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EXPLORING THE ASSOCIATION BETWEEN NETWORK, COGNITIVE, STRUCTURAL SOCIAL CAPITAL AND THE RISK OF CLINICAL DEPRESSION IN TAIWAN

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ABSTRACT

Depression is the one of most common mental health conditions in Taiwan. Although evidence suggests that social capital is associated with depression, few studies have comprehensively explored the influence of social capital on depression. Also evidence in Taiwan is limited in comparison to other Western countries. Data from the 1997 Taiwan Social Change Survey (n=2,598), which is the only dataset that contains the best available information to measure and compare all three dimensions of social capital (network, cognitive, and structural social capital), were used to examine the association between three dimensions of neighborhood- and individual-level social capital and depression among Taiwanese adults 20 years and older. The 20-item Center for Epidemiological Studies Depression Scale was used to measure depressive symptoms; scores ≥ 15 indicated being at a risk for clinical depression. Three dimensions of social capital were assessed: cognitive social capital (measured using questions on perceived neighborhood trust and reciprocity), structural social capital (measured using questions about local social participation), and network social capital (measured using a position generator). In order to develop a greater understanding of the mechanisms linking social capital and depression, multivariable logistic regression models were used to assess the relationship between the three dimensions of social capital and the risk of clinical depression, the association between age-based patterns of social capital and the risk of clinical depression, and the independent association between neighborhood-level social capital and the risk of clinical depression.

The main findings from this study suggest the dimensions of social capital did not have the same relationship with being at the risk of clinical depression. Higher scores of cognitive social capital and structural social capital were both independently associated with lower odds of being at risk for clinical depression after controlling for potential confounders. Network social capital was not associated with being at risk for clinical depression except for network diversity. In the second paper, the study revealed that there are different age patterns for network, cognitive and structural social capita but we only observed age variations in network social capital and the risk for clinical depression among age 65 and older. The results from the third paper showed that neighborhood-level social capital was not associated with the risk of clinical depression. Disentangling the multidimensional and multilevel nature of social capital may inform our understanding of the mechanisms linking social capital and depression to promote mental health.

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CHAPTER 1

INTRODUCTION

1.1   Background and Significance

Depression is among the most prevalent mental illnesses experienced throughout

the world (1). According to the World Health Organization, depression is ranked as one

of the leading cause of disability worldwide (2) and a major contributor to the global

burden of disease. In Taiwan, depression is an increasing public health problem.

Approximately 5.3% of the Taiwanese population ages 15 years and older have

experienced severe depression in the past year (3, 4). Furthermore, there are age

differences in depression in Taiwan. For example, 6.8% of the Taiwanese population

ages 15-17 years have experienced severe depression but over 8% the Taiwanese

population ages 65 years and older have experienced severe depression (3, 4).

Previous studies have demonstrated that individual-level factors (i.e. gender and

marital status) and socioeconomic position indicators (educational attainment,

employment status, and health insurance status) predicts higher risk of depression (5-7).

It has been suggested that the unemployment and an increasing divorce rate may be

important at explaining depression risk (5), but these factors do not completely explain

the risk of depression in Taiwan. Psychosocial factors such as social capital may be

important to furthering our understanding of depression in Taiwan.

Social capital is a multidimensional concept that describes social relationships

within societies or between groups of people (8-10). Several prior studies conducted in

the U.S., the UK, and Canada demonstrated strong negative associations between depression and social capital. (11-13). These studies have contributed to elucidating some of the mechanisms linking social capital and risk of depression. However, studies exploring the relationship between social capital and depression in Taiwan are limited, although several studies have examined the relationship between social capital, health, and health behaviors among Taiwanese adults (14) (15).

To our knowledge, only one study examined social capital and depression in Taiwan (16). This study defined social capital using only one indicator, network social capital, which assesses how resources are accessed within social networks for personal benefit (17, 18). The results from this study suggested a negative association with depression in Taiwan. However, social capital may also be characterized by cognitive and structural dimensions. The cognitive dimension represents perceptions of support, reciprocity, sharing and trust (what people "feel") and the structural dimension refers to the extent and type of associational links or activity (what people "do") (19). Researchers are increasingly interested in differentiating between cognitive (20-22), structural (23, 24), and network (12, 16, 25) components of social capital and its influence on depression. Each dimension represents a specific mechanism through which social capital may operate to increase or decrease risk of depression. Investigating how multiple dimensions of social capital influence depression warrants further investigation and may provide valuable insight about depression among Taiwanese adults.

Relatively little attention has been given to whether the association between age-based patterns of social capital and depression. Overall levels of social interaction (i.e. trust and daily contact), tends to decline across the life course, while network social

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capital ties such as employment and work connections may expand across the life-course (26). It is possible that these patterns of social capital accumulation or decline with age may translate into health outcomes. To develop a greater understanding of the mechanisms linking social capital and depression, this study examined the age-based patterns of network, cognitive and structural social capital and assess whether it is associated with age differences in the risk of depression.

Social capital can be conceptualized as a property of groups of people (a contextual construct) or of individuals (19, 27, 28). Individual-level social capital, based on Bourdieu, conceptualizes social capital as a benefit arising principally through the scope and influence of an individual's social network (29). Contextual-level social capital, derived from Putman, emphasizes the collective aspect of social capital and has a shared property based on community activities and not of individuals alone (10, 30). Numerous studies have documented the independent association between depression and social capital as both on individual- and contextual-level concept (12, 20, 28, 31, 32). However, whether social capital is a contextual characteristic of communities, school, workplace or societies, or a beneficial property which is associated with individuals and their social relationships is still debated (33, 34). Understanding whether the health benefits of social capital are individual, contextual or both may guide the development of effective intervention and prevention programs (35) to improve or prevent depressive symptoms. However, in Taiwan, the examination of this issue still remains inconclusive and need to explore how the association between contextual- and individual-level network, cognitive and structural social capital and depression.

The overall goal of this study was to develop a greater understanding of the mechanisms linking social capital and depression. More specifically we explored the association between social capital and the risk of clinical depression, age-based patterns and multiple levels of social capital and their associations with the risk of clinical depression. Using data from the Taiwan Social Change Survey (TSCS), a national survey administered every 5 years that assesses a wide-range of personal and social issues such as personal need, education, social class, politics, media influences, cultural values, physical health, and mental health. The following aims were explored:

Specific Aim 1: To examine the association between three dimensions of social capital – network, cognitive and structural social capital – and the risk of clinical depression.

Hypothesis 1.1: It is hypothesized that there will be a negative association between cognitive social capital and the risk of clinical depression.

Hypothesis 1.2: It is hypothesized that there will be a negative association between structural social capital and the risk of clinical depression.

Hypothesis 1.3: It is hypothesized that there will be a negative association between network social capital and the risk of clinical depression.

Specific Aim 2: To examine the associations between age-based patterns of network, cognitive and structural social capital and the risk of clinical depression.

Hypothesis 2.1: It is hypothesized that there are distinct patterns in age-based patterns of network, cognitive and structural social capital.

Hypothesis 2.2: It is hypothesized that the association between network social capital and the risk of clinical depression will vary by age.

Hypothesis 2.3: It is hypothesized that cognitive and structural social capital would consistently associate with the risk of clinical depression among different ages.

Specific Aim 3: To examine the independent association between three dimensions of neighborhood-level social capital – network, cognitive and structural social capital – and the risk of clinical depression after adjusting potential confounders and individual-level social capital.

Hypothesis 3.1: It is hypothesized that neighborhood-level network social capital will be associated with the risk of clinical depression after accounting for neighborhood-level (i.e. neighborhood characteristics) and individual-level (i.e. demographic factor, socioeconomic status and network social capital) confounders.

Hypothesis 3.2: It is hypothesized that neighborhood-level cognitive social capital will be associated with the risk of clinical depression after accounting for neighborhood-level (i.e. neighborhood characteristics) and individual-level (i.e. demographic factor, socioeconomic status and cognitive social capital) confounders.

Hypothesis 3.3: It is hypothesized that neighborhood-level structural social capital will be associated with the risk of clinical depression after accounting for neighborhood-level (i.e. neighborhood characteristics) and individual-level (i.e. demographic factor, socioeconomic status and structural social capital) confounders.

CHAPTER 2

LITERATURE REVIEW

2.1   Depression

Depression and major depressive disorder is a commonly occurring, serious, recurrent disorder. The general symptoms of depression include a very low mood, feelings of worthlessness, inappropriate guilt or regret, helplessness, hopelessness, and self-hatred and decreasing of interest in nearly all daily activities (36). Sometimes it would combine with physical symptoms, including multiple physical symptoms such as fatigue, headaches, or digestive problems , which are the most common presenting problem in developing countries, according to the World Health Organization's criteria for depression (37). When the symptoms of major depressive disorder persist for at least two weeks, there is a major depressive episode and those episodes often recurrent throughout the life-course.

Based on symptoms of depression, they could cause negative impacts on individual's quality of life at home, work, school, and in social settings (38). Furthermore, depression is known to be associated with a variety of physical conditions including morbidity and mortality (39). Based on meta-analyses of longitudinal studies, depression could be a predictor of some physical disorder such as coronary artery disease (40, 41), stroke (42), heart attacks (43), diabetes

(44),and certain types of cancer (45). Also depression seemed to increase the risk of death from cardiovascular disease (46). The most serious consequence of depression would be suicide and on average about 15% patients with major depressive disorders died by suicide in previous reviews (47, 48).

2.1.1   Depression in worldwide

Depression and major depressive disorder is among the most prevalent mental illness experienced throughout the world (1), affecting 3.2% of the world' s population (49). Based on the World Health Organization (WHO), depression was ranked as the fourth leading cause of disability worldwide (50) and projected that, by 2020, it will be the second leading cause of disability worldwide (49, 51). Lifetime prevalence of depression may vary across countries, ranged from 1.5% in Taiwan to 19.0% in Beirut (52) but population studies have consistently shown major depression to be about twice as common in women as in men (53, 54). The age-of-onset distribution of depression could be wider the than many other mental disorders, which from late adolescence to late adulthood (38, 55) and people are most likely to suffer their first depressive episode between the ages of 30 and 40, and there is a second, smaller peak of incidence between ages 50 and 60 (55).

2.1.2   Depression in Taiwan

The National health interview survey which measured depression by using the Taiwanese Depression Questionnaire (TDQ) estimated that 5.3% of Taiwanese population who aged over 15 experienced major depression in 2002 (3, 4). In the Taiwan Psychiatric Epidemiological Project conducting from 1982 to1986, the lifetime prevalence of major depression disorder in Taiwan is 1.14% which was determined by

the Diagnostic and Statistical Manual of Mental Disorders (DSM)-III criteria and the lifetime prevalence of major depression disorder in women is significantly higher than men (56). Furthermore, the Taiwan Psychiatric Morbidity Survey (TPMS) determined depression by the World Health Organization (WHO) Composite International Diagnostic Interview (WMH-CIDI) also pointed out that women had a significantly higher prevalence rate than men (57). Previous epidemiological study of community subjects in Taiwan had shown that elderly people had a higher risk of depression (56), and in the Taiwan Old Age Depression Study included aged 65 years and over in south Taiwan the one-month prevalence of major depression was 5.9% which diagnosed depression by the GMS-AGECAT (Automated Geriatric Examination for Computerized Assisted Taxonomy) (6).

2.1.3 Risk factors for depression

Since there might be a serious consequence of depression, it is important to understand predictors and risk factors for elevated levels of depressive symptoms. Generally speaking, depression is associated with demographic factors and socioeconomic status. Almost all community epidemiological studies find that gender, age, and marital status are associated with depression, for example, women typically have a twofold increased risk of major depression compared with men (58), prevalence of major depression generally goes down with age (52, 59) and individuals who are separated or divorced have significantly higher rates of major depression than do the currently married (52, 59). Furthermore, people with financial strain, less income or lack of employment were significantly associated with depression (60-62).

In Taiwan, there is also an association between depression and demographic factors, socioeconomic status, health status and health behaviors (6, 57, 63). However, the association between depression and risk factors might differ by gender and age groups. In 2002, the National Survey on the Health Promotion Knowledge, Attitudes, and Behavior of Taiwanese Adults which determined depressive symptoms by using the Taiwanese Depression Questionnaire (TDQ) tried to evaluate the potential risk factors for depression (63). It found that men in the 20-44 and 45-64 age groups, depressive symptoms were associated with lower income level and women aged 20-44, the only socioeconomic factor linked with depressive symptoms was marital status. Both men and women aged 20-44 exercising regularly were less likely to have depressive symptoms but depressive symptoms were associated with smoking and drinking behavior only in women.

Recently, the concept of social capital has become one of potentially influential factors for depression in studies. Several prior studies conducted in the U.S., the UK, and Canada demonstrate strong negative associations between social capital and depression (11-13). To our knowledge, only one study examined social capital and depression in Taiwan (16). Therefore, it is necessary to perform the analysis for evaluate the association between social capital and depression in Taiwanese population. Furthermore, in order to clearly understand the mechanism between social capital and depression and design the early prevention and treatment for the specific groups of population, the association should be evaluated whether it could vary by different gender and age.

2.2 Social capital

The concept of social capital developed originally in the sociology and political

science literature and is increasingly recognized in epidemiology as a significant factor

influencing physical and mental health (27, 28) over the last two decades (64). Generally,

social capital is a way of describing social relationships within societies or groups of

people (65) and it is relational and refers to the material, informational and affective

resources to which individuals and, potentially, groups have access through their social

connections (66). Social capital is defined as the social resources that exist in the

relationships between individuals and groups wherein such resources can be accessed and

used to reach individual or collective goals (9, 30, 67, 68). These resources may be

characterized as material, informational and affective to which individuals and,

potentially, groups have access through their social connections (66). Most empirical

studies in public health focus on the concept of social capital around levels of trust,

community participation, and community/individual networks (69). Pierre Bourdieu (8),

James Coleman (10, 30), and Robert Putnam (10), are credited with the contemporary

conceptualization of social capital, representing important yet distinct aspects of

understanding of social capital.

   2.2.1   Definitions of social capital

Pierre Bourdieu, a French sociologist, is reported with the first contemporary

analysis of social capital (8). Bourdieu was interested in how social class and inequality

were socially reproduced (67, 70) and he focused on understanding how people use

different strategies to be successful in the social hierarchy based on the differential

distribution of their own resource including social capital. Bourdieu conceptualized three

types of capital including economic, cultural, and social capital which contributed to the competition for power and position among the social classes (8, 71).

Bourdieu defined social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition—or in other words, to membership in a group—which provides each of its members with the backing of the collectively-owned capital, a 'credential' which entitles them to credit, in various senses of the word" (pp. 248-249) (8). Bourdieu's definition of social capital concentrates exclusively on an individual's social relationships as the variable of interest (69) and the volume of social capital would depend on the size of network connections individual can effectively mobilize and the volume of the capital possessed in individual's own right by each of those to whom individual is connected (8).

Bourdieu's conceptualization of social capital is similar to that of social network theory (72) which indicated that social capital is individual focus, and benefits arise principally through the scope and influence of an individual's social network (18, 73). Social capital was therefore primarily a property of individuals (69). Social capital is a resource of individuals and families inherent in their network of relationships and capable of being transformed into other forms of capital—economic and cultural (74) and it is the ability of persons and families to command resources through their membership in networks and other social structures (75, 76). Social capital as the sum of an individual's social relationships—which were perceived as assets that allowed differential access to societal resources such as employment and educational opportunities (69) and therefore

the benefit of social capital arises principally through the scope and influence of an individual's social network.

