHI has been launched in 1995, providing comprehensive coverage in medical services for all people at low copayments. Before the implementation of NHI, 59% of the population was covered by various social insurance programs, such as labor insurance, government employee insurance, and farmers' insurance with different payment schemes and coverages. However, the remaining 41% of the population was uninsured, and most of the uninsured were the elderly, children, and people who lost jobs. Since 1995, NHI has integrated different social insurance programs and offered a uniform benefit package to all citizens and legal residents in Taiwan. It is a compulsory health insurance system with a single-payer design. NHI has a fairly comprehensive benefit package including outpatient care, inpatient care, prescription drugs, dental care, eye care, mental illness treatment, traditional Chinese medicine, and in-home care. The introduction of NHI has greatly alleviated people's financial burdens to access good quality of care with rather modest cost sharing. In Taiwan, most hospitals and clinics are private. Around 94% of health care providers are contracted with the government and obtain reimbursement when they provide medical services. In addition, people can easily access health care without referral and queuing. NHI is mainly financed by payroll based premiums. In order to contain growing medical expenditures, the government has also implemented a range of payment reforms in recent years (National Health Insurance Administration, 2016)

In 1996, NHI introduced the program of adult preventive care services, offering free general preventive care services to people aged 65 and older annually and people aged between 40 and 65 once every three years. The general adult preventive care services currently contain personal information inquiries, physical examinations, laboratory tests, and health consultation services. In addition to general preventive care, NHI offers a variety of disease-specific preventive care services to people aged 65 and older for free or at low copayments. Despite the utilization rate of preventive care services having increased over time since the inception of the adult preventive care program in 1996, general preventive care use remains around 35%.

### 1.5. Objective of the study

Our literature review shows that while the association between social capital and health/health behavior has been well established, relatively fewer studies have focused on the relationship between social capital and preventive care services, especially among the elderly. The objective of our study is to fill the gap by exploring the relationship between social capital and preventive care use among people aged 65 and older in Taiwan, where the preventive care services are free or at low copayments under NHI. Moreover, we distinguish different types of social capital, including informal network contact and formal social participation, and their associations with general and disease-specific preventive care uses. Given Taiwan's rapid aging population and rising health care expenditures among the nation's elderly, efficient use of preventive care services can help reduce medical costs and enhance population health. The results generated from our study could provide useful policy implications to the promotion of preventive care.

## 2. Method

### 2.1. Data and sample

The data of our study come from the National Health Interview Survey (NHIS), which is a nationally representative dataset conducted jointly by the National Health Research Institutes and Health Promotion Administration, Ministry of Health and Welfare in Taiwan. The survey treats each of the 23 cities and counties in Taiwan as a single population and independently draws representative samples from them based on a multi-stage stratified sampling design. Using face-to-face interviews, the survey has been conducted in a cross-sectional pattern every four years since 2001. The core sets of questionnaires in each survey include demographic background, health condition, health behavior, medical utilization, and family economic status. The section of medical utilization contains detailed information on respondents' utilization of various types of preventive care services. We employ the 2009 dataset, because it is the most recent released one.

The 2009 survey contains an effective sample of 25,636 people, with an overall response rate of 84%. The dataset includes three subsamples stratified by age: those aged under 12, those aged between 12 and 64, and those aged 65 and older, with 3531, 19,201 and 2904 effective respondents, respectively. The analytical sample for this study is elderly people aged 65 and older, because they are the target of the NHI adult preventive care program.

### 2.2. Model

The purpose of this study is to examine the association between social capital and the utilization of preventive care among people aged 65 and older covered by the free annual adult preventive care program. The model of preventive care service utilization is specified as:

$$Preventive_i = \beta_0 + \beta_1 SocCap_i + \beta_2 Z_i + u_i, \quad (1)$$

where the dependent variable $Preventive_i$ is a binary variable indicating whether or not an individual utilizes a specific preventive care service; $SocCap_i$ represents an individual's social capital; $Z_i$ is a vector of variables affecting an individual's preventive behavior; $u_i$ is the error term; and $\beta_0$, $\beta_1$, and $\beta_2$ are parameters to be estimated.

Based on the 2009 NHIS data, $Preventive_i$ is constructed by twelve separate preventive care services. We use all respondents' answers as to whether or not over the past year they received the *NHI general health examinations (adult preventive care services)*, *non-NHI general health examinations*, *blood pressure test*, *blood sugar test before a meal*, *blood sugar test after a meal*, *blood cholesterol test*, *flu shot*, *fecal occult blood test*, and *bone density test*. We also employ all respondents' answers as to whether or not they received a *colonoscopy* over the past ten years. For gender-specific preventive care services, we utilize female respondents' answers as to whether or not they took a *Pap test* in the past year and answers from female respondents aged below 70 as to whether or not they received a *breast examination* in the past year. Using twelve separate preventive services, Eq. (1) is estimated by the logistic model respectively.