The other conceptualization of social capital is based on the work of James Coleman (10, 30). James Coleman was an education sociologist as well as a "founding father" of social capital theory. Coleman's earlier work explored the effect of human capital on students' educational achievements and it showed that students with more social capital such as the physical presence of parents and the attention they receive from them are less likely to drop out of school (9). Based on this result, he pointed out that social capital in the family and community plays a crucial role in creating human capital for the next generation (9).

Coleman defined social capital by its function and he pointed out that "social capital is not a single entity, but a variety of different entities with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors—whether persons or corporate actors—within the structure. Like other forms of capital, social capital is productive, making possible the achievement of certain ends that in its absence would not be possible. Unlike other forms of capital, social capital exists in the structure of relations between actors and among actors. It is not lodged either in the actors themselves or in physical implements of production" (pp. S98) (9). Based on Coleman's concept, social capital focuses on the role of group values and norms (69) and related to the density of social ties and their capacity to enforce the observance of the norms (74). Social capital was viewed as embodying in relationships between individuals, between groups, and between groups and abstract bodies such as the state (69) and also as a source of social control, crime, and neighborhood security (18,

77). Coleman explicitly argued that social capital is a public good, but he also argued that its benefits might accrue to individuals or groups as a result of their participation in a set of social relationships (9).

Robert Putman's theory of social capital is among the most commonly used in the health sciences (69, 78). A political scientist by training, Putnam's definition of social capital comes from the empirical studies of the performance of regional government in Italy (30). He was interested in exploring why declining social capital causes a major threat to the continued maintenance of democracy and one of his studies showed that local governments in northern Italy were much more effective, responsive and efficient than those in the south, which could be explained by the unequal levels of social capital between North and the South (Making Democracy Work, Putnam 1993). Therefore, Putman identified that more social capital is good for democracy while less of it may spell trouble (30). Putman's definition of social capital which was built on Coleman's work was "the features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (pp. 167) (10, 30). Often Putman's definition referred to as the social cohesion theory (29) which emphasize social capital as a group attribute and analyze it as a contextual influence on individual health (27). Therefore, social capital is a shared property based on community activities and not of individuals alone (78) and is often measured by gathering data at the individual level (69).

Putman's social capital had five principal characteristics (30), including: (1) community networks, voluntary, state, personal networks, and density; (2) civic engagement, participation, and use of civic networks; (3) local civic identity—sense of

belonging, solidarity, and equality with other members; (4) reciprocity and norms of

cooperation, a sense of obligation to help others, and confidence in return of assistance;

(5) trust in the community. Based on Putnam's concept, social capital is divided into two

dimensions: cognitive, such as trust, and structural, such as participation (28, 78).

Generally speaking, Putman's social capital is communitarian focus which emphasizes

the collective aspect of social capital and has a shared property based on community

activities and not of individuals alone (10, 30). It is a public good—the amount of

participatory potential, civic orientation, and trust in others available to cities, states, or

nations and it has beneficial effects on social groups and its positive externalities often go

beyond group boundaries to benefit the whole community (30, 68).

To sum up, the three pioneering researchers provide their own approaches toward

the concept of social capital, each representing a relatively distinct tributary in the social

capital literature. Both Coleman and Bourdieu's social capital consider the importance of

examining social networks. However, Bourdieu's social capital is a resource of

individuals and families inherent in their network of relationships (8), by contrast,

Coleman's social capital is a anything that facilitates individual or collective action,

generated by networks of relationships, reciprocity, trust, and social norms (9). Putnam

has a different vision of social capital than either Bourdieu or Coleman. Putnam

emphasized the collective aspect of social capital and integrated structural aspects such as

civic engagement with cognitive aspects such as interpersonal trust and norms of

reciprocity (10, 30). While Bourdieu regards social capital as a benefit arises through an

individual's social network, Putnam emphasizes that social capital as a contextual-level

(e.g. neighborhood) variable. Moreover, Coleman's social capital fell somewhere in the

middle of Bourdieu's and Putnam's which argued that social capital is a public good, but also argued that its benefits might accrue to individuals or groups (9).

2.2.2 Three dimensions of social capital

Based on existing literature and different definitions of social capital, there are two distinct schools of social capital: social network and social cohesion (79). According to Bourdieu's social capital, it discusses the interplay between personal and network which corresponds to the school of social network. For the school of social network, social capital represents the resources that are embedded within an individual's social networks, that is, it is regarded as a property of individuals (18) and also indicates a network dimension of social capital. Network social capital directly measures how and to whom individuals are connected within their social structures by investigating the size, range, and diversity of individual's social connections, and the resources potentially available within those networks. Network social capital is typically measured by two instruments: the name generators and position generators. The Name generators maps personal networks (80), focuses on individuals rather than structural positions, and captures networks characterized (81-83). However, the name generator fails to capture the full range of resources embedded in social networks. The position generators maps positional networks, focuses on the structural positions network members occupy, and captures the resources embedded in social networks (84, 85). Generally speak, the name generators indicates social capital by structural positions of named contacts and the position generators indicates social capital by the distribution of accessed positions. The name generator not as useful and efficient as the position generator for capturing network

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social capital (86, 87). Higher level of network social capital may influence one's health outcome through providing more health information or more social support (16).

In contrast, Coleman' and Putnam's social capital emphasized the benefits of social capital as collective assets or public goods which refers to the school of social cohesion. In the school of social cohesion, social capital represents the resources available to members of tightly knit communities (27) and the social cohesion perspective is the most commonly used to define social capital in population health research (27). Furthermore, based on Putman concept (30), social capital in social cohesion school could be divided into two dimension: cognitive and structural social capital (28, 78). Cognitive social capital consists of values, norms, reciprocity, altruism, and civic responsibility (69) and reflects subjective attitudes such as trust in others and norms of reciprocity (27). Structural social capital consists of relationships, networks, associations, and institutional structures that link people and groups together (69). Structural social capital could be seen as externally observable aspects of social organization which includes behavioral manifestations of network connections and civic engagement. In short, cognitive social capital represents what people "feel" and is the quality of social relations and is often operationalized as perceptions of trust and reciprocity (19) and structural social capital indicates what people "do" and is the structure of social relations or networks and is often operationalized as social participation and organizational affiliation (19).

Public health research demonstrates that the different dimensions of social capital can influence individual physical and mental health. However, the investigation of this in

Taiwan has been limited. This study seeks to contribute to the understanding of how various dimensions of social capital may influence depression.

2.2.3 Two levels of social capital

There is an ongoing methodological debate in the literature regarding conceptualizing social capital as a property of groups of people (a contextual construct) or of individuals (19, 27, 28). Social capital as an individual-level construct is strongly influenced by the work of Pierre Bourdieu (8) and views social capital as the personal network-based benefits that belong to individuals as a result of their membership in social networks. Individual-level social capital, based on Bourdieu, conceptualizes social capital as a benefit arising principally through the scope and influence of an individual's social network (29) and measured by individuals' participation in social relationships (for example, membership of groups) and perceptions of trust and reciprocity. Studies exploring the association between social capital and health outcomes have largely conceptualized social capital at the individual level and their findings are robust and consistent especially in exploring the association between individual-level social capital and self-report (88) or mental health (28). However, a purely individualistic approach may obscure very real contextual effect (33).

The contextual-level view of social capital is influenced by Putnam's work and views social capital as a collective attribute, a property of groups of people and a public good (10, 30). Contextual-level social capital, derived from Putman, emphasizes the collective aspect of social capital and has a shared property based on community activities and not of individuals alone (10, 30). Furthermore, contextual-level social capital is considered as a resource of a group of people working together in order to

achieve collective goals that could not be accomplished by individuals themselves (89). Contextual-level social capital usually could be measured by aggregating the responses of individuals in population surveys to the contextual level (28), such as neighborhood, workplace or family.

Although individual-level measures of social capital are more commonly used than contextual-level measures (28), the simultaneous investigation of individual- and contextual-level social capital may provide a greater understanding of the multilevel mechanisms linking social capital and mental health outcome such as depression. The finding from those studies can potentially guide the development of effective intervention and prevention programs to improve or even prevent depressive symptoms.

2.3   The association between social capital and depression

Social capital is one of the social determinants of mental health that might play a considerable role in explaining variations in mental health outcomes. There is an extensive body of research investigating the association between social capital and mental health research. Several prior reviews have summarized the association between social capital and mental health, in generally, these reviews found an inverse relationship between social capital and various mental health outcomes (28, 69, 78, 90). In addition, the concept of social capital has become a potential factor for explaining mental health and become increasingly prominent as a potentially influence factor in health promotion programs (91, 92), social epidemiologic research (20), and mental health policy (91, 93).

A growing number of studies have suggested a link between social capital and depression. In those studies, social capital is measured by multiple dimensions within its concept including network, cognitive, and structural social capital. Network social capital

comes from a relational perspective, and is possessed by individuals' network members (16) and individuals can access and use network social capital only through their social ties with their network members (16). Although research had showed people with more network social capital are more likely to have a better self-rated health (16, 94-96), only few studies had explored the association between network social capital and depression and results are inconsistent. Some studies found the inverse association between depression and network social capital measuring by a name generator (12, 25). However, in Webber et al.'s study, network social capital which used a resource generator to measure access to specific types of resources within individual's neighborhoods did not associated with depression (97). Network social capital proposes that resources embedded in social networks may enhance one's mental health through different mechanisms (16). First, network social capital may provide a sense of purpose, belonging, and social attachment, which enhance mental health outcomes (98, 99). Second, network social capital may affect mental health through providing people access to job opportunities, decent housing, health information, high quality health care and other instrumental resources (16, 98). Furthermore, individuals embedded in high level of network social capital may receive higher levels of social support and have more adequate social support which associated with better mental health (25). To our knowledge, only one study examined network social capital and depression in Taiwan (16). This study measured network social capital by both name generator and position generator and the results suggested a negative association between position-based network social capital and depression. Overall, the evidence form those studies provide some support that network social capital may be a potential social determinant of depression.

Most studies of social capital and depression have used the concept of cognitive or structural social capital as measures, for example, social trust and participation (69). Cognitive social capital can refer to perceptions of relation in one's own community. In De Silva et al.'s review, it found a strong inverse relation between cognitive social capital and common mental disorders (28). Several studies have shown there is a consistently inverse association between individual-level generalized trust and depressive symptoms (12, 100-102). In other studies, cognitive social capital which represented as perceived neighborhood trust, interpersonal trust and higher trust in friend has a negative association with depression (21, 24, 103). Other indicators for cognitive social capital such as sense of belonging, willingness of neighbors help, perceived neighbors cohesion, partnership in community, social support and social reciprocity are also found to had a negative association with depression (12, 21-23, 101). In the USA, the prospective study showed that perceptions of higher levels of cognitive social capital (trust of neighbors and sense of belonging) are associated with lower risks of developing major depression during 2–3 year follow-up after controlling for socioeconomic status, baseline diagnosis of major depression and other sociodemographic covariates (20). This prospective study could reduce the possibility of reverse causation from cress-sectional design and provide a more reliable evidence of the association between cognitive social capital and depression. Possible explanation is that people perceive high level of cognitive social capital may have a direct protective association with depression (99). Individual interactions with trusting neighbors may produce positive psychological states, such as a sense of being ''accepted'' within the community (20). In addition, people with high level of cognitive social capital may find it easier to obtain stress-buffering effects such

as social support to cope with daily stress which refers to stress-buffering model (99). Since individuals with trust are less likely to experience stress and thus less likely to face negative health outcomes than those who do not trust as easily (104), stress has been proposed as a potential mechanism linking trust and health. People perceive a high social trust community may be beneficial for depressed people to have better access to affective support, which may improve their prognosis (105, 106) and also trust could generate stress-buffering effects by increasing positive affective states, including feelings of security and self-esteem, which possibly decreases one's mental distress (101). Since individual's stress could be reduced by increased cohesive neighborhood and influence the rates of depression (107), higher social capital might minimize the stress through not only modify negative life event and long-term difficulties but also increase individual social support and then affect mental health (19).

Structural social capital can refer to linkages of relation in one's own community and the association between structural social capital and depression is inconsistent. In De Silva et al.'s review, it was showed that more than sixty percent of studies of structural social capital found no association with common mental disorders (28). Other empirical studies showed that structural social capital which measured by community participation, and volunteer work was not associated with depression (12, 20, 21) and in the USA, the prospective study also showed that structural dimensions of social capital were not associated with major depression (20). By contrast, a study of a working class suburb in Australia found that involvement in community groups was associated with worse physical health because respondents were more likely to view their participation in local community groups as emotionally and physically draining (108). Nevertheless, for Asian

immigrants, the study found that both political participation and information sharing were associated with a lower level of depression (23) and the other finding demonstrated that older adults with low level of structural so social capital which measured by social contact with friends and neighbors would had high risk of depression (24). The potential interpretation is that individuals with high organizational participation may receive greater social support or the needed services and resources, which might be useful for coping with mental stress (23, 109). Furthermore, since people may enlarge their social network by participating activities, they may increase the level of social support with it and become less isolated socially which related to better mental health (110).

Diversity of findings from three dimension of social capital and depression emphasis the importance of assessing different dimensions of social capital, since they may not be associated with health outcomes to the same degree. Previous studies may only examine the association between one or two dimensions of social capital on depression. Future research should examine the association between network, cognitive and structural social capital and depression for a more comprehensive understanding of how different dimensions of social capital operate together to influence depression.

2.4   The association between age-based patterns of social capital and depression

2.4.1   Social capital and age-based patterns

By exploring the age-based patterns of social capita, it could provide the information about how people navigate the various spheres of their lives (e.g., work, family, and educational spheres) (26) and also contribute to broader patterns of cumulative advantage ∕ disadvantage (111). Since there are several different definitions of social capital, social capital could be view as an umbrella term used to describe aspects of

social networks, relations, trust, support and power and therefore the patterns of social capital for each aspect across life-course stage might be different.

Research in the social support literature has examined age variation in social capital and it showed that age effects suggest a decline in the size of most of their social networks but has an increased support from relatives but not from friends, neighbors, and acquaintances (112). The other paper point out that in most age groups, both men and women also enjoyed a slight rise in social support while those living without a partner experienced decreased support (113). Furthermore, the increased trend of organizations participation was found with increased age, but involvement with organizations declines in old age, except that religious affiliations and community groups are more likely to be maintained (113). The study also show that older people had higher neighborhood attachment and greater levels of voluntary group engagement, but weaker social networks/social support than younger people (113).

McDonald and Mair provided the other important evidence of the trajectory of work-related social capital across life-course and it showed that Social capital embedded in occupational networks tends to accumulate with age, but eventually levels off (and may also decline) in later ages (26). Overall levels of social interaction (i.e. daily contact, closeness and density) tends to decline across the life course, while network social capital ties such as employment and work connections and trust in occupational contacts may expand across the life-course (McDonald and Mair, 2010). The social resource factor score and organizational memberships have similar patterns with a slight uptick in social capital among the 56–65 age group (26).

The trajectory of social capital across life-course stage might be different from gender. For example, women aged over 75 years and lived without a partner would experience decreased support (113). In McDonald and Mair's study, it found that specific dimensions of work-related social capital across the life-course stage may display distinct patterns by gender (26). The proportion of male contacts increases with age was only demonstrated among women indicated that different gender have distinctive patterns of social participation in occupational environments across the work career which influence how social resources accrue (26). Since women may be more likely than men to maintain their close connections to work contacts and to construct occupational networks of highly trusted contacts, trust in network contacts increases with age was only demonstrated among women (26). Only women experience an increase in daily contact in mid-life (26) because the mid-career transition, such as childbearing and changes in career paths, is more commonly experienced by women and construct the potential for fostering an increase in social interaction for women (114).

2.4.2   The association between age-based patterns of social capital and health

Recent studies on social capital and health have started to investigate whether the associations between different dimensions of social capital and health would vary by age, but results remain inconsistent (115-118). Social capital to be important for older people in general (113) and the positive effect of strong social support on elders' health, especially psychological health, has been much evinced and discussed (119). Cognitive social capital which measured by institutional indicator is significantly more important for health of older people (60 years or older) than for younger people (120). Furthermore, higher levels of well-being and self-rated health are also more common among the aging

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people who volunteer (121) or participate in clubs and associations (122) and social participation and access to help as two dimensions of social capital that are strong indicators for older people 's health (123). However, in Japan, high cognitive social capital which measured by trust were not significantly associated with good self-rated health using a multilevel mode in older population after adjustment for the Gini coefficient (124).

2.4.3   The association between age-based patterns of social capital and depression

Relatively little attention has been given to whether the association between social capital and depression varies by life-course stage. In previous studies, they found that cognitive social capital which measured by trust in friends (24), trust in neighbors, sense of belonging, willingness of neighbors help (21), and social support (22) and structural social capital which measured by social contact with friends and neighbors (22) are both associated with depression in older population. It is also possible that these patterns of social capital accumulation or decline by life-course stage may be associated with gender differences in depression risk. A stronger association between psychological health and informal social capital which corresponds to resources based on subjective feelings as well as on emotional and geographic closeness to other known people in older than in younger men (120). The decline in social capital with advancing age can be due to the fact, that older people have fewer good friends (113) and Managing life in retirement seems to be particularly important for men (125) because women may have already developed in earlier years of life (120).

However, there are some limitations for previous studies. All studies, except one, focus on the specific age group in their studies were unable to fully assess life-course stage variation in social capital. In previous studies, they have not yet been investigated systematically whether the strength of the association between different dimensions of social capital and depression would differ in different age groups and have questionable generalizability for outside of western countries. The ways in which different dimensions of social capital affect depression across life-course stage and whether the effect of different dimensions of social capital would vary by gender should be studied in more detail.

2.5   The association between contextual-level, individual-level social capital and depression

There is an ongoing methodological debate in the literature regarding conceptualizing social capital as a property of groups of people (an contextual construct) or of individuals (19, 27, 28). In the studies that use individual-level cognitive social capital, they found there is the inverse association between cognitive social capital and depression in almost all of studies (11, 20-24, 28, 101). The effect of individual-level structural social capital on depression or depressive symptoms was not so clear, because some of studies measured structural dimension of social capital did not have statistically significant association with depression or depressive symptoms (20, 126).

Results were more complex in studies of using contextual-level social capital and most of studies conducted in European countries and USA which might not represent the situation outside of these two places. Some studies (31, 32) reported significantly inverse association between structural social capital and depression or depressive symptoms but

in Stafford et al.'s study, it showed the positive association between cognitive social capital (attachment to neighborhood) and depression or depressive symptoms. There is a study that evaluated the association between linking social capital and depression or depressive symptoms and it also showed significantly inverse association (127).

Recently there is a comment that social capital should not be considered as a dichotomy (contextual or individual) (34) and it should be consider that both micro and macro levels of social capital can affect health simultaneously in studies (89, 128). For example, In Kouvonen et al.'s study (129), there was a significantly inverse association between individual-level social capital and depression or depressive symptoms but no association between contextual-level social capital and depression or depressive symptoms. Two studies that conducted in general population showed inverse associations between individual-level cognitive social capital and depression (130, 131) but there is one positive (131) and one inverse (130) association were detected between structural dimension of individual-level social capital and depression or depressive symptoms.

Basically, individual-level social capital is a measure of participants' feeling of their environment, their social networks, and their level of participation in their community and contextual-level social capital could indicate that a contextual phenomenon of whole community (28). By using both levels of social capital, it could provide a greater understanding of the mechanism among the multilevel social capital and depression. If the study did not include contextual-level social capital (e.g. neighborhood social capital), it would not the ability to precluded differentiating whether measure social capital at the contextual level precluded differentiating whether the ''places'' people live matters for depression, or whether the perception of individuals toward ''place'' matters

for depression (20). Therefore, multilevel analysis might be another approach to assess associations between social capital and depression because it could include both individual-level and contextual-level social capital and also detect more complex cross-level interaction effects, i.e., the influence of certain (social) environments may not be the same for all groups of people (132) , as they may capture separate processes in relation to mental health (28, 69). Since most of studies conducted in the US, the UK, and Canada, it is important to conduct the study to evaluate the examination of exploring the association between individual/contextual level social capital and depression in Taiwanese population.

CHAPTER 3

METHODS

3.1   Research datasets

    3.1.1   Taiwan Social Change Survey (TSCS)

The Taiwan Social Change Survey (TSCS) is a multi-cycle, long-term, nationally representative cross-sectional survey. The survey collects data on social issues relating to family, culture, religion, politics, social network and social class in addition to self-reported health and behavioral characteristics among residents in Taiwan. Since 1990, the TSCS administers selected modules every five years. The five-year cycle of TSCS assesses changes in economic attitudes, family, globalization, national identity, political participation, social networks, and social problems and approximates 2000 participants for each year survey (133). The TSCS was conducted by the Institute of Sociology, Academia Sinica (surveys before the first year of the third cycle were conducted by the Institute of Ethnology, Academia Sinica), and sponsored by the Ministry of Science and Technology (formerly known as National Science Council), Republic of China.

A stratified random sampling method was used to select adults were 20-year old or older for participation in the survey. The sampling frame was island-wide of Taiwan and excluded outlying islands and mountain townships. The 309 townships and districts of Taiwan, Taipei, Kaohsiung and Provincial city were divided into ten strata (134).

Then, the number of samples which needed be selected in each stratum was determined by the proportion of population with the proposed age range from 20 to 74 and the sampling in each stratum was conducted independently. For each stratum, the primary selection units were townships and districts and the secondary sampling units were lis (a li is a geographical division created by the Taiwan Census Bureau) and villages but, in Taipei and Kaohsiung, the primary selection units would directly be selected from lis and villages. Lis and villages were randomly selected from each township/district and the eligible participants were selected by a table of random numbers prepared in advance. The sampling method of "Probability Proportional to Size" (PPS) was applied to each unit in each stratum and therefore the probability of being selected was proportional to the size of each unit. In order to make the sample distribution better fit the population distribution, the weights were provide and generated by the Center for Survey Research (CSR), Academia Sinica, according the population distribution by sex, age, residential area (urban/rural), and education levels in the year that survey data was collected.

Data were collected in the mode of face-to-face interviews using a structured questionnaire. All participants were given full instruction of the study and informed consent was obtained from each participant. The ethics committee of the National Science Council of Taiwan approved this survey. In addition, all interviewers received a standardized 2-day training workshop before conducting interviews.

3.1.2 Taiwan Population and Housing Census

The Taiwan Population and Housing Census is a basic national census carrying out on a regular basis in accordance with the Taiwan Statistics Law. This census is designed to collect the socioeconomic characteristics of population, quality and size of

housing units, household composition, educational attainment, working status, housing status and other related information of Taiwan-Fukien Area. Data are used as a major reference for the formulation of national policies, implement of urban development plans and promulgation of academic researches. There are four censuses have been conducted by the Ministry of Interior in conjunction with the Population Census Office of Executive Yuan in 1956, 1966, 1980 and 1990 and the responsibility of conducting the 2000 Population and Housing Census (the 5th Census) has transferred to Directorate-General of Budget, Accounting and Statistics (DGBAS). Population and Housing Census that covered 22 million population and 7 million housing units and collected information on population and housing characteristics would provide the government as a reference for the formulation of long-term national plans and meet the increasing demand for social welfare.

In order to carry out the census, the DGBAS has invited scholars and experts of demographical, statistical and social studies to participate in the discussion and formulation of the census plan, collected census documents of the United Nations and absorbed the experiences of worldwide countries, including U.S.A., U.K., Canada, Japan, Sweden and Denmark. The Census covers cities and counties of Taiwan Area (including Taipei Municipality, Kaohsiung Municipality which including Tung-Sha and Nan-Sha Archipelago), Kinmen County and Lienkiang County of Fukien area. The Census adopted both the field personal interview approach and official administrative records linkage to produce the related statistics. To release the difficulties of recruitment of enumerators, the DGBAS has invited well-trained civil labor force to participate in the field personal interview. The completed census forms were sent to the DGBAS for data processing. The

DGBAS adopted the Optical Character Recognition (OCR) technology to scan the census forms, recognize and edit the data on line, and save the data in an image format.

3.2   Study population

Both individual- and neighborhood-level data for this study in the *Specific Aim 1, 2 and 3* came from the third survey of the third cycle (1997) of the TSCS. This study defined neighborhoods by the geographical level of townships/districts with an average of 60,000 people. In 1997, TSCS administered the "Social Network and Community" questionnaire which was the only year that contained questions to measure three dimensions of social capital (network, cognitive, and structural social capital) in addition to the Center for Epidemiological Studies Depression Scale (CES-D) to measure depression. The "Social Network and Community" questionnaire was designed by a team of sociological researches and has been widely used in research examining social capital and health outcomes (135). The questions in the "Social Network and Community" module were pilot tested and validated. Focus groups of 8 to 10 persons from a wide range of social strata answered and discussed those questions and researches would base on responders' feedback to modify questions. Then, 400 participants joined the pretest in order to test the feasibility of the questionnaire. The finalized questionnaire was answered by samples that aged from 20 to 74, and a total of 2,835 sampled participants completed questionnaire.

In order to adjusted neighborhood demographic and socioeconomic status in multilevel analyses, neighborhood-level control variables were derived from the 2000 Taiwan Population and Housing Census. Eligibility for the final analysis would only

include respondents who have completed information on the outcome variable and exposure variables of three dimensions of social capital.

3.3   The measurement of outcome variable

Depressive symptoms is the main health outcome in this study which is measured by the 20-item Center for Epidemiological Studies Depression Scale (CES-D) (136) (Appendix A). The CES-D is one of the most accepted and commonly used validated tools to measure symptoms of depression (137). The CES-D is a short and cost effective depression tool used not only in clinical populations (138) but also in community samples(139, 140). It is used to measure the current level of depressive symptomatology (136), not the progress of depressive symptoms. Items in the CES-D represent six major symptom areas of depression, including depressed mood, guilt and worthlessness, helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance (136)

The Chinese version of CES-D was directly translated from the 20-item CES-D by two psychiatrists (141) and has been widely used in Taiwan (142-145). Prior studies have shown that the Chinese version of the CES-D is a reliable and valid measure of depressive symptoms for the Taiwanese adult which the sensitivity and specificity were 92.0% and 91.0% (141). It is also a useful screening tool for depressive disorder among Taiwanese adolescents (145) and older adults (142-144). For each of the 20 items of CES-D scale, participants are asked: "how many days during the past week they have experienced a given symptom." The item responses are on a 4-point Likert-type scale to indicate the frequency of the symptoms (0: less than one day in the past week; 1=: 1-2 days in the past week; 2: 3-4 days in the past week; 3: 5-7 days in the past week). The

minimum value 0 indicates that the symptom which represent by the item occurred rarely, and the maximum value 3 means the item under investigation occurred most or all of the time. For 16 of the 20 items in the CES-D, the higher the score represent the greater depressive symptoms. However, for the remaining four items (item 4, 8, 12, & 16), the higher the score represent the less depressive symptoms, and therefore need to reverse the scoring for these fours items in order to calculate the potential total scores. The potential total scores range from 0 to 60 and the higher scores are indicative of a greater level of depressive symptoms. For purposes of analyses, the cut-off point for being at a risk of clinical depression in the present study was based on a CES-D score ≥ 15 as recommended in the previous report (146).

3.4   The measurement of exposure variable

The exposure variables were three dimensions of social capital – network, cognitive and structural social capital – for the *Specific Aim 1, 2 and 3* in this study.

3.4.1   The measurement of network social capital

Network social capital was measured by using the position generator (84, 85). The position generator could identify contacts associated with a representative sample by occupational position and is map network social capital (16, 147). On the questionnaire, a sample of 15 ordered occupational positions salient in Taiwan, ranging from housemaids/cleaning workers to physicians (see Table 3.1 and Table 3.2) were listed along with the comparative occupational prestige scale to represent the prestige scores of these occupations (148). Each participant was asked "Of your relatives, friends, and acquaintances, are there any who have the jobs listed in the following table?" If the

participant knew several contacts that held a particular job, they were asked to name only the one who occurred to them first.

There were three components of network social capital which could represent three aspects in the position generator: extensity, upper reachability and range (16, 85). Extensity represented the quantity of network social capital and it was measured by the total number of occupations in which respondents identified one contact. The potential values ranged from 1 to 15 where 1 reflected a respondent know one contact in only one of the fifteen listed positions and 15 reflected a respondent know one contact in each of the fifteen listed positions. Upper reachability represented the quality of network social capital and it was measured by the highest prestige score of occupations that respondents have access to. The potential values ranged from 22 to 79 where the lowest value reflected that a respondent only know a housemaid/cleaner worker and the highest value reflected that a respondent know a physician. Range represented the diversity of network social capital and it was measured by the difference between the highest and lowest prestige scores of occupations that respondents have access to. The potential values ranged from 0 (respondents the highest and lowest prestige scores of accessed occupations were equal) to 56 (respondents know not only the lowest but also the highest occupations).

Internal reliability across different variables of network social capital would be assessed and the evidences for conducting the composite score would be evaluated by correlation and a factor analysis. Three network social capital variables were found to be reliable with a Cronbach's alpha of 0.90 and highly correlated with each other (p <0.0001). Furthermore, factor analysis offered a single factor solution with an eigenvalue

of 2.5, and no other factors with eigenvalues > 1. Therefore, principle component analysis was used to construct an individual-level network social capital composite score (the composite score of network social capital = 0.34985 extensity + 0.35956 upper reachability + 0.38178 ranges) for each participant and it would be utilized in the analyses proposed for the *Specific Aim 1, 2 and 3*. In order to calculate individual-level network social capital composite score, we would standardize three network social capital variables with means 0 and standard deviations 1. Meanwhile, those standardize variables would be used in in the sensitivity analyses.

3.4.2   The measurement of cognitive and structural social capital

There is no survey questions specifically designed to measure cognitive or structural social capital in the TSCS. The questions selected to represent cognitive and structural social capital were chosen based on Putman's conceptualization of social capital (30) which consists of features such as interpersonal trust, norms of reciprocity, ties of social networks, and social engagement and integrated both cognitive aspects and structural aspects together. The questions in the study were found to be comparable with previous studies.