We form our main explanatory variable $SocCap_i$ by two types of social capital measures: social network and social participation. First, the 2009 NHIS dataset contains information on each elderly respondent's frequency of contact with five types of relations, including (their) children, siblings, other relatives, friends, and neighbors. For each type of contact, respondents rate the frequency of contact as every day, at least two or three times a week, at least once a week, at least once a month, seldom, never, or having no such type of relation. We define each type of contact as a valid connection if the frequency of contact is at least once a month or more often. A contact is not a valid connection if the respondent seldom or never contacts with the relation or has no such relation. We use each respondent's number of valid connections as an indicator of their social network, ranging from 0 to 5.

Second, the 2009 NHIS contains information on whether and how often each elderly respondent participates in each of three types of social activities: volunteering, religious activity, and community/neighborhood activity. For each type of activity, we define that a respondent exhibits valid participation if he or she regularly or sometimes attends the activity. Participation is not valid if he or she seldom or never attends. The indicator of social participation is constructed by the number of activities that a respondent shows valid participation.

According to prior studies, $Z_i$ includes socioeconomic background (age, gender, educational attainment, marital status, ethnicity, region of residence, and household income) and health status (the presence of any activity limitation and chronic disease). Kenkel (1994) suggested that the demand for preventive care could increase with age, because older people face a higher incidence of preventable diseases. On the other hand, the demand for preventive care could decrease with age, because older people have a shorter length of remaining life and therefore have less incentive to invest in health. We include age and age squared in our model to control for the direction and rate of change of the age effect. To control for gender differences in preventive care service utilization (Vaidya, Partha, & Karmakar, 2012), we use a male dummy variable in our model.

Previous literature has suggested that health information and health knowledge play a significant role in health investment (Hsieh & Lin, 1997; Kenkel, 1990, 1991; Chen, Lin, & Lin, 2013). We use educational attainment to control for health knowledge in our model, with a dummy variable indicating whether the respondent has a high school degree or not. Spousal companionship and spouse's health behavior are also found to be important factors of preventive care use (Falba & Sindelar, 2008; Lau & Kirby,2009). We control the respondent's marital status as being married or not.

Chen, Diamant, Pourat, and Kagawa-Singer (2005) noted ethnic disparities in the use of preventive care services among the American elderly. To control for ethnic differences in Taiwan, according to the ethnicity of one's father we divide our sample into four major ethnic groups: Minnan, Hakka, Mainlander, and aborigine or others. We also include region of residence (north, center, south, and east) to account for possible regional barrier to preventive care services (Chen et al., 2013; Lin, Tian, & Chen, 2011) and employ household monthly income (< NTD50,000, NTD50,000-100,000, > NTD100,000, and missing values) to account for any potential financial barrier (Chen, Peng, Lee, & Liu, 2015). We create an additional group for missing values of household income, because there is a non-negligible proportion of people who did not state their household income levels.

We finally include the presence of activity limitation and chronic disease in the model to control for health status. The presence of activity limitation could limit older people's accessibility to preventive care. The presence of chronic disease, reflecting a person's health condition, influences his or her incentive to invest in health (Wu, 2003).