3.4.2.1 The measurement of cognitive social capital

Cognitive social capital represents the quality of social relations and could be characterized as what people "feel"(19). Furthermore, it is often operationalized as perceptions of trust, norms, reciprocity, and perceptions of surrounding social environments. For the *Specific Aim 1, 2 and 3* in this study, cognitive social capital was assessed along with 3 components which contained 2 aspects: trust in neighbors and perception of neighborhood reciprocity (Table 3.3).

Trust in neighbors. One components would be used to assess the aspect of participant's perception of the trust of his or her neighbors. Respondents were asked "How would you describe the people who live around you?" It has seven responses scores, ranging from "mutual suspicion" (codes 1) to "trust each other" (codes 7). Responses were coded so that a higher score represented higher trust in neighbors.

Perceived neighborhood reciprocity. Two components would be used to measure the aspect of perceived neighborhood reciprocity: (1) care and (2) familiarity. To measure the continuous variable of care, and familiarity, respondents were asked "For the aspect of care and familiarity, how would you describe the people who live around you?" There are 7 scores for each aspect of perceived neighborhood reciprocity and responses were coded so that a higher score represented higher perception of care or familiarity in neighborhood.

Internal reliability across different variables of cognitive social capital would be assessed and the evidence for conducting the composite score would be evaluated by correlation and factor analysis. The Cronbach's alpha for the three cognitive social capital variables was 0.86, suggesting that the variables have relatively high internal consistency and also three cognitive social capital variables are highly correlated with each other (p <0.0001). Furthermore, factor analysis offers a single factor solution with an eigenvalue of 2.4, and no other factors with eigenvalues > 1. Therefore, for the *Specific Aim 1, 2 and 3*, an individual-level cognitive social capital composite score would be calculated by summing together the scores from three variables of cognitive social capital and viewed as a continuous variable for each participant. Furthermore, in the sensitivity analyses, we would use three continuous cognitive social capital variables

3.4.2.2 The measurement of structural social capital

Structural social capital responds the structure of social relations or networks and could be characterized as what people "do"(19). Also, it is often operationalized as social participation and organizational affiliation. For the *Specific Aim 1, 2 and 3* in this study, individual-level structural social capital was assessed along with two components which contained two aspects: participation in organization and participation in the local community (Table 3.4).

Participation in the organization. Participation in the organization would be calculated as the number of organizations in which respondents were members (ranging from 0 - 7). Respondents were asked: "Have you attended an organization or club activity in the past 1 year?" Seven types of voluntary organizations were included in the response: religious, political, social movement, social service, alumni, occupational, and "other, if any." Based on responses, we would have two types of *Participation in the organization*: 1) no participation in the organization; and 2) participation in at least one organization.

Participation in the local community activity. Participation in the local community would be created as the number of local community events which respondents attended (ranging from 0 - 6). Respondents are asked to answer the question: "Have you attended a local community event in the past 1 year?" Response include the following six events: li's/village's meeting (a li is a geographical division created by the Taiwan Census Bureau), activity held by li/village, activity held by school, temple fair, church activity and activity held by other club/organization. Based on responses, we would have two types of *Participation in the local community* activity: 1) no participation in the local community activity; and 2) participation in at least one local community activity.

Internal reliability across different variables of structural social capital would be assessed and the evidence for conducting the composite score would be evaluated by correlation and factor analysis. Structural social capital had a Cronbach's alpha of 0.48, which is low, and it might be a signal of the variables tapping different things, hence, are measures of different latent variables. However, two structural social capital variables are highly correlated with each other ($p <0.0001$) and factor analysis offers a single factor solution, and therefore, we would still construct an individual-level cognitive social capital composite variable for the *Specific Aim 1, 2 and 3*. Based on two structural social capital variables, the individual-level structural social capital composite variable would be grouped into two groups: 1) no participation; and 2) participation in at least one organization or local community activity. Two structural social capital variables would be used in the sensitivity analyses.

3.4.3 The measurement of contextual-level social capital

In order to correspond with the *Specific Aim 3* in the study, the contextual level was operationalized by the neighborhood in this study. A neighborhood was defined by a township/district which is created by visible boundaries such as streets and rivers. It is the smallest geographic area that was provided by the TSCS. In Taiwan, there are 359 townships/districts in 1997 and each township/district has around 60 thousand people. In this study, it included 55 townships/districts and each township/district has around 47 people.

Neighborhood-level composite network social capital score would be the mean of individual-level network composite social capital scores for all participants from the same neighborhood. Neighborhood-level composite cognitive social capital score would be the

mean of individual-level composite cognitive social capital scores for all participants from the same neighborhood. Neighborhood-level composite structural social capital score would be the percentage of participation in at least one organization or local community activity for all participants from the same neighborhood.

3.5   The measurement of potential confounders

Based on Harpahm et al.'s study (19) , it is important to consider potential confounders in this study which includes respondents' demographic factor and socioeconomic status in the analyses in order to identify the effect of three dimension of social capital on depression. Table 3.5 provides a brief summary of individual-level potential confounders to be used in the analysis, and their coding schemes. However, based on the study purpose for the Specific Aim 3, it is also important to control neighborhood-level characteristics which may impact social capital variables at both the individual- and neighborhood-levels.

3.5.1   Individual-level demographic factors

Individual-level demographic factors which included age, gender, marital status, and religious belief have been shown to be important covariates for the study of depression, and thus should be controlled in the statistical analysis.

o Age: Age was coded as years since the individual was born and measured as a continuous variable ranging from 20 to 74. However, for purpose of the Specific Aim 2, age would be recoded into four different life-course stages for the respondents: the young adults (age 20 to 34), the adults (age 35 to 49), the middle aged (age 50 to 64), and the elderly (age 65 and over). The category of "the young adult" served as the reference group.

o Gender: Recoded into a dichotomous variable with male as the reference category (male = 1; female = 2).

o Marital status: Based on the questionnaire, this variable was recoded into four categories of marital status (single, currently married, widowed, or separated/divorced) in this study. The category of "currently married" was treated as the reference category.

o Religious belief: Respondents were asked: "Which of the following religious denominations do you identify with?" This variable was recoded into a dichotomous variable of religious belief (1= religious belief, 2= no religious belief) with religious belief as the reference category.

3.5.2 Individual-level socioeconomic status

Three commonly used variables, education, income and employment, were included in the study to measure individual-level socioeconomic status.

o Education: Education is measured by the highest degree the respondent attained and has 14 categories in TSCS, corresponding to the educational system in Taiwan. According to the categories used by Directorate-general of Budget, Accounting and Statistics in Taiwan, individuals' highest degrees were classified and recoded to three categories of variables: junior high school or below (1= none/self-study, elementary school, junior high school and vocational junior high school), senior high school (2= high school, vocational high school, and cadet school) and junior college or above (3= 5-year/2-year/3-year/military/police junior college, military/police college, college of

technology, college and graduate school). The category of "junior high school or below" served as the reference group.

- o Income: Income was measured as the average personal income per month which including year-end bonuses and it consists of 23 levels, from 0 NTD (i.e. New Taiwan Dollar; 1 NTD ≈ 0.03 US$) to 300,000 NTD or above. In this study, income was recoded into four categories: 1) no income, 2) less than NT$19 999, 3) NT$20 000 to NT$39 999 and 4) over NT$40 000 and the category of "no income" was treated as the reference group.

- o Employment: This variable was collapses those who are not in the labor force and who are unemployed into the category of "not currently employed" and treat this as the reference group. There were three categories which were used as measures of employment: 1) not currently employed, 2) currently employed (self-employment, employed in family firms, and employed in non-familial firms) and 3) retired. The category of "not currently employed" was treated as the reference group

3.5.3 Neighborhood-level characteristics

Neighborhood-level characteristics were derived from the 2000 Taiwan Population and Housing Census. The fundamental neighborhood characteristics which contain a neighborhood's socioeconomic status, family structure, and age distribution are viewed as describing neighborhood contexts (149). Therefore, neighborhood-level characteristics in this study included: the percentages of residents with less than a middle school education, the percentage of no employment, the percentage of

divorced/separated, the percentage of residents younger than 15 and the percentage of residents older than 65.

3.6   Data analyses

     3.6.1   Analytic approaches for the Specific Aim 1

For the Specific Aim 1, it examined whether there are associations between three dimensions of social capital – network social capital, cognitive social capital and structural social capital – and depression respectively and the interaction effects between three dimensions of social capital and gender. First, in order to provide a description of the data, the percentages/means and standard error for demographic factors, socioeconomic status and three dimensions of social capital for being at a risk of clinical depression versus not would be described and the comparison for two groups would be assessed by using the Chi-square test for categorical variables and t-test for continuous variables.

Next, there was a series of multivariable logistic regression models building process was used to evaluate the association between three dimensions of social capital and depression as well the interaction effects respectively. The basic model (M1) for the outcome contains the composite score for only one dimension of social capital at a time to examine whether it has a crude association with depression. For the second model (M2), demographic factors (including age, marital status, and religion status) and socioeconomic status (including educational, income, and employment) were added in the basic model to evaluate the adjusted effect of each dimension of social capital on depression. For the third model (M3), the two-way interaction terms between each dimension of social capital and gender would be added to the Model 2. Furthermore, in

order to under the detail mechanism between each aspect of three dimensions of social capital and depression, the same series of multivariable logistic regression models was used for each variable in three dimensions of social capital. All hypotheses would be tested at α=0 .05 level of significance. All statistical analysis would adjust for complex sampling frame and be conducted by Statistical Analysis System (SAS), version 9.3.

In sensitivity analyses, in order to confirm whether the three dimensions of social capital influenced each other, we added all composite scores for the three dimensions of social capital into a model simultaneously and ran crude and fully adjust models after testing for the potential of multicollinearity by the variance inflation factors (150) in the data. All hypotheses would be tested at α=0 .05 level of significance. All statistical analysis would adjust for complex sampling frame and be conducted by Statistical Analysis System (SAS), version 9.3.

3.6.2   Analytic approaches for the Specific Aim 2

For the Specific Aim 2, it would examine whether age-based patterns of three dimensions of social capital – network social capital, cognitive social capital and structural social capital – were associated with depression separately. First, in order to provide a description of the data, the percentages/means and standard error for demographic factors, socioeconomic status and three dimensions of social capital for being at a risk of clinical depression versus not among four age groups would be described and the comparison for two groups would be assessed by using the Chi-square test for categorical variables and t-test for continuous variables.

Next, there was a series of multivariable logistic regression models building process was used to evaluate the association between three dimensions of social capital

and depression respectively. The basic model (M1) for the outcome contained the composite score for only one dimension of social capital at a time to examine whether it has a crude association with depression. For the second model (M2), demographic factors (including age, marital status, and religion status) and socioeconomic status (including educational, income, and employment) were added in the basic model to evaluate the adjusted effect of each dimension of social capital on depression. In the final model (M3), the two-way interaction terms of age and separate dimensions of social capital were added to the model to test whether the effects of different dimensions of social capital on depression were modified by age. For the significantly analyzed interaction term in the specific dimension of social capital, the same series of multivariable logistic regression models was used to evaluate the association between the specific dimension of social capital and depression among four age groups separately.

Furthermore, we conducted further analyses in order to under the detail mechanism between each aspect of three dimensions of social capital and depression. Based on the same series of multivariable logistic regression models as above, each variable in three dimensions of social capital would be used to explore how these variables associate with depression respectively. All hypotheses would be tested at $\alpha=0.05$ level of significance. All statistical analysis would adjust for complex sampling frame and be conducted by Statistical Analysis System (SAS), version 9.3.

3.6.3   Analytic approaches for the Specific Aim 3

For the Specific Aim 3, multilevel logistic regression was used to examine the independent association between three dimensions of neighborhood-level social capital (which are network, cognitive and structural social capital) and depression. First,

neighborhood-level network, cognitive and structural social capital would be calculated based on three dimensions of individual-level social capital for all participant from the same neighborhood respectively. Then, in order to provide a description of the data, the percentages/means and standard error for demographic factors, socioeconomic status and three dimensions of social capital in both neighborhood- and individual-levels for being at a risk of clinical depression versus not would be described and the comparison for two groups would be assessed by using the Chi-square test for categorical variables and t-test for continuous variables.

Next, there was a series of multilevel logistic regression models building process was used to assess whether the effects of each dimension of neighborhood-level social capital exist above and beyond individual-level social capital. This study would use the SAS GLIMMIX to fit multilevel models with a binomial distribution assumption and a logit link. The null model (M0) only had the constant term in the fixed and random parts which is a two-level null (empty) model of individuals (level 1) nested within neighborhoods (level 2) with no predictor variables in the fixed and the random parts of the model. And then, the next model (M1) for the outcome only contained one dimension of neighborhood-level social capital at a time to examine whether it has a crude association with depression. For the second model (M2), individual-level demographic factors (including age, marital status, and religion status) and socioeconomic status (including educational, income, and employment) were added in the M1 model to evaluate the adjusted effect of each dimension of neighborhood-level social capital on depression. Based on the second model, the third model (M3) additionally controlled neighborhood-level characteristics to examine the adjusted effect of each dimension of

neighborhood-level social capital on depression. In the fourth model (M4), the same dimension of both neighborhood- and individual-level social capital would all add in the third model at the same time and it could assess whether the effect of neighborhood-level social capital is genuinely contextual, or whether it would reflect compositional differences in individual-level social capital.

Furthermore, we would conduct further analyses in order to under the detail mechanism between each aspect of three dimensions of neighborhood-level social capital and depression. Based on the same series of multilevel logistic regression models as above, each variable in three dimensions of social capital would be used to explore how these variables associate with depression respectively. All hypotheses would be tested at α=0 .05 level of significance. All statistical analysis would adjust for complex sampling frame and be conducted by Statistical Analysis System (SAS), version 9.3.

Table 3.1 The prestige scores of occupational positions in the position generator

Occupational position	The prestige scores
Physician	78
Lawyer	73
Owner of large factory/firm	70
Assemblymen/women	69
Manger of large factory/firm	62
High school teachers	60
Division head	55
Reporter	55
Nurse	54
Owner of small factory/firm	48
Police	40
Electrician	36
Truck driver	31
Office workman/guard	26
Housemaid, cleaning worker	22

Table 3.2 The questions for Network social capital (NSC) in the 1997 TSCS

Aspect	Variable	Calculation	Response categories
The quantity of network social capital	Extensity	The total number of occupations in which respondents identified one contact	Continuous (1 – 15)
The quality of network social capital	Upper reachability	The highest prestige score of occupations that respondents have access to	Continuous (22 – 78)
The diversity of network social capital	Range	The difference between the highest and lowest prestige scores of occupations that respondents have access to	Continuous (0 – 56)

Table 3.3 The questions for Cognitive social capital (CSC) in the 1997 TSCS

Aspect	Variable	Question	Response categories
Trust in neighbors	Trust in neighbors	In the neighborhood/ community, residents could trust each other	1 = not trust . . 7 = highly trust
Perceptions of neighborhood reciprocity	Care	In the neighborhood/ community, residents are taking care with each other	1 = not care . . 7 = highly care
	Familiarity	In the neighborhood/ community, residents would know each other	1 = not familiar . . 7 = highly familiar

Table 3.4 The questions for Structural social capital (SSC) in the 1997 TSCS

Aspect	Variable	Question	Response categories
Participation in organization	Participation in organization	Have you attended an organization or club activity in the past 1 year? (7 types of voluntary organizations were included in the response)	Continuous (0 – 7)
Participation in the local community	Participation in the local community	Have you attended a local community event in the past 1 year? (6 events were included in the response)	Continuous (0 – 6)

Table 3.5 Summary of individual-level control variables in regression analysis

Construct	Variables	Categories
Demographic factors		
	Age	Continuous (for Aim 1 and 3)
		Category (for Aim 2)
		1=20-34 years (reference)
		2=35-49 years
		3=50-64 years
		4=65+
	Gender	1=Male (reference)
		2=Female
	Marital status	1=Currently married (reference)
		2=Single
		3=Widowed
		4=Separated/divorced
	Religious belief	1=Religious belief (reference)
		2=No religious belief
Socioeconomic status		
	Education	1=Junior high school or below (reference)
		2=Senior high school

	3=Junior college or above
Income	1=No income (reference)
	2=Less than $19 999
	3=$20 000 to $39 999
	4=Over $40 000
Employment	1=Not currently employed (reference)
	2=Self-employment
	3=Familial employed
	4=Non-familial employment

CHAPTER 4

NETWORK, COGNITIVE AND STRUCTURAL SOCIAL CAPITAL AND THE RISK OF

DEPRESSION IN TAIWAN

4.1 Introduction

Depression is among the most prevalent mental illnesses experienced (1) and is

ranked as one of the leading causes of disability worldwide (2). In Taiwan, depression is

an increasing public health problem. Approximately 5.3% of the Taiwanese population

ages 15 years and older have experienced major depression in the past year (3, 4).

Previous studies have demonstrated that individual-level factors (e.g., marital status) and

socioeconomic position indicators (educational attainment, employment status, and health

insurance status) predict higher risk of depression (5-7). Psychosocial factors such as

social capital may also be associated with lower risk of depression and improved mental

health status (28, 90, 151). However, the role of social capital and depression in Taiwan

is not clearly understood.

Social capital is a multidimensional concept that describes social relationships

within societies or between groups of people (8-10). There are three dimensions of social

capital that have been widely used in the public health literature, which may reflect three

distinct pathways to influence depression. Network social capital refers to resources

accessed within social networks for personal benefit (17). Cognitive social capital reflects

subjective perceptions of the quality of social relationships such as trust, support, norms,

and reciprocity (152). Structural social capital refers to the objective quantity of social relationships and activities, such as membership in associational activities or institutions and community participation, that link people and groups together (152). In general, empirical evidence suggests that people with a diverse and broad range of social capital may have more positive mental health outcomes (28, 90). However, evidence regarding the association between the type of social capital and mental health has not always been consistent (28).

Heterogeneity in the association between social capital and depression may be in part attributable to the type of measure used to operationalize social capital (94, 153, 154), which may reflect distinctive pathways to impact health. Network social capital proposes that resources embedded in social networks may enhance one's mental health by providing health information or "socially-valuable resources" (16, 155). The mechanisms linking cognitive social capital and depression may operate by producing positive psychological states, such as a sense of being ''accepted'' (20), feelings of security, and high self-esteem or self-efficacy (19, 156). It has been postulated that structural social capital contributes to mental health by increasing access to social support resources or information through social participation.(99). However, only a few studies have explicitly distinguished between the effect of network, structural, and cognitive social capital. For instance, Carpiano and Hystad (2011) showed that better self-reported mental health was associated with both network social capital and cognitive social capital; however, there was no significant association with structural social capital (94). Bassett and Moore (2013) showed that cognitive and network social capital were associated with depressive symptoms, but structural social capital had no effect (12).

Heterogeneity in social capital-health relationships has also been found in studies of other health outcomes. In a study examining the relationship between social capital and physical inactivity, only network and structural social capital were associated with lower risk of physical inactivity (157). The results from these studies demonstrate that cognitive, structural, and network dimensions of social capital may have different associations with a single outcome, potentially indicating differential mechanisms operating to influence health.

To further our understanding of the specific mechanisms linking cognitive, structural and network social capital on depression, additional research is needed to investigate the relative associations. Studies explicitly testing the relationship between network, cognitive and structural measures when examining one specific health outcome are limited. In contrast, most research tends to focus on exploring the effect of one dimension of social capital on one outcome (12). Furthermore, no studies have examined the potential differences in the relationship between network, structural and cognitive social capital on depression in Taiwan. Most prior studies of social capital and depression have been conducted in Western countries; few studies have been published from Asian countries. The possible differential relationship between network, structural and cognitive social capital may be highly contingent on the social and historical context of where and how individuals access social capital (158-160). Identifying variations in the association between type of social capital and depressive symptoms may have implications for the design of mental health promotion programs and interventions. To address these gaps in the literature, we examine the association between three dimensions of social capital and depressive symptoms using the 1997 Taiwan Social Change Survey, a nationally

representative population-based sample in Taiwan. Based on previous studies, we hypothesize that the network, cognitive and structural dimensions of social capital would have protective effect.

4.2 Methods

Data

The Taiwan Social Change Survey (TSCS) is a multi-cycle, long-term, nationally representative cross-sectional survey. The survey collects data on social issues relating to family, culture, religion, politics, social networks and social class, in addition to self-reported health and behavioral characteristics among residents in Taiwan. The TSCS is conducted by the Institute of Sociology, Academia Sinica, and sponsored by the Ministry of Science and Technology, Republic of China. The detailed survey procedure of the TSCS have been published elsewhere (85, 135). Briefly, TSCS used a stratified random sampling method to select adults 20 to 74 years old for participation in the survey. Data were collected by face-to-face interviews using a structured questionnaire. All participants were given full instruction of the study and informed consent was obtained from each participant. The ethics committee of the National Science Council of Taiwan approved this survey.

We used data from the third survey of the third cycle, which was conducted from June to November 1997. This 1997 TSCS dataset is unique because it is the only dataset that contains the best available information to measure all three dimensions of social capital (network, cognitive, and structural social capital) in Taiwan; only cognitive and structural social capital were captured in more recent TSCS datasets. A total of 2,835 participants with in 55 neighborhoods completed the questionnaire with a response rate of

94%. Respondents were excluded if they were missing information on the outcome

(n=85) or the exposure (n=161), yielding a final analytic sample of 2598 adults.

Measurements

Outcome variable

Depressive symptoms were measured using the 20-item Center for

Epidemiological Studies Depression Scale (CES-D) (136) . The Chinese version of CES-

D was translated directly from the 20-item CES-D by two psychiatrists (141) and has

been widely used in Taiwan (142-145, 161). Prior studies have shown that the Chinese

version of the CES-D is a reliable (Cronbach's alpha of 0.86) and validly measures

depressive symptoms with high sensitivity (92%) and specificity (91.0%) (141).

Participants were asked the frequency of experiencing each symptom in the past week.

Item responses were on a 4-point scale to indicate the frequency of the symptoms (0: less

than one day in the past week; 1=: 1-2 days in the past week; 2: 3-4 days in the past

week; 3: 5-7 days in the past week). After summing the score for each item together,

CES-D scores $\geq$ 15 were categorized as being at risk for clinical depression and <15 as

not being at risk for clinical depression (146, 161).

Exposure variable

Social capital was conceptualized along three dimensions: network, structural, and

cognitive. The TSCS position generator with a list of 15 ordered occupational positions

(84, 85) assessed network social capital. Each participant was asked "Of your relatives,

friends, and acquaintances, are there any who have the jobs listed in the following table?"

The choices for the 15 positions were ranged from housemaids/cleaning workers to

physicians.   Network social capital was measured along three variables: (1) extensity –

the total number of occupations which was identified by each participant; (2) upper

reachability – the highest prestige occupation that each participant could access; and (3)

range – the difference between highest and lowest prestige occupation that each

participant could access) (16, 85). The three variables were standardized (i.e. means = 0;

and standard deviation =1) for comparability. As a result of the high correlation between

these variables (range of the Pearson correlation coefficient from 0.64 to 0.84), an

individual-level composite network social capital score was constructed by the weighted

sum of the three network social capital variables. The weights were the standardized

scoring coefficients from the first component of a principal components analysis because

84% of the variability could be accounted by the first component. High internal reliability

justified the use of the composite score (Cronbach's alpha = 0.90).

There were two components of cognitive social capital: trust in neighbors and

perception of neighborhood reciprocity. Trust in neighbors was measured with one

question: "For the aspect of trust, how would you describe people who live around you?"

Perceived neighborhood reciprocity was measured using two items: (1) care and (2)

familiarity. To assess care, respondents were asked "For the aspect of care, how would

you describe the people who live around you?" To assess familiarity, respondents were

asked "For the aspect of familiarity, how would you describe the people who live around

you?" Respondents were asked to rank the responses from the three questions using a 7-

point scale. A composite cognitive social capital score was calculated by summing

together the scores from the three variables; it was used as a continuous variable in the

main analyses. The three items of the composite score were highly correlated with each

other (range of the Pearson correlation coefficient from 0.65 to 0.72) and demonstrated high internal reliability (Cronbach's alpha = 0.86)

Structural social capital was operationalized as: participation in organizations and participation in the local community. Participation in organizations was assessed by the following question: "Have you attended an organization or club activity in the past 1 year?" Respondents indicated whether they participated in one or more of the following types of organizations: religious, political, social movement, social service, alumni, occupational, and "other, if any." Participation in the local community was based on one question: "Have you attended a local community event in the past 1 year?" Respondents indicated whether they participated in one or more of the following types of events: li's/village's meeting (a li is a geographical division with around 2000 individuals created by the Taiwan Census Bureau), activity held by li/village, activity held by school, temple fair, church activity and activity held by other club/organization. For each variable of structural social capital, it would be categorized into two levels: (1) no participation and (2) participation in one or more. The composite score for structural social capital was measured as a categorical variable with two levels: (1) participation in neither the organization nor the local community; and 2) participation in at least one organization or local community.

Confounders / covariates

We included several potential confounders that have been used in prior studies examining social capital and depression (19). Demographic factors included age (continuous), gender (men and women), marital status (currently married, single and formerly married), and religious belief (religious belief and no religious belief). Three

commonly used socioeconomic variables were included: employment (not currently

employed, currently employed and retired), education (junior high school or below,

senior high school and junior college or above) and income status (no income, less than

NT$19 999, NT$20 000 to NT$39 999 and over NT$40 000).

Data analyses

Descriptive statistics for continuous variables were reported by weighted means

and standard error, and categorical variables were reported by weighted percentages and

standard error. The distribution of demographic factors, socioeconomic status and the

three dimensions of social capital were assessed for being at risk for clinical depression

versus not; comparisons were assessed using the Chi-square test for categorical variables

and t-test for continuous variables.

A series of multivariable logistic regression models were used to separately

evaluate the association between the three dimensions of social capital and depressive

symptoms. For each dimension, two models were constructed: Model 1 (crude):

composite social capital score; Model 2 (fully adjusted): Model 1 + demographic factors

(including age, marital status, and religion status) and socioeconomic status (including

educational, income, and employment). The individual components for each dimension

of social capital were also compared in separate models. Interaction terms between

composite social capital and gender were tested for each dimension in the fully adjusted

model. None of the analyzed interaction terms between the composite score in each

dimension of social capital and gender were statistically significantly after adjusting for

demographic factors and socioeconomic status. In sensitivity analyses, in order to

confirm whether the three dimensions of social capital influenced each other, we added

all composite scores for the three dimensions of social capital into a model simultaneously and ran crude and fully adjust models after testing for the potential of multicollinearity by the variance inflation factors (150) in the data. All statistical analyses applied sampling weights to adjust for complex sampling frame and were conducted using Statistical Analysis System (SAS), version 9.3 and the significant level was at p-value ≤ 0.05.

4.3 Results

Characteristics for the study population are presented in Table 4.1. Nearly 34% of all participants were at risk for clinical depression based on a CESD cutoff of >=15. Most participants were currently married, had religious beliefs, and were currently employed. Comparing different levels in education and income, more people had only junior high school or lower educational level and had income NT$20 000 to NT$39 999. In this study, the higher number of network or cognitive social capital represented higher perception of network or cognitive social capital. For structural social capital, more than 77% of respondents participated in at least one local community activity or organization.

The comparisons between groups at risk and not at risk for clinical depression were presented in Table 4.2. Participants at risk for clinical depression were less likely to be married, employed, and have an income higher than $20000 as compared to participants not at risk for clinical depression. Furthermore, network and cognitive social capital scores were significantly lower among participants at risk for clinical depression compared to those not at risk. Meanwhile, in the individual-level structural social capital, participants at risk for clinical depression had significantly lower percentage in

participating at least one activity in the local community or one organization than those not at risk.

Table 4.3 presented the associations between being at risk for clinical depression and the composite score as well as each variable in network social capital, controlling for demographic and socioeconomic variables (age, marital status, religious status, work, education and income). The composite score of network social capital was not associated with being at risk for clinical depression after controlling for all the considered variables. However, the variable of Extensity in network social capital was associated with a lower odds of being at risk for clinical depression after controlling for potential confounders (OR = 0.90, 95% C.I. = 0.81, 0.99) from the fully adjusted model.

The composite score as well as each variable in cognitive social capital were associated with lower odds of being at risk for clinical depression in adjusted models (Table 4.4). People with the higher composite score in cognitive social capital had lower odds to be at risk for clinical depression (OR = 0.92, 95% C.I. = 0.89, 0.94) than those with the low composite score after controlling for potential confounders from the fully adjusted model. In addition, people with a higher score of trust in neighbors (OR = 0.80, 95% C.I. = 0.74, 0.86), higher perceptions of neighborhood care (OR = 0.83, 95% C.I. = 0.78, 0.88) and higher perceptions of neighborhood familiarity (OR = 0.82, 95% C.I. = 0.77, 0.88) were associated with lower odds of being at risk for clinical depression after controlling for potential confounders from the fully adjusted model.

The composite score for structural social capital and the variable of participation in the local community were associated with statistically significant lower odds of being at risk for clinical depression in adjusted models (Table 4.5). Participation in at least one

local community activities or organization had lower odds of being at risk for clinical

depression than not participanting (OR = 0.79, 95% C.I. = 0.64, 0.94) after controlling for

potential confounders. Furthermore, to distinguish whether the types of social

participation mattered, people who participated in at least one local community activities

(OR = 0.76, 95% C.I. = 0.62, 0.92) had lower odds of being at risk for clinical depression

after controlling for potential confounders.

In the sensitivity analysis, we reran the model simultaneously adjusting for all

composite scores for the three dimensions of social capital (Table 4.6). Since the variance

inflation factor were less 10 when all three dimensions of social capital were included,

there was no multicollinearity problem (162). In the fully adjusted model, network and

structural social capital were not associated with being at risk for clinical depression, but

the higher composite score in cognitive social capital was still independently associated

with lower odds of being at risk for clinical depression (OR = 0.92, 95% C.I. =0.90,

0.94).

4.4 Discussion

The current study examined the association between three types of social capital

(i.e., network, cognitive and structural social capital) and depressive symptoms among a

population-based sample of adults in Taiwan. Differential associations between type of

social capital and depressive symptoms were observed. People with higher composite

scores for cognitive and structural social capital had lower odds of being at risk for

clinical depression compared to those with lower composite scores. Although composite

scores of network social capital were not associated with depressive symptoms, a

component of network social capital, network diversity, was associated with lower odds of being at risk for clinical depression.