**Table 1**
Definition of variables.

| Variable | Definition |
|---|---|
| Dependent variables | |
| NHI health exams | =1 if receiving the NHI general health examinations in the past year; =0 otherwise. |
| Non-NHI health exams | =1 if receiving non-NHI general health examinations in the past year; =0 otherwise. |
| Blood pressure test | =1 if receiving blood pressure test in the past year; =0 otherwise. |
| Blood sugar test before a meal | =1 if receiving blood sugar test before a meal in the past year; =0 otherwise. |
| Blood sugar test after a meal | =1 if receiving blood sugar test after a meal in the past year; =0 otherwise. |
| Blood cholesterol test | =1 if receiving blood cholesterol test in the past year; =0 otherwise. |
| Flu shot | =1 if receiving flu shot in the past year; =0 otherwise. |
| Fecal occult blood test | =1 if receiving fecal occult blood test in the past year; =0 otherwise. |
| Colonoscopy | =1 if receiving colonoscopy over the past 10 years; =0 otherwise. |
| Bone density test | =1 if receiving bone density test in the past year; =0 otherwise. |
| Pap test | =1 if receiving Pap test in the past year; =0 otherwise. (Female only) |
| Breast exam | =1 if receiving breast ultrasound examination or mammography in the past year; =0 otherwise. (Female below age 70 only) |
| Independent variables | |
| Social capital | |
| Network | Count of social network, 0–5.<br>5 network contacts: Meeting regularly (at least once a month) with children, meeting regularly (at least once a month) with siblings, meeting regularly (at least once a month) with other relatives, contacting regularly (at least once a month) with friends, and interacting regularly (at least once a month) with neighbors. |
| Participation | Count of social participation, 0–3.<br>3 social activities: Being a volunteer, participating in any religious activity, and joining in any community group and activity. |
| Age | Respondent's age. |
| Age squared | Respondent's age squared. |
| Male | =1 if male; =0 if female. |
| High school | =1 if the number of schooling years is more than 12 (inclusive); =0 otherwise. |
| Married | =1 if being married; =0 otherwise. |
| Ethnicity | |
| Minnan (Reference) | =1 if the respondent's father is Minnan; =0 otherwise. |
| Hakka | =1 if the respondent's father is Hakka; =0 otherwise. |
| Mainlander | =1 if the respondent's father is a Mainlander (born in Mainland); =0 otherwise. |
| Aborigine and others | =1 if the respondent's fathers is aborigine or from remote islands or other countries; =0 otherwise. |
| Region of residence | |
| North (Reference) | =1 if living in Ilan County, Keelung City, Taipei City, Taipei County, Taoyuan County, Hsinchu City, Hsinchu County, or Miaoli County; =0 otherwise. |
| Center | =1 if living in Taichung City, Taichung County, Chunghua County, Nantou County, or Yunlin County; =0 otherwise. |
| South | =1 if living in Chiayi city, Chiayi County, Tainan City, Tainan County, Kaohsiung City, Kaohsiung County, or Pingtung County; =0 otherwise. |
| East | =1 if living in Taitung County, Hualien County, or Penghu County; =0 otherwise. |
| Household income | |
| NTD 0–50,000 (Reference) | =1 if household monthly income is below NTD50,000; =0 otherwise. |
| NTD 50,000–100,000 | =1 if household monthly income is between NTD50,000 (inclusive) and NTD100,000; =0 otherwise. |
| NTD 100,000 and over | =1 if household monthly income is equal to or higher than NTD100,000; =0 otherwise. |
| Missing value | =1 if household monthly income is missing; =0 otherwise. |
| Health status | |
| ADL | =1 if having any difficulty in performing any of the following activities: Eating, bathing, dressing, going to the bathroom, going to bed, or walking indoors; =0 otherwise. |
| Chronic disease | =1 if having any of the following chronic diseases: High blood pressure, diabetes, or high blood cholesterol; =0 otherwise. |

Our model defines a respondent as having activity limitation if he or she has any difficulty in eating, bathing, dressing, going to the bathroom, going to bed, or walking indoors. A respondent is defined as having a chronic disease if he or she has high blood pressure, diabetes, or high blood cholesterol.

Prior studies suggest that health insurance coverage is an important determinant of demand for preventive care, because insurance coverage affects the prices of preventive care services (Kenkel, 1994; DeVoe, Fryer, Phillips, & Green, 2003; Hsieh & Lin, 1997; Parente, Salkever, & DaVanzo, 2005). In Taiwan, over 99% of people are covered by NHI. Unlike previous NHIS surveys, the 2009 NHIS does not contain information regarding whether or not an individual has purchased private health insurance. Therefore, we do not control for private health insurance in our model. Table 1 summarizes the definitions of all variables in the model.

## 3. Results

### 3.1. Descriptive statistics

Table 2 reports the summary statistics. Excluding missing values, about one third of the respondents have utilized the NHI general health examinations, while only 8.8% of the respondents have received non-NHI general health examinations. The utilization rates of blood pressure test, blood sugar test before a meal, and flu shot are higher than 50%; however, for most of disease-specific preventive care services, the utilization rates are below 20%.

As for our main explanatory variables, an individual has an average of 2.633 out of 5 network contacts and participates in an average of 0.573 out of 3 social activities. The coefficient of correlation between the two social capital variables is 0.306. The two social capital variables have positive coefficients of correlation with most preventive care services. For instance, the correlation between network contacts and NHI general health examinations is 0.092 and the correlation between social participation and NHI general health examination is 0.127.

### 3.2. Estimation results

Tables 3 and 4 report the logistic model estimation results for twelve different types of preventive care services. Table 3 presents the results for three types of preventive care: NHI general health examinations, non-NHI general health examinations, and blood related tests. Table 4 presents the results for disease-specific preventive care services. Odds ratios are reported, representing the multiplicative effect