Our findings are generally consistent with previous Western studies demonstrating no association between network social capital and depression (12, 97). The lack of an association between composite network social capital and depressive symptoms may be due to the type of network ties that a position generator appears to capture (12). It is possible that the position generator captures people's weaker social ties (66, 155, 163, 164) that may not provide support or resources that would help reduce depression (12). Our results are inconsistent with Song and Lin's study (2009) (16). Although both this study and Song and Lin's study used the 1997 TSCS data and the same way to construct the composite sore for network social capital, Song and Lin's study indicated that there was a negative association between network social capital and depression. The major difference is that depressive symptoms was operationalized as continuous variable in Song and Lin's study, whereas we used a cut-of-point (CES-D > 15 to identify people at risk for clinical depression). By using the categorical variable, we might capture a group of people with more severe depressive symptoms and the resource or support from network social capital may not be sufficient to reduce risk. Song and Lin did not assess the association between the individual components of network social capital. In our study, network extensity was the only component of network social capital associated with depressive symptoms. This finding is consistent with other studies that have found greater network diversity significantly associated with better self-reported mental health (94), less physical inactivity (157) and higher self-rated health (153) compared to those less network diversity. Network diversity may be indicative of a

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person's choice of access to informational sources and connections that may influence depression (157). These results suggest that differences in the associations between network social capital and depressive symptoms are due to specific components which may reflect different mechanisms.

Both composite and individual components of cognitive social capital were associated with lower odds of depressive symptoms. Our findings were consistent with previous work where an inverse association between depressive symptoms and cognitive social capital represented as either perceived neighborhood trust, interpersonal trust, perceived neighborhood cohesion, and social reciprocity have been documented (12, 20, 21, 24, 103). High levels of cognitive social capital may have a direct protective association for depression (99) by producing positive psychological states, such as a sense of being ''accepted,'' and feelings of security, which may decrease mental distress (20, 101). In addition, people with high levels of cognitive social capital may more easily attain social support to cope with and buffer against stress (99).

Prior associations between structural social capital and depression have been mixed. Some studies showed that structural social capital, measured by community participation, volunteer work, and community cohesion, was not associated with depression in general population (12, 20, 21, 126), whereas various forms of social participation (i.e., religious participation and volunteer work) were associated with depression among older adults (165, 166). These differences may be a function of the forms of participation. Our results indicated that the association between structural social capital and depressive symptoms was dependent on how it was measured. Our study, individuals who participated in at least one local community activity had lower odds of

being at a risk of clinical depression. However, participation in the organization was not associated with being at the risk of clinical depression. Based on these two results, we could assume that only people who have participated in the local community activity may have benefits to reduce a risk of clinical depression. Taiwanese tend to be a kinship-based society where people have close relationships with family. It is possible that local community organizations (i.e., schools and churches) may be more likely to be kinship-based, whereas participation in other organizations (i.e., work, political) are more likely to include non-family members. However, we were not able to capture this level of detail from the questionnaire. Participation and involvement in community organizations represent key mental health resources that enable people to enlarge their social network, which may in turn increase the level of positive social support and decrease feelings of isolation (110). However, future research is needed to determine whether distinguishing between different forms of participation (e.g., community versus religious) can further our understanding of the mechanisms linking structural social capital and depression.

Limitations and Strengths

Findings from this analysis must be considered within the context of several limitations. Since we used a cross-sectional study design to analyze the associations in this study, confirmation of a causal relationship between social capital and depression is not possible. It is possible that we may be observing reverse causality, where an individual's mental health status could influence measures of social capital. However, our findings are consistent with evidence from recent longitudinal studies assessing social capital and depression showing inverse associations (20). Another limitation is that there might be measurement error in the assessment of social capital. We do not have detailed

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measurement of the nature of social capital. For example, the civic participation at the community level and voluntarism are also important indicators for social capital in other studies but not measured in this study. Also, we only measured social capital at the individual-level; it would be hard to make the conclusion that the individual-level social capital was independently associated with being at a risk of clinical depression without additionally consider of social capital at the neighborhood-level. Furthermore, there may be a limitation about the measurement of depressive symptoms as a categorical variable. Although several prior studies have showed that categorized depressive symptoms represented optimization of sensitivity and specificity for screening cases of depression (167, 168), there is a possibility that we would not be able to detect the association between social capital and minor depressive symptoms.

This study has several strengths. First, the TSCS is nationally representative and the results are generalizable to the overall population in Taiwan. Second, social capital is measured in a comprehensive way. Although social capital is a multidimensional concept, many studies, particularly in Taiwan, did not examine social capital comprehensively. Compared to prior studies, the use of three dimensions of social capital is an advantage of this study, which will deepen our understanding of how different dimensions of social capital are associated with depression. Furthermore, this is the first study to comprehensively evaluate the association between three dimensions of social capital and depression in Taiwan. These findings have the potential to have important theoretical value and policy implications. Since we found the association between cognitive social capital, participation in the local community activity and network diversity and the risk of

clinical depression, future direction for prevention programs could consider incorporating those important elements in.

Conclusion

This study adds to the limited body of research on social capital and depression in Taiwan. To our knowledge, this is the first study to comprehensively explore whether there are differences in the association between network, cognitive and structural social capital and depressive symptoms. Our results suggest that the association between social capital and depression in Taiwan differs according to the specific dimension of social capital assessed. Disaggregating this multidimensional measure furthers our understanding of the relationship between social capital and depressive symptoms.

Table 4.1 Distribution of demographic factors, socioeconomic status and social capital, 1997 Taiwan Social Change Survey (TSCS)

	All n^a=2598 N^b=2576
The risk of clinical depression, weighted % (SE)	33.8 (1.0)
Age, weighted mean (SE)	40.5 (0.3)
Gender	
Men	49.8 (1.0)
Women	50.2 (1.0)
Marital status, weighted % (SE)	
1=Currently married	67.9 (1.0)
2=Single	25.8 (0.9)
3=Formerly married	6.3 (0.5)
Religious status, weighted % (SE)	
1=Religious belief	77.5 (0.9)
2=No religious belief	22.5 (0.9)
Employment, weighted % (SE)	
1=Not currently employed	26.4 (0.9)
2=Currently employed	70.2 (0.9)
3=Retired	3.5 (0.3)
Education, weighted % (SE)	
1=Junior high school or below	49.2 (1.0)
2=Senior high school	28.6 (0.9)
3=Junior college or above	22.2 (0.8)
Income, weighted % (SE)	
1=No income	27.4 (0.9)
2=Less than $19 999	17.6 (0.8)
3=$20 000 to $39 999	30.8 (1.0)
4=Over $40 000	24.2 (0.9)
Network social capital, weighted mean (SE)	
Composite score	-0.08 (0.02)
The quantity of network social capital - Extensity	-0.08 (0.02)
The quality of network social capital - Upper reachability	-0.07 (0.02)
The diversity of network social capital - Range	-0.07 (0.02)
Cognitive social capital, weighted mean (SE)	
Composite score	15.65 (0.08)
Trust in neighbors	5.11 (0.03)
Perceptions of neighborhood care	5.07 (0.03)
Perceptions of neighborhood familiarity	5.47 (0.03)
Structural social capital, weighted % (SE)	
Composite score	
No	23.0 (0.9)
1 or more	77.0 (0.9)
Participation in the local community	
No	33.3 (1.0)
1 or more	66.7 (1.0)
Participation in organization	
No	52.9 (1.0)
1 or more	47.1 (1.0)

[a]: unweighted sample size
[b]: weighted sample size

Table 4.2 Comparison between not at risk and at risk of clinical depression in demographic factors, socioeconomic status and three dimensions of social capital for 1997 Taiwan Social Change Survey (TSCS)

	All		
	Not at risk	At risk	
	n^a =1764	n=834	
	N^b=1705	N=871.72	
	Mean (SE)	**Mean (SE)**	**p-value^c**
Age	40.8 (0.3)	39.7 (0.5)	0.07
	Weighted % (SE)	**Weighted % (SE)**	**p-value**
Gender			<.0001
Men	54.9 (1.3)	39.9 (1.8)	
Women	45.1 (1.3)	60.1 (1.8)	
Marital status			<.0001
1=Currently married	73.0 (1.2)	57.8 (1.8)	
2=Single	22.4 (1.1)	32.4 (1.7)	
3=Formerly married	4.6 (0.5)	9.8 (1.1)	
Religious status			0.17
1=Religious belief	78.4 (1.0)	75.9 (1.6)	
2=No religious belief	21.6 (1.0)	24.1 (1.6)	
Employment			
1=Not currently employed	22.2 (1.1)	34.4 (1.7)	<.0001
2=Currently employed	74.2 (1.1)	62.3 (1.8)	
3=Retired	3.5 (0.4)	3.3 (0.6)	
Education			0.39
1=Junior high school or below	50.0 (1.3)	47.8 (1.8)	
2=Senior high school	28.7 (1.1)	28.5 (1.6)	
3=Junior college or above	21.4 (1.0)	23.7 (1.5)	
Income			<.0001
1=No income	24.5 (1.1)	33.0 (1.7)	
2=Less than $19 999	15.5 (0.9)	21.7 (1.5)	
3=$20 000 to $39 999	32.4 (1.2)	27.8 (1.6)	
4=Over $40 000	27.7 (1.1)	17.5 (1.4)	
	Mean (SE)	**Mean (SE)**	**p-value**
Network social capital			
Composite score	-0.03 (0.02)	-0.17 (0.04)	0.002
The quantity of network social capital - Extensity	-0.03 (0.02)	-0.19 (0.03)	<.0001
The quality of network social capital - Upper reachability	-0.03 (0.03)	-0.14 (0.04)	0.02
The diversity of network social capital - Range	-0.03 (0.02)	-0.14 (0.04)	0.02
Cognitive social capital			
Composite score	16.08 (0.09)	14.82 (0.14)	<.0001
Trust in neighbors	5.24 (0.03)	4.85 (0.05)	<.0001
Perceptions of neighborhood care	5.23 (0.04)	4.78 (0.06)	<.0001
Perceptions of neighborhood familiarity	5.61 (0.03)	5.20 (0.06)	<.0001
	Weighted % (SE)	**Weighted % (SE)**	**p-value**
Structural social capital			
Composite score			0.003
No	21.0 (1.0)	26.9 (1.6)	
1 or more	79.0 (1.0)	73.1 (1.6)	
Participation in the local community			0.001
No	30.9 (1.2)	38.0 (1.8)	

1 or more	69.1 (1.2)	62.0 (1.8)	
Participation in organization			0.03
No	51.4 (1.3)	56.0 (1.8)	
1 or more	48.6 (1.3)	44.0 (1.8)	

[a]: unweighted sample size

[b]: weighted sample size

[c]: The p-value of the comparison of depression and non-depression groups

Table 4.3 Logistic regression model analysis of the association between the risk of clinical depression and network social capital respectively in 1997 TSCS

	Model 1[a]	Model 2-1	Model 2-2	Model 2-3	Model 2-4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Network social capital					
Composite score	0.87 (0.80, 0.95)	0.91 (0.83, 1.01)			
Extensity	0.84 (0.77, 0.92)		0.90 (0.81, 0.99)		
Upper reachability	0.90 (0.83, 0.98)			0.92 (0.84, 1.01)	
Range	0.90 (0.83, 0.98)				0.94 (0.85, 1.03)
Gender					
Male		1.00	1.00	1.00	1.00
Female		1.64 (1.34, 2.01)	1.62 (1.32, 1.99)	1.64 (1.34, 2.01)	1.64 (1.34, 2.00)
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status					
1=Currently married		1.00	1.00	1.00	1.00
2=Single		1.89 (1.46, 2.47)	1.89 (1.45, 2.46)	1.91 (1.46, 2.48)	1.91 (1.47, 2.49)
3=Formerly married		2.28 (1.57, 3.30)	2.30 (1.59, 3.34)	2.27 (1.57, 3.29)	2.28 (1.57, 3.30)
Religious status					
1=Religious belief		1.00	1.00	1.00	1.00
2=No religious belief		1.02 (0.82, 1.28)	1.02 (0.82, 1.27)	1.03 (0.82, 1.28)	1.03 (0.82, 1.28)
Employment					
1=Not currently employed		1.00	1.00	1.00	1.00
2=Currently employed		0.59 (0.39, 0.87)	0.58 (0.39, 0.87)	0.59 (0.40, 0.87)	0.59 (0.40, 0.88)
3=Retired		0.77 (0.46, 1.27)	0.75 (0.45, 1.26)	0.78 (0.47, 1.29)	0.77 (0.46, 1.28)
Education					
1=Junior high school or below		1.00	1.00	1.00	1.00
2=Senior high school		1.14 (0.88, 1.48)	1.15 (0.88, 1.49)	1.14 (0.88, 1.48)	1.12 (0.87, 1.46)
3=Junior college or above		1.23 (0.91, 1.66)	1.23 (0.92, 1.66)	1.11 (0.73, 1.71)	1.20 (0.89, 1.61)
Income					
1=No income		1.00	1.00	1.00	1.00
2=Less than $19 999		1.60 (1.06, 2.41)	1.62 (1.07, 2.45)	1.58 (1.05, 2.37)	1.60 (1.06, 2.41)
3=$20 000 to $39 999		1.13 (0.74, 1.74)	1.15 (0.74, 1.77)	1.11 (0.73, 1.71)	1.12 (0.73, 1.73)
4=Over $40 000		1.01 (0.64, 1.60)	1.04 (0.65, 1.65)	0.98 (0.62, 1.55)	0.99 (0.62, 1.57)

[a]: the crude model would be run for Compositive score and each component for network social capital individually

Table 4.4 Logistic regression model analysis of the association between the risk ofclinical depression and cognitive social capital respectively in 1997 TSCS