**Table 2**
Summary statistics.

| Variable | Mean | S.D. | N |
|---|---|---|---|
| Dependent variables | | | |
| NHI health exams | 0.326 | 0.469 | 2873 |
| Non-NHI health exams | 0.088 | 0.283 | 2889 |
| Blood pressure test | 0.907 | 0.290 | 2889 |
| Blood sugar test before a meal | 0.535 | 0.499 | 2831 |
| Blood sugar test after a meal | 0.155 | 0.362 | 2817 |
| Blood cholesterol test | 0.450 | 0.498 | 2813 |
| Flu shot | 0.535 | 0.499 | 2883 |
| Fecal occult blood test | 0.139 | 0.346 | 2847 |
| Colonoscopy | 0.145 | 0.352 | 2865 |
| Bone density test | 0.136 | 0.343 | 2844 |
| Pap test | 0.198 | 0.399 | 1597 |
| Breast exam | 0.206 | 0.405 | 510 |
| Independent variables | | | |
| Social capital | | | |
| Network | 2.633 | 1.267 | 2866 |
| Participation | 0.573 | 0.804 | 2901 |
| Age | 74.754 | 6.775 | 2904 |
| Age squared | 5633.976 | 1041.690 | 2904 |
| Male | 0.431 | 0.495 | 2904 |
| High school | 0.134 | 0.341 | 2874 |
| Married | 0.620 | 0.485 | 2903 |
| Ethnicity | | | |
| Minnan (Reference) | 0.735 | 0.441 | 2898 |
| Hakka | 0.131 | 0.338 | 2898 |
| Mainlander | 0.113 | 0.316 | 2898 |
| Aborigine and others | 0.021 | 0.142 | 2898 |
| Region of residence | | | |
| North (Reference) | 0.318 | 0.466 | 2902 |
| Center | 0.231 | 0.421 | 2902 |
| South | 0.316 | 0.465 | 2902 |
| East | 0.136 | 0.343 | 2902 |
| Household income | | | |
| NTD 0–50,000 (Reference) | 0.548 | 0.498 | 2904 |
| NTD 50,000–100,000 | 0.092 | 0.289 | 2904 |
| NTD 100,000 and over | 0.033 | 0.180 | 2904 |
| Missing value | 0.327 | 0.469 | 2904 |
| Health status | | | |
| ADL | 0.178 | 0.383 | 2901 |
| Chronic disease | 0.632 | 0.482 | 2903 |

Note: Pap test and breast exam have fewer observations, because Pap test is for female only and breast exam is for female aged below 70 only. For other variables, the sample sizes are slightly lower than the full sample size due to missing values.

of a unit change in an explanatory variable on the relative risk (odds) of utilizing the preventive care rather than not utilizing the preventive care. An odds ratio greater than one means that a unit increase in an explanatory variable increases the odds; an odds ratio lower than one means that a unit increase in an explanatory variable reduces the odds (Cameron & Trivedi, 2010).

Controlling for other socioeconomic variables, our results show that social participation is significantly associated with the NHI general health examinations and most types of disease-specific preventive care services, while social network is related to the NHI general health examinations and some of the preventive care services only. The elderly who participate in one more social activity have around 30% higher odds of taking the NHI general health examinations, blood pressure test, flu shot, fecal occult blood test, and bone density test. The participants have 19.5% higher odds of having a colonoscopy. For females, participating in one more social activity is associated with 25.1% higher odds of taking a Pap test. For females aged below 70, participating in one more social activity contributes to 33.1% higher odds of receiving a breast examination. However, we do not find social participation to have significant associations with non-NHI general health examinations, blood sugar tests, and blood cholesterol test.

As for social network, our results show that the elderly who own one more type of network contact have 10.2% higher odds of receiving NHI general health examinations, 14.4% higher odds of non-NHI general health examinations, 10.9% higher odds of a blood sugar test after meal, and 9.8% higher odds of a blood cholesterol test. For female-specific health examinations, having one more type of network contact results in 18.4% higher odds of taking a Pap test. However, social network is not significantly associated with most of the disease-specific preventive care uses.

Among the socioeconomic variables, having a high school degree, being married, and having any chronic disease are all significantly associated with most of the preventive care utilizations. As people grow older, their odds of receiving NHI general health examinations, blood sugar tests before and after a meal, flu shot, and Pap test all increase. The pattern of the increase in odds follows an inverted U-shape, as the odds ratio of age squared is lower than 1. Compared to females, males have higher odds of receiving non-NHI general health examinations, but lower odds of receiving a blood cholesterol test and bone density test.

Compared to people who live in the north area, people living in the central area have higher odds of utilizing NHI general health examinations and flu shot, but lower odds of utilizing other preventive care services, including non-NHI general health examinations, blood sugar tests, blood cholesterol test, and fecal occult blood test. Household income is not found to be significant. Lastly, while having a chronic disease results in much greater odds of receiving most types of preventive care use, having any activity limitation reduces the odds of having NHI general health examinations, flu shot, and Pap test, but increases the odds of taking a blood sugar test after a meal.

Tables 5 and 6 present the estimation results of logistic model for subsamples divided by the presence of chronic disease and by gender, respectively. The odds ratios of social network and participation are reported. The results in Table 5 show that the chronic-disease subsample exhibits a similar pattern as the full sample, in which both social network and social participation have significant associations with the NHI general health examinations, but only social participation is significantly related to disease-specific preventive care services. However, in the subsample with no chronic disease, the link between social participation and disease-specific preventive care goes away. The effects of participating in more activities on the odds of taking a colonoscopy, a bone density test, a Pap test, and a breast examination become insignificant.

Table 6 shows the differences between the male and female subsamples. We can observe that for the NHI general health examinations and the blood pressure test, the positive effects of social network and social participation are greater and more significant among the female group than the male group. However, in the case of disease-specific preventive care, there is no systematic difference between males and females.