	Model 1[a]	Model 2-1	Model 2-2	Model 2-3	Model 2-4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Cognitive social capital					
Composite score	0.92 (0.90, 0.94)	0.92 (0.89, 0.94)			
Trust in neighbors	0.80 (0.75, 0.85)		0.80 (0.74, 0.86)		
Perceptions of neighborhood care	0.83 (0.79, 0.88)			0.83 (0.78, 0.88)	
Perceptions of neighborhood familiarity	0.83 (0.78, 0.88)				0.82 (0.77, 0.88)
Gender					
Male		1.00	1.00	1.00	1.00
Female		1.58 (1.28, 1.93)	1.59 (1.29, 1.95)	1.60 (1.30, 1.96)	1.57 (1.28, 1.93)
Age		1.01 (1.00, 1.02)	1.01 (1.00, 1.02)	1.01 (1.00, 1.02)	1.01 (1.00, 1.02)
Marital status					
1=Currently married		1.00	1.00	1.00	1.00
2=Single		1.93 (1.48, 2.51)	1.90 (1.46, 2.48)	1.94 (1.49, 2.53)	1.95 (1.50, 2.55)
3=Formerly married		2.25 (1.55, 3.27)	2.23 (1.53, 3.25)	2.26 (1.56, 3.28)	2.29 (1.57, 3.32)
Religious status					
1=Religious belief		1.00	1.00	1.00	1.00
2=No religious belief		1.00 (0.80, 1.24)	1.02 (0.82, 1.28)	1.00 (0.80, 1.25)	1.00 (0.80, 1.25)
Employment					
1=Not currently employed		1.00	1.00	1.00	1.00
2=Currently employed		0.61 (0.41, 0.90)	0.60 (0.41, 0.90)	0.61 (0.41, 0.91)	0.60 (0.40, 0.89)
3=Retired		0.76 (0.46, 1.28)	0.78 (0.47, 1.30)	0.76 (0.46, 1.28)	0.76 (0.46, 1.27)
Education					
1=Junior high school or below		1.00	1.00	1.00	1.00
2=Senior high school		1.02 (0.79, 1.32)	1.05 (0.81, 1.36)	1.05 (0.81, 1.35)	1.02 (0.79, 1.33)
3=Junior college or above		1.05 (0.78, 1.41)	1.10 (0.82, 1.48)	1.09 (0.81, 1.47)	1.04 (0.77, 1.39)
Income					
1=No income		1.00	1.00	1.00	1.00
2=Less than $19 999		1.62 (1.08, 2.43)	1.58 (1.05, 2.39)	1.61 (1.07, 2.42)	1.64 (1.09, 2.47)
3=$20 000 to $39 999		1.09 (0.71, 1.68)	1.08 (0.70, 1.67)	1.09 (0.71, 1.69)	1.10 (0.72, 1.68)
4=Over $40 000		0.87 (0.55, 1.38)	0.89 (0.56, 1.41)	0.88 (0.56, 1.41)	0.90 (0.57, 1.41)

[a]: the crude model would be run for Compositive score and each component for network social capital individually

Table 4.5 Logistic regression model analysis of the association between the risk of clinical depression and structural social capital respectively in 1997 TSCS

	Model 1[a]	Model 2-1	Model 2-2	Model 2-3
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Structural social capital				
Composite score				
No participation	1.00	1.00		
1 or more	0.73 (0.59, 0.89)	0.79 (0.64, 0.98)		
Participation in the local community				
No participation	1.00		1.00	
1 or more	0.73 (0.61, 0.88)		0.76 (0.62, 0.92)	
Participation in organization				
No participation	1.00			1.00
1 or more	0.83 (0.70, 0.99)			0.90 (0.75, 1.09)
Gender				
Male		1.00	1.00	1.00
Female		1.62 (1.32, 1.98)	1.61 (1.32, 1.98)	1.61 (1.32, 1.98)
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		1.00	1.00	1.00
2=Single		1.93 (1.48, 2.51)	1.92 (1.47, 2.49)	1.94 (1.49, 2.52)
3=Formerly married		2.27 (1.57, 3.29)	2.27 (1.56, 3.28)	2.29 (1.58, 3.31)
Religious status				
1=Religious belief		1.00	1.00	1.00
2=No religious belief		1.01 (0.81, 1.26)	1.00 (0.80, 1.25)	1.03 (0.82, 1.28)
Employment				
1=Not currently employed		1.00	1.00	1.00
2=Currently employed		0.60 (0.40, 0.89)	0.60 (0.40, 0.89)	0.59 (0.39, 0.87)
3=Retired		0.77 (0.46, 1.27)	0.76 (0.46, 1.26)	0.77 (0.47, 1.29)
Education				
1=Junior high school or below		1.00	1.00	1.00
2=Senior high school		1.10 (0.85, 1.42)	1.09 (0.84, 1.41)	1.11 (0.86, 1.44)
3=Junior college or above		1.18 (0.88, 1.58)	1.15 (0.86, 1.54)	1.19 (0.89, 1.60)
Income				
1=No income		1.00	1.00	1.00
2=Less than $19 999		1.58 (1.05, 2.39)	1.59 (1.05, 2.40)	1.60 (1.06, 2.41)
3=$20 000 to $39 999		1.08 (0.71, 1.67)	1.08 (0.70, 1.66)	1.11 (0.72, 1.71)

4=Over $40 000	0.95 (0.60, 1.51)	0.94 (0.59, 1.48)	0.98 (0.62, 1.55)

[a]: the crude model would be run for Compositive score and each component for network social capital individually

Table 4.6 Logistic regression model analysis of the association between the risk of clinical depression, network, cognitive and structural social capital in 1997 TSCS

	Model 1	Model 2
	OR (95% C.I.)	OR (95% C.I.)
Network social capital - Composite score	0.86 (0.79, 0.94)	0.93 (0.84, 1.03)
Cognitive social capital - Composite score	0.92 (0.90, 0.94)	0.92 (0.90, 0.94)
Structural social capital - Composite score		
No participation	1.00	1.00
1 or more	0.83 (0.67, 1.02)	0.87 (0.70, 1.09)
Gender		
Male		1.00
Female		1.59 (1.29, 1.95)
Age		1.01 (1.00, 1.02)
Marital status		
1=Currently married		1.00
2=Single		1.87 (1.43, 2.45)
3=Formerly married		2.21 (1.52, 3.21)
Religious status		
1=Religious belief		1.00
2=No religious belief		0.97 (0.78, 1.22)
Employment		
1=Not currently employed		1.00
2=Currently employed		0.61 (0.41, 0.90)
3=Retired		0.75 (0.45, 1.25)
Education		
1=Junior high school or below		1.00
2=Senior high school		1.05 (0.81, 1.37)
3=Junior college or above		1.11 (0.82, 1.50)
Income		
1=No income		1.00
2=Less than $19 999		1.62 (1.08, 2.43)
3=$20 000 to $39 999		1.11 (0.72, 1.71)
4=Over $40 000		0.92 (0.58, 1.46)

CHAPTER 5

AGE-BASED PATTERNS OF SOCIAL CAPITAL AND THE RISK OF CLINICAL

DEPRESSION AMONG TAIWANESE POPULATION

5.1 Introduction

Social capital is a multidimensional concept that describes social relationships within societies or between groups of people (9, 10, 169). Several prior studies conducted in the U.S., the UK, and Canada demonstrates higher levels of social capital were associated with better health outcomes, such as mental health. (11-13). In general, empirical evidence suggests that people with a diverse and broad range of social capital may have lower risk of depression and improved mental health status (28, 90, 151), but evidence regarding type of social capital has not been consistently associated with outcomes (28, 90). There are reasons to believe that the variations may be a function of age-based patterning in the accumulation, receipt, and decline of social capital, which can translate into variations in health outcomes (28, 90).

Relatively few studies have examined age-based patterns of social capital. Identifying unique trajectories can help to further understand processes of social capital and health. Age-based patterns of social capital may vary across different age groups due to the development context of young, middle and old age (26, 112, 170). (26). The accumulation of social capital may be sensitive to life course transitions such as cohabitation, marriage, parenthood or retirement (26). Studies have shown that social

capital may decline as people age (171, 172) or may increase when people cohabitate or marry (171, 173). It is not clear whether age-based patterns of social capital are the same across different forms of social capital. (170). For instance, network social capital, measured by the position generator, tended to accumulate over the course of life with diminishing levels of network social capital among older population (26). In contrast, cognitive social capital, measured by trust, continuously increased with age (26). Relatively few studies have examined age variations in different dimensions of social capital because many studies rely on age-specific samples and focused on single dimension of social capital (26).The existence of age-based patterns of social capital warrants further exploration of "the importance of timing for conditioning the effects of social capital (26)."

These age-based differences in access and accumulation of social capital may translate into age-related differences in health outcomes. There is evidence to suggest that social capital is predictive of depressive symptoms among children, young- middle-age, and older adults (174). However, some studies show that social capital may be more important for the psychological health of certain age groups relative to other age groups. For example, some studies show that the strength of the association between social capital and mental health among older adults is stronger in comparison to younger adults (175). It is not clear whether this association is stronger because of the social capital accrued over one's life course. There remains an important gap within the literature since few studies have linked age-based patterns in social capital to variations in health outcomes.

More research is needed to establish how social capital may influence risk for clinical depression among different age groups. Findings from the U.S. context may not be generalizable to other societal and cultural context such as Taiwan. A recent study by McDonald et al. demonstrated the cross-national differences between the U.S., Taiwan, and China, in access to social capital accumulation by age (170). Therefore, in order to advance our understanding, we examine age-based patterns in social capital to determine whether these features may predict and explain risk for clinical depression. The present study addresses gap in the literature by examining the relationship between age-based trajectories of social capital and depressive symptoms. More specifically, we compare age-based patterns of network, structural, and cognitive social capital and determine whether the association between network, cognitive and structural social capital and the risk of clinical depression may vary across age groups by using a population-based sample from the 1997 Taiwan Social Change Survey (TSCS). The data from the 1997 TSCS provides a distinctive opportunity to compare age-based patterns of network, structural, and cognitive social capital and examine the associations with depressive symptoms. We hypothesized that there are distinct patterns in age-based patterns of network, cognitive and structural social capital where the age-based patterns of network and structural social capital would be descending along with age but the age-based patterns of cognitive social capital would be increasing along with age. Furthermore, we hypothesized that only the association between network social capital and depressive symptoms would vary aby age, but cognitive and structural social capital would consistently associated with depressive symptoms among different ages.

5.2 Methods

Data

       The Taiwan Social Change Survey (TSCS) is a multi-cycle, long-term, nationally representative cross-sectional survey. The survey collects data on social issues relating to family, culture, religion, politics, social networks and social class, in addition to self-reported health and behavioral characteristics among residents in Taiwan. The TSCS is conducted by the Institute of Sociology, Academia Sinica, and sponsored by the Ministry of Science and Technology, Republic of China. The detailed survey procedure of the TSCS have been published elsewhere (85, 135). Briefly, TSCS used a stratified random sampling method to select adults 20 to 74 years old for participation in the survey. Data were collected by face-to-face interviews using a structured questionnaire. All participants were given full instruction of the study and informed consent was obtained from each participant. The ethics committee of the National Science Council of Taiwan approved this survey.

       We used data from the third survey of the third cycle, which was conducted from June to November 1997. This 1997 TSCS dataset is unique because it is the only data that contains the best available information to measure all three dimensions of social capital (network, cognitive, and structural social capital in Taiwan; only cognitive and structural social capital were captured in more recent TSCS dataset. A total of 2,835 participants completed the questionnaire a response rate of 94%. Respondents were excluded if they were missing information on the outcome (n=85) or the exposure (n=161), yielding a final analytic sample of 2598 adults.

Measurements

Outcome variable

Depressive symptoms were measured using the 20-item Center for
Epidemiological Studies Depression Scale (CES-D) (136) . The Chinese version of CES-
D was translated directly from the 20-item CES-D by two psychiatrists (141) and has
been widely used in Taiwan (142-145, 161). Prior studies have shown that the Chinese
version of the CES-D is a reliable (Cronbach's alpha of 0.86) and validly measures
depressive symptoms with high sensitivity (92%) and specificity (91.0%) (141).
Participants were asked the frequency of experiencing each symptom in the past week.
Item responses were on a 4-point scale to indicate the frequency of the symptoms (0: less
than one day in the past week; 1=: 1-2 days in the past week; 2: 3-4 days in the past
week; 3: 5-7 days in the past week). After summing the score for each item together,
CES-D scores $\geq$ 15 were categorized as being at risk for clinical depression and <15 as
not being at risk for clinical depression (146, 161).

Exposure variable

Social capital was conceptualized along three dimensions: network, structural, and
cognitive. The TSCS position generator with a list of 15 ordered occupational positions
(84, 85) assessed network social capital. Each participant was asked "Of your relatives,
friends, and acquaintances, are there any who have the jobs listed in the following table?"
The choices for the 15 positions were ranged from housemaids/cleaning workers to
physicians.   Network social capital was measured along three variables: (1) extensity –
the total number of occupations which was identified by each participant; (2) upper
reachability – the highest prestige occupation that each participant could access; and (3)

range – the difference between highest and lowest prestige occupation that each participant could access) (16, 85). The three variables were standardized (i.e. means = 0; and standard deviation =1) for comparability. As a result of the high correlation between these variables (range of the Pearson correlation coefficient from 0.64 to 0.84), an individual-level composite network social capital score was constructed by the weighted sum of the three network social capital variables. The weights were the standardized scoring coefficients form the first component of a principal components analysis because of 84% of the variability could be accounted by the first component. High internal reliability justified the use of the composite score (Cronbach's alpha = 0.90).

There were two components of cognitive social capital: trust in neighbors and perception of neighborhood reciprocity. Trust in neighbors was measured with one question: "For the aspect of trust, how would you describe people who live around you?" Perceived neighborhood reciprocity was measured using two items: (1) care and (2) familiarity. To assess care, respondents were asked "For the aspect of care, how would you describe the people who live around you?" To assess familiarity, respondents were asked "For the aspect of familiarity, how would you describe the people who live around you?" Respondents were asked to rank the responses from the three questions using a 7-point scale. A composite cognitive social capital score was calculated by summing together the scores from the three variables; it was used as a continuous variable in the main analyses. The three items of the composite score were highly correlated with each other ($p < 0.0001$) and demonstrated high internal reliability (Cronbach's alpha = 0.86)

Structural social capital was operationalized as: participation in organizations and participation in the local community. Participation in organizations was assessed by the

following question: "Have you attended an organization or club activity in the past 1 year?" Respondents indicated whether they participated in one or more of the following types of organizations, including religious, political, social movement, social service, alumni, occupational, and "other, if any." Participation in the local community was based on one question: "Have you attended a local community event in the past 1 year?" Respondents indicated whether they participated in one or more of the following types of events: li's/village's meeting (a li is a geographical division created by the Taiwan Census Bureau), activity held by li/village, activity held by school, temple fair, church activity and activity held by other club/organization. For each variable of structural social capital, it would be categorized into two levels: (1) no participation and (2) participation in one or more. The composite score for structural social capital was measured as a categorical variable with two levels: (1) participation in neither the organization nor the local community; and 2) participation in at least one organization or local community.

Confounders / covariates

We included several potential confounders that have been used in prior studies examining social capital and depression (19). Demographic factors included gender (men and women), marital status (currently married, single and formerly married), and religious belief (religious belief and no religious belief). Three commonly used socioeconomic variables were included: employment (not currently employed, currently employed and retired), education (junior high school or below, senior high school and junior college or above) and income status (no income, less than NT$19 999, NT$20 000 to NT$39 999 and over NT$40 000). Age is effect modifier with four groups in this study: age 20-34, age 35-49, age 50-64 and age ≥65.

Data analyses

Descriptive statistics for continuous variables were reported by weighted means and standard error, and categorical variables were reported by weighted percentages and standard error across four age groups. The distribution of demographic factors, socioeconomic status and the three dimensions of social capital among four age groups were assessed; comparisons were assessed using the Chi-square test for categorical variables and t-test for continuous variables.

A series of multivariable logistic regression models were used to separately evaluate the association between the three dimensions of social capital and depressive symptoms. For each dimension, two models were constructed: Model 1 (crude): composite social capital score; Model 2 (fully adjusted): Model 1 + demographic factors (including age, marital status, and religion status) and socioeconomic status (including educational, income, and employment). The individual components for each dimension of social capital were also compared in separate models. Interaction terms between composite social capital and age groups were tested for each dimension in the fully adjusted model (Model 3). Only the interaction between the composite score of network social capital and depressive symptoms was statistically significant after adjusting for demographic factors and socioeconomic status. Therefore, the same series of multivariable logistic regression models were used to separately evaluate the association between the composite social capital score of network social capital and depressive symptoms for four age groups. All statistical analyses applied sampling weights to adjust for complex sampling frame and were conducted using Statistical Analysis System (SAS), version 9.3 and the significant level was at p-value < 0.05.