## 4. Discussion

The purpose of our study is to examine the association between social capital and the utilization of preventive care services by Taiwanese elderly under the NHI system. NHI provides basic preventive care services and a variety of advanced health examinations at very low copayments. As the utilization rates of the preventive care services remain low, our study explores whether social capital is associated with preventive care use.

The literature has suggested several pathways through which social capital could improve preventive care behavior, including social capital facilitating access to healthcare services, individuals obtaining health information via formal or informal social networks, and social capital enforcing social norms of health investment (Kawachi et al., 1999). Our results support the hypothesis that social capital improves the elderly's preventive care utilization.

For the NHI general health examinations (the adult preventive care services), social capital in terms of both network contacts and social participation is significantly associated with their utilization. There are

**Table 3**
Social capital and preventive care utilization.

| Dependent variable | NHI health exam | Non-NHI health exam | Blood pressure test | Blood sugar test (before) | Blood sugar test (after) | Blood cholesterol test |
|---|---|---|---|---|---|---|
| Independent variables | | | | | | |
| Social capital | | | | | | |
| Network | 1.102*** | 1.144** | 1.083 | 1.051 | 1.109** | 1.098*** |
| | (0.040) | (0.070) | (0.064) | (0.037) | (0.054) | (0.039) |
| Participation | 1.303*** | 1.055 | 1.302*** | 1.087 | 0.958 | 1.035 |
| | (0.070) | (0.086) | (0.121) | (0.059) | (0.073) | (0.055) |
| Age | 1.465*** | 0.962 | 1.039 | 1.788*** | 1.457** | 1.199 |
| | (0.195) | (0.201) | (0.180) | (0.237) | (0.278) | (0.159) |
| Age squared | 0.998*** | 1.000 | 1.000 | 0.996*** | 0.997** | 0.999 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Male | 0.895 | 1.325* | 0.971 | 0.892 | 1.094 | 0.842* |
| | (0.083) | (0.199) | (0.144) | (0.080) | (0.127) | (0.075) |
| High school | 1.579*** | 2.262*** | 1.589* | 1.449*** | 1.817*** | 1.911*** |
| | (0.209) | (0.426) | (0.398) | (0.191) | (0.296) | (0.248) |
| Married | 1.457*** | 0.633*** | 1.407** | 1.164* | 1.223* | 1.128 |
| | (0.138) | (0.096) | (0.219) | (0.106) | (0.149) | (0.103) |
| Ethnicity | | | | | | |
| Minnan (Reference) | | | | | | |
| Hakka | 1.222 | 0.679 | 0.897 | 0.903 | 0.545*** | 0.981 |
| | (0.154) | (0.162) | (0.194) | (0.114) | (0.101) | (0.123) |
| Mainlander | 1.416** | 1.045 | 1.356 | 1.782*** | 0.977 | 1.548*** |
| | (0.209) | (0.256) | (0.388) | (0.277) | (0.180) | (0.230) |
| Aborigine and others | 1.451 | 0.726 | 1.346 | 0.866 | 0.579 | 0.583* |
| | (0.425) | (0.359) | (0.866) | (0.252) | (0.228) | (0.183) |
| Region of residence | | | | | | |
| North (Reference) | | | | | | |
| Center | 1.299** | 0.625** | 0.880 | 0.799* | 0.464*** | 0.826* |
| | (0.153) | (0.128) | (0.175) | (0.093) | (0.074) | (0.096) |
| South | 1.012 | 1.057 | 0.955 | 0.947 | 0.562*** | 1.060 |
| | (0.112) | (0.185) | (0.174) | (0.101) | (0.079) | (0.112) |
| East | 1.429*** | 0.954 | 1.197 | 0.914 | 1.082 | 0.810 |
| | (0.198) | (0.215) | (0.298) | (0.128) | (0.182) | (0.112) |
| Household income | | | | | | |
| NTD 0–50,000 (Reference) | | | | | | |
| NTD 50,000–100,000 | 1.025 | 1.168 | 1.195 | 1.062 | 0.965 | 0.854 |
| | (0.152) | (0.251) | (0.311) | (0.153) | (0.183) | (0.123) |
| NTD 100,000 and over | 0.638* | 0.861 | 1.622 | 1.153 | 1.045 | 0.998 |
| | (0.159) | (0.301) | (0.811) | (0.271) | (0.294) | (0.227) |
| Missing value | 0.971 | 0.760* | 1.125 | 1.070 | 0.730** | 0.808** |
| | (0.091) | (0.119) | (0.170) | (0.097) | (0.093) | (0.074) |
| Health status | | | | | | |
| ADL | 0.633*** | 1.241 | 1.233 | 1.138 | 2.109*** | 0.925 |
| | (0.083) | (0.254) | (0.266) | (0.135) | (0.316) | (0.113) |
| Chronic disease | 1.639*** | 1.458** | 9.466*** | 3.395*** | 2.994*** | 3.016*** |
| | (0.147) | (0.217) | (1.556) | (0.288) | (0.396) | (0.264) |
| Constant | 0.000*** | 2.094 | 0.215 | 0.000*** | 0.000** | 0.001 |
| | (0.000) | (16.476) | (1.431) | (0.000) | (0.000) | (0.005) |
| N | 2805 | 2816 | 2816 | 2758 | 2746 | 2744 |
| Log-likelihood | −1689.821 | −802.244 | −732.473 | −1751.061 | −1095.831 | −1749.946 |

Note: Robust standard errors in parentheses.
* p < 0.1.
** p < 0.05.
*** p < 0.01.

three possible channels for this link based on Kawachi et al. (1999). First, older people might gain information about the availability of services and information concerning health from their network contacts and social groups, which subsequently induce them to receive those services. Second, the network contacts and social groups might accompany older people to receive preventive care services. Third, the idea of health investment in terms of preventive care could be enhanced within formal social groups and informal network contacts. Our results also show that the link between social capital and the utilization of NHI general health examinations is stronger among females. It suggests that the social influence on women seems to be greater (Antonucci & Akiyama, 1987).

For disease-specific preventive care (including flu shot, fecal occult blood test, colonoscopy, bone density test, Pap test, and breast examination), social participation (but not network contact) induces utilization by the elderly, especially those who have at least one chronic disease. There are three possible explanations for this phenomenon. First, it is peers in the groups who help improve the elderly's disease-specific preventive behavior. We conjecture that older people attend social groups in which members are in the same age cohort and share similar interests. Peers in these groups are then more capable of enhancing each other's disease-specific preventive care behavior. Second, there might be better knowledge exchange within formal groups with respect to disease-specific information. For example, local public health centers often distribute flyers and posters of disease information, and even hold health education classes in community centers. Another example is that in Taiwan, many volunteering opportunities are in hospitals, where professional health information is readily available. Third, as for the stronger effect of social participation among people with chronic diseases, it could be that people with chronic disease might have more hospital visits, be more health conscious, and be more aware of certain health conditions, and therefore are more likely to receive

**Table 4**
Social capital and preventive care utilization.

| Dependent variable | Flu shot | Fecal occult blood test | Colonoscopy | Bone density test | Pap test | Breast exam |
|---|---|---|---|---|---|---|
| Independent variables | | | | | | |
| Social capital | | | | | | |
| Network | 1.051 | 0.950 | 1.052 | 1.030 | 1.184*** | 1.054 |
| | (0.037) | (0.049) | (0.050) | (0.052) | (0.070) | (0.104) |
| Participation | 1.293*** | 1.325*** | 1.195*** | 1.272*** | 1.251*** | 1.331** |
| | (0.069) | (0.093) | (0.082) | (0.090) | (0.101) | (0.173) |
| Age | 2.154*** | 1.203 | 0.872 | 0.915 | 2.038** | 1607.572 |
| | (0.253) | (0.223) | (0.150) | (0.166) | (0.678) | (14148.251) |
| Age squared | 0.995*** | 0.999 | 1.001 | 1.000 | 0.994** | 0.947 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.062) |
| Male | 0.934 | 1.092 | 1.155 | 0.447*** | | |
| | (0.081) | (0.137) | (0.135) | (0.057) | | |
| High school | 1.114 | 1.699*** | 1.974*** | 1.656*** | 2.485*** | 3.272*** |
| | (0.144) | (0.280) | (0.299) | (0.279) | (0.637) | (1.139) |
| Married | 1.473*** | 1.128 | 1.047 | 1.369** | 1.309* | 0.840 |
| | (0.132) | (0.144) | (0.130) | (0.175) | (0.189) | (0.205) |
| Ethnicity | | | | | | |
| Minnan (Reference) | | | | | | |
| Hakka | 1.252* | 0.559*** | 0.759 | 0.783 | 0.858 | 1.529 |
| | (0.159) | (0.115) | (0.137) | (0.145) | (0.177) | (0.499) |
| Mainlander | 1.538*** | 1.929*** | 1.500** | 1.355 | 0.520* | 0.891 |
| | (0.222) | (0.347) | (0.267) | (0.280) | (0.190) | (0.441) |
| Aborigine and others | 0.859 | 2.094** | 0.692 | 0.323 | 1.327 | 0.561 |
| | (0.250) | (0.740) | (0.294) | (0.242) | (0.626) | (0.642) |
| Region of residence | | | | | | |
| North (Reference) | | | | | | |
| Center | 1.477*** | 0.515*** | 0.998 | 1.282 | 0.879 | 1.109 |
| | (0.166) | (0.086) | (0.152) | (0.198) | (0.170) | (0.382) |
| South | 1.116 | 0.724** | 0.897 | 1.043 | 0.753 | 1.180 |
| | (0.115) | (0.103) | (0.128) | (0.155) | (0.133) | (0.339) |
| East | 1.588*** | 0.655** | 1.163 | 0.652* | 0.899 | 1.132 |
| | (0.218) | (0.129) | (0.208) | (0.148) | (0.208) | (0.458) |
| Household income | | | | | | |
| NTD 0–50,000 (Reference) | | | | | | |
| NTD 50,000–100,000 | 1.337* | 1.117 | 1.300 | 1.210 | 1.046 | 1.120 |
| | (0.199) | (0.218) | (0.235) | (0.227) | (0.260) | (0.414) |
| NTD 100,000 and over | 1.237 | 1.284 | 1.092 | 1.020 | 1.060 | 1.498 |
| | (0.282) | (0.349) | (0.302) | (0.291) | (0.438) | (0.872) |
| Missing value | 1.001 | 1.130 | 0.999 | 0.947 | 1.143 | 1.192 |
| | (0.087) | (0.143) | (0.125) | (0.120) | (0.169) | (0.302) |
| Health status | | | | | | |
| ADL | 0.763** | 1.101 | 1.133 | 0.906 | 0.616* | 0.948 |
| | (0.087) | (0.192) | (0.183) | (0.163) | (0.158) | (0.458) |
| Chronic disease | 1.466*** | 1.235* | 1.439*** | 1.026 | 1.714*** | 1.423 |
| | (0.121) | (0.147) | (0.173) | (0.123) | (0.266) | (0.353) |
| Constant | 0.000*** | 0.000 | 30.475 | 7.905 | 0.000** | 0.000 |
| | (0.000) | (0.003) | (198.361) | (54.252) | (0.000) | (0.000) |
| N | 2810 | 2779 | 2794 | 2774 | 1559 | 503 |
| Log-likelihood | −1835.248 | −1071.417 | −1127.280 | −1054.242 | −676.384 | −245.212 |

Note: Robust standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

disease-specific preventive care through peer effects.

Consistent with previous studies, we find that education and marriage lead to more utilization. Education enhances health information, which results in a higher level of health investment. Spouses might be a source of information and accompaniment or give people an incentive to improve their health (Lau & Kirby, 2009). The presence of chronic disease is related to the utilization of most preventive care services. It could be the case that people having chronic diseases are more health conscious and therefore are more likely to pursue preventive care services. Those people with chronic diseases also visit doctors regularly and are recommended by doctors to take more preventive care services (Chen et al., 2013).

There are two possible reasons that household income does not play a role in the decisions of preventive care in our study. First, the question of household income in our dataset contains a choice of "Don't know" for people aged 65 and over, and about one third of the respondents in our sample chose this option. Second, for the elderly aged 65 and older, the NHI general health examinations and most of the other specific preventive care services are covered by NHI for free or at low copayments. Therefore, a financial barrier for people to pursue preventive care services does not seem to exist.

Our study comes with some limitations. First, due to data limitation, our study focuses only on social networks and social participation at the individual level, and our social participation includes only volunteering, religious activity, and community activity. As the literature defines social capital to consist of trust, norms and networks, future studies with better datasets could take into account other features such as other types of social participation (e.g., political activity), and use direct measures of trust and norms. Future studies could also explore community-level social capital. Research in these directions could improve our understanding of the relationship between preventive behavior and the broader sense of social capital for the elderly. Second, ever

**Table 5**
Social capital and preventive care utilization – subsamples by chronic disease.

| Dependent variable | NHI health exam | Non-NHI health exam | Blood pressure test | Blood sugar test (before) | Blood sugar test (after) | Blood cholesterol test |
|---|---|---|---|---|---|---|
| Chronic-disease subsample | | | | | | |
| Network | 1.080* | 1.196** | 1.267 | 1.043 | 1.109* | 1.077* |
| | (0.048) | (0.087) | (0.186) | (0.046) | (0.062) | (0.047) |
| Participation | 1.338*** | 0.972 | 1.537* | 1.056 | 0.877 | 1.063 |
| | (0.089) | (0.099) | (0.355) | (0.073) | (0.076) | (0.072) |
| N | 1784 | 1790 | 1789 | 1750 | 1735 | 1744 |
| No-chronic-disease subsample | | | | | | |
| Network | 1.136** | 1.111 | 1.051 | 1.088 | 1.143 | 1.159** |
| | (0.073) | (0.123) | (0.069) | (0.064) | (0.117) | (0.072) |
| Participation | 1.174* | 1.251 | 1.277** | 1.152 | 1.177 | 1.008 |
| | (0.107) | (0.172) | (0.133) | (0.100) | (0.180) | (0.092) |
| N | 1021 | 1026 | 1027 | 1008 | 1011 | 1000 |

| Dependent variable | Flu shot | Fecal occult blood test | Colonoscopy | Bone density test | Pap test | Breast exam |
|---|---|---|---|---|---|---|
| Chronic-disease subsample | | | | | | |
| Network | 0.983 | 0.936 | 1.069 | 1.012 | 1.235*** | 1.090 |
| | (0.043) | (0.058) | (0.063) | (0.064) | (0.086) | (0.138) |
| Participation | 1.258*** | 1.348*** | 1.221** | 1.393*** | 1.303*** | 1.300* |
| | (0.086) | (0.117) | (0.104) | (0.123) | (0.126) | (0.203) |
| N | 1787 | 1768 | 1779 | 1764 | 1058 | 324 |
| No-chronic-disease subsample | | | | | | |
| Network | 1.144** | 0.997 | 1.025 | 1.089 | 1.135 | 1.007 |
| | (0.064) | (0.090) | (0.083) | (0.092) | (0.129) | (0.177) |
| Participation | 1.269*** | 1.287** | 1.198 | 1.130 | 1.185 | 1.405 |
| | (0.107) | (0.153) | (0.143) | (0.136) | (0.188) | (0.343) |
| N | 1023 | 1011 | 1015 | 996 | 501 | 176 |

Note: The models are controlled for age, gender, education, marital status, ethnicity, region of residence, household income, and health status. Due to the relatively smaller sample sizes of the subgroups, we use a dummy variable (age above/below 75) to control for the age effect. Robust standard errors in parentheses.
* p < 0.1.
** p < 0.05.
*** p < 0.01.

**Table 6**
Social capital and preventive care utilization – subsamples by gender.

| Dependent variable | NHI health exam | Non-NHI health exam | Blood pressure test | Blood sugar test (before) | Blood sugar test (after) | Blood cholesterol test |
|---|---|---|---|---|---|---|
| Male subsample | | | | | | |
| Network | 1.045 | 1.047 | 0.967 | 1.066 | 1.153* | 1.121** |
| | (0.056) | (0.091) | (0.086) | (0.057) | (0.084) | (0.059) |
| Participation | 1.239*** | 1.095 | 1.108 | 1.110 | 1.054 | 0.979 |
| | (0.102) | (0.134) | (0.141) | (0.091) | (0.116) | (0.080) |
| N | 1217 | 1218 | 1216 | 1198 | 1196 | 1194 |
| Female subsample | | | | | | |
| Network | 1.149*** | 1.272*** | 1.225** | 1.055 | 1.082 | 1.090* |
| | (0.058) | (0.109) | (0.103) | (0.050) | (0.075) | (0.053) |
| Participation | 1.354*** | 1.073 | 1.602*** | 1.087 | 0.872 | 1.102 |
| | (0.096) | (0.120) | (0.220) | (0.080) | (0.095) | (0.080) |
| N | 1588 | 1598 | 1600 | 1560 | 1550 | 1550 |

| Dependent variable | Flu shot | Fecal occult blood test | Colonoscopy | Bone density test |
|---|---|---|---|---|
| Male subsample | | | | |
| Network | 1.052 | 0.850** | 1.035 | 1.009 |
| | (0.055) | (0.061) | (0.073) | (0.091) |
| Participation | 1.244*** | 1.246** | 1.293** | 1.388*** |
| | (0.099) | (0.136) | (0.135) | (0.168) |
| N | 1216 | 1208 | 1214 | 1203 |
| Female subsample | | | | |
| Network | 1.046 | 1.065 | 1.065 | 1.056 |
| | (0.048) | (0.076) | (0.071) | (0.065) |
| Participation | 1.285*** | 1.449*** | 1.132 | 1.229** |
| | (0.091) | (0.137) | (0.105) | (0.108) |
| N | 1594 | 1571 | 1580 | 1571 |

Note: The models are controlled for age, gender, education, marital status, ethnicity, region of residence, household income, and health status. Due to the relatively smaller sample sizes of the subgroups, we use a dummy variable (age above/below 75) to control for the age effect. Robust standard errors in parentheses.
* p < 0.1.
** p < 0.05.
*** p < 0.01.

since the 2009 survey, NHIS does not contain information on whether the respondents have private health insurance, and therefore we do not control for private health insurance in our model. As suggested by previous studies, having private health insurance could induce people to utilize more preventive care services. Although most of the preventive care services examined herein are covered by NHI and the effect of private health insurance might be relatively minor, for people who are not aware of NHI's preventive care services, private health insurance might still play some sort of a role.

## 5. Conclusion

To promote population health and better control the escalating medical expenditures resulting from the rapid growing aging population, encouraging people to take preventive measures and use preventive care services is of great importance. Under Taiwan's NHI, most preventive care services are provided on a periodical basis at low copayments to people aged 65 and older, but the utilization rates remain low. Our study provides evidence that social capital is associated with the elderly's preventive care behavior, and social capital relates to general and disease-specific preventive care uses through different channels. The associations between social capital and different types of preventive care use found in our study could be considered as an important factor when making policies to promote the utilization of preventive care.

## Conflicts of interest

None.

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