5.3 Results

Characteristics for the study population among four age groups are presented in Table 5.1. Among the oldest age groups (Age ≥65) had the highest percentage of met the criteria for being at risk for clinical depression which is 43.3% and the pattern of this percentage across four age-groups is "U" shape (Figure 1). For all four age-groups, most people were currently married, had religious belief and were currently employed or retired, except the youngest age group (Age 20-34) which most people were not currently married. Only participants in the youngest age group had higher percentage of having senior high school and most people in the rest of age groups had only junior high school or lower educational level. Also, participations in older age group (Age 50-64 and Age ≥65) were more likely to have no income and participants younger age group (Age 20-34 and Age 35-49) were more likely to have income $20 000 to $39 999 or more. The composite score and scores of each variable for network social capital slightly increasing on younger age groups but decease sharply in older age groups. The composite score and scores of each variable for cognitive social capital consistently increased with age increased. For structural social capital, participants from all four age-groups had higher percentage of participating at least one organization or activity in the local community than no participation. Furthermore, figures which showed age-based patterns of network, cognitive, and structural social capital for being at risk for clinical depression versus not were presented in Figure 2. Overall, age-based patterns of network social capital showed a slight rise during Age 20-34 and Age 35-49 and a steep decline later in life (Figure 2A). Also, age-based patterns of cognitive social capital showed a consistent increase across age (Figure 2B). Age-based patterns of structural social capital indicated a rise during

Age 20-34 and Age 35-49. However, the age-based pattern for participants at risk for clinical depression decreased but the age-based pattern for participants not at risk for clinical depression has a slight increase during the late life (Figure 2C)

From Table 5.2 to Table 5.4, they presented the associations between being at risk for clinical depression and the composite score as well as each variable in network, cognitive and structural social capital respectively, controlling for the demographic and socioeconomic variables (age, marital and religious status, work, education and income). According to the results of study, the composite score and each variable of network social capital was not significantly associated with being at risk for clinical depression after controlling for potential confounders (Table 5.2), but the interaction between the composite score and each variable of network social capital and age groups were significant. The composite score as well as each variable in cognitive social capital was significantly associated with being at risk for clinical depression (Table 5.3). People with higher the composite score of cognitive social capital (OR = 0.92, 95% C.I. = 0.89, 0.94), score of trust in neighbors (OR = 0.80, 95% C.I. = 0.74, 0.86), perceptions of neighborhood care (OR = 0.83, 95% C.I. = 0.78, 0.88) and perceptions of neighborhood familiarity (OR = 0.82, 95% C.I. = 0.77, 0.88) were significantly associated with lower risk of being at risk for clinical depression after controlling for potential confounders. Participation in at least one local community activity or organization had lower odds of being at risk for clinical depression than no participants (OR = 0.79, 95% C.I. = 0.63, 0.98) after controlling for potential confounders (Table 5.4). Furthermore, only people who participated in at least one local community activities (OR = 0.76, 95% C.I. = 0.62, 0.92) was significantly associated with lower risks of being at risk for clinical depression

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after controlling for potential confounders. However, none of the analyzed interaction terms between the composite score and each variable of cognitive and structural social capital and age groups were significant after adjusting for potential confounders.

Since the interaction between the composite score and each variable of network social capital and age groups were significant, we implemented subpopulation analyses by using a series of multivariable logistic regression models to evaluate whether the association between the composite score and each variable of network social capital and being at risk for clinical depression would vary by age (Table 5-8). The composite score and each variable of network social capital and was significantly associated with being at risk for clinical depression only among the oldest age group (Age ≥65). Among the oldest age group (Age ≥65), People with the higher composite score in network social capital were associated with lower odds of being at risk for clinical depression (OR = 0.70, 95% C.I. = 0.54, 0.92) after controlling for potential confounders. Meanwhile, people with higher score of extensity in network social capital (OR = 0.60, 95% C.I. = 0.42, 0.85), upper reachability in network social capital (OR = 0.78, 95% C.I. = 0.62, 0.99) and range in network social capital (OR = 0.76, 95% C.I. = 0.59, 0.97) were significantly associated with lower odds of being at risk for clinical depression after controlling for potential confounders.

5.4 Discussion

To our knowledge, this is the first study systematically assessed whether there are different age-based patterns for network, cognitive and structural social capital and to explore the association between age-based patterns of social capital and the risk for clinical depression. This study showed that there are different age patterns for network,

cognitive and structural social capital. We only observed age variations in network social capital and the risk for clinical depression and we found that the higher score of network social capital associates with lower odds of being at risk for clinical depression only among older age group but not among younger age group. Age-based patterns in cognitive or structural social capital were not predictive of age differences in being at risk for clinical depression. We did not find significant age variations in cognitive or structural social capital and risk for clinical depression.

McDonald, Chen, and Mair (2015) compared the age-based patterns of multiple indicators for social capital in Taiwan, China, and the U.S. (170). Our age patterns were consistent with what they found for network social capital but not for structural social capital. It has been previously shown that work-related social networks exhibit a curvilinear relationship. For example in McDonald et al 2015, occupational connections, measured by the position generator, showed a steep rise in occupational connections during the first portion of life and a steep decline later in life in Taiwan. Although our results did not show such a steep rise during early adulthood, our findings parallel the steep decline among older adults. According to previous studies, there is a decline in network social capital with advancing age (170). For structural social capital, the results from the study of the cross-national comparison showed that although both respondents in Taiwan and the U.S. show an accumulative pattern of membership participation across age, Taiwanese reported relatively lower levels of organizational memberships than Americans across age and organizational membership play a much more dominant role in U.S. than in Taiwan (170). However, we did not see that pattern in this study and the possible reason is that data for two studies were collected in different years which could

represent various social contexts between two time points in Taiwan. In this study, the

data was came from1997 when civil organizations were just beginning to involve

substantial number of Taiwanese adults (176) whereas the McDonald et al.' study was

used 2005 data that social participation was increased accelerated according to the

Bureau of Statistics in Taiwan. Although, we are not able to directly compare and

contrast cognitive social capital, our findings suggest that cognitive social capital, include

the variable of trust in neighbors, neighborhood care and neighborhood familiarity, was

consistently accumulated with age. Since individuals might stay longer in neighborhood

while they aged, they could have more chance to develop greater trust, care or familiarity

in neighbors over time.

Age differences in the association social capital and being at risk for clinical

depression were only observed for network social capital. The result showed that not only

higher score of the composite score of network social capital but also higher scores of the

individual components of network social capital (i.e. extensity, upper reachability and

range) were associated with being at risk for clinical depression in older population.

Despite the decline in network social capital, older adults still benefitted from their own

network and we saw an association, whereas, we did not see an association among

younger adults. Although, in this study, network social capital is lower for older adults, a

person who could still stay in those older adults' network might truly be able to help. For

example, the McDonald and Mair's study indicated that trust in occupational contacts,

which was measured by trust in contacts in the Position generator, was positively

associated with age (26). Since individuals could eventually rid their networks of

untrustworthy contacts and result in increasing trust within their network, people might

get greater access of social support as increasing in average network trust (26) which might have a benefit on depression especially among older population.

In this study, a high level of cognitive social capital was significantly associated with being at risk for clinical depression, but there were no significant age difference in this association. Our findings are not compatible with other studies that have been conducted in the U.S showing cognitive social capital was associated with depression only including older population (21, 177). Furthermore, Muckenhuber et al. found that cognitive social capital is significantly more important for psychological health of older people (> 60 years or older) than for younger people (120) in a sample conducted in Austria. These differences may be a function of cultural traditions in the U.S versus Taiwan. In Taiwan, the Confucian tradition emphasizes the importance of interpersonal familial relationships (178, 179), which is the basis of social organization and represents a key source of reciprocal supports among parents and children, siblings, and other relatives (180). Therefore, for Taiwanese, cognitive social capital in family might be more important than in neighborhood especially older population usually would live with their family and would be taken care by their family in Taiwan (181). Another reason why we may not have seen an age differences may be due to the item measuring trust and perception which does not differentiate between family and neighbors. For instance, a cross-national comparison study between Taiwan and the United States showed that the extended family system, which was measured by the number of co-resident family members, was associated with lower risk of being at risk for clinical depression, controlling for all the explanatory variables in Taiwan but not in the U.S. (180). Further

study needs to explore whether the cognitive social capital from family really has stronger association with being at risk for clinical depression in Taiwan.

Structural social capital was associated with being at risk for clinical depression among different age groups, but there were no significant age difference in this association. Based on the Chiao et al.'s study, structural social capital, including continuously participating or initiating participation in social activities later life, is significantly associated with fewer depressive symptoms among older Taiwanese adults (182). However, one limitation in the Chiao et al.'s study is that it only used only one age group and therefore, the Chiao et al.'s study could not provide the evidence that the association between structural social capital and depression would vary by age. Taiwan has not had as strong a historical tradition of community participation in voluntary associations as the United States because the authoritarian regime which lasted over four decades until the late 1980s precluded the development of civic culture. Taiwan's civic participation is only a recent phenomenon, with participation in voluntary organizations and volunteering activities increasing significantly after Kuomintang regime began to lose power in the mid-1980s (183). According to the Bureau of Statistics in Taiwan, memberships in civic associations increased steadily over the past 2 decades. In Taiwan, since increases in civic engagement are so recent, their full impact on social support structure may not show so quickly and also the effect of social support on health may not so obvious when comparing with western countries. Therefore, further study need to explore whether the association between social participation and the risk for clinical depression has changed recently in Taiwan.

Limitations and Strengths

Findings from this analysis must be considered within the context of several limitations. Since we used a cross-sectional study design to analyze the associations in this study, confirmation of a causal relationship between social capital and the risk for clinical depression is not possible. It is possible that we may be observing reverse causality, where individuals with elevated scores being at the risk for clinical depression may be more likely to rate lower for any dimension of social capital. However, our findings are congruent with evidence from recent longitudinal studies assessing social capital and depression showing significant negative associations (20). The other limitation is that there might be measurement error in the assessment of social capital. We do not have detailed measurement of the nature of social capital. For example, there is a possibility that Taiwanese would be more like to access their social capital from other setting, such as family. Although this study revealed that ways that access to network, cognitive and structural social capital could be vary by age, it is still possible that period or cohort effects may influence the age-based patterns of social capital presented and need to further explore.

This study has several strengths. First, the TSCS is a nationally representative and the results are generalizable to the overall population in Taiwan. Second, social capital is measured in a comprehensive way. Although social capital is a multidimensional concept, many studies particularly in Taiwan did not examine social capital comprehensively. Compared to prior studies, the use of network, cognitive, and structural dimensions of social capital is an advantage of this study, which will deepen our understanding of how different dimensions of social capital are associated with being

at risk for clinical depression. Furthermore, this is the first study not only to comprehensively study the variation of age-based patterns of network, cognitive and structural social capital but also to evaluate age differences in the association between three dimensions of social capital and being at risk for clinical depression in Taiwan. These findings have the potential to have important theoretical value and policy implications for specific age groups. If we find the association between a certain dimension of social capital and being at risk for clinical depression on certain age groups, findings from this study may provide new direction for prevention programs.

Conclusion

This study adds to the limited body of research on age-based patterns in social capital and being at risk for clinical depression in Taiwan. To our knowledge, this is the first study to comprehensively explore age-based patterns in social capital and to examine the relationship between social capital and risk for clinical depression varies by age. Our results suggest that age structures access to social capital and age-based patterns of social capital could vary by dimensions of social capital. Furthermore, only age-based pattern of network social capital matters for being at risk for clinical depression in Taiwan but not cognitive and structural social capital. Disaggregating those age-based patterns in multidimensional measure furthers our understanding of the relationship between social capital and depression symptoms. However, further research is needed to examine age-related processes related to social capital and mental health.

Table 5.1 Distribution of demographic factors, socioeconomic status and three dimensions of social capital among different age groups, 1997 Taiwan Social Change Survey (TSCS)

	Age 20-34	Age 35-49	Age 50-64	Age ≥65
	n^a=858 N^b=1023	n=1014 N=929	n=481 N=420	n=245 N=204
The risk of clinical depression, weighted % (SE)	38.6 (1.7)	28.8 (1.5)	28.7 (2.2)	43.3 (3.3)
Gender, weighted % (SE)				
1=Men	52.5 (1.8)	46.4 (1.7)	49.9 (2.4)	52.0 (3.3)
2=Women	47.5 (1.8)	53.6 (1.7)	50.1 (2.4)	48.0 (3.3)
Marital status, weighted % (SE)				
1=Currently married	41.6 (1.7)	86.2 (1.2)	88.3 (1.5)	74.4 (3.0)
2=Single/separated/divorced/widowed	58.4 (1.7)	13.8 (1.2)	2.4 (0.7)	25.6 (3.0)
Religious status, weighted % (SE)				
1=Religious belief	71.9 (.16)	80.4 (1.3)	83.3 (1.8)	81.3 (2.6)
2=No religious belief	28.1 (1.6)	19.6 (1.3)	16.7 (1.8)	18.7 (2.6)
Employment, weighted % (SE)				
1=Not currently employed	25.6 (1.5)	22.2 (1.4)	32.7 (2.3)	36.6 (3.3)
2=Currently employed/ Retired	74.4 (1.5)	77.8 (1.4)	67.3 (2.3)	63.4 (3.3)
Education, weighted % (SE)				
1=Junior high school or below	18.3 (1.5)	57.2 (1.6)	87.4 (1.2)	89.3 (1.6)
2=Senior high school	43.6 (1.7)	26.8 (1.4)	6.9 (0.9)	6.5 (1.3)
3=Junior college or above	38.1 (1.7)	16.0 (1.0)	5.7 (0.8)	4.2 (0.9)
Income, weighted % (SE)				
1=No income	22.9 (1.5)	20.6 (1.4)	37.0 (2.4)	62.6 (3.3)
2=Less than $19 999	15.7 (1.3)	15.5 (1.3)	23.4 (2.1)	25.0 (3.0)
3=$20 000 to $39 999	38.1 (1.7)	30.8 (1.6)	23.6 (2.1)	7.2 (1.5)
4=Over $40 000	23.2 (1.5)	33.1 (1.5)	16.0 (1.6)	5.3 (1.3)
Network social capital, weighted mean (SE)				
Composite score	-0.01 (0.03)	0.05 (0.03)	-0.29 (0.06)	-0.57 (0.08)
The quantity of network social capital - Extensity	-0.03 (0.03)	0.06 (0.03)	-0.28 (0.05)	-0.59 (0.06)
The quality of network social capital - Upper reachability	0.01 (0.03)	0.01 (0.03)	-0.26 (0.06)	-0.43 (0.09)
The diversity of network social capital - Range	-0.02 (0.03)	0.07 (0.03)	-0.26 (0.06)	-0.56 (0.08)
Cognitive social capital, weighted mean (SE)				
Composite score	14.86 (0.13)	15.63 (0.12)	16.82 (0.17)	17.33 (0.25)
Trust in neighbors	4.80 (0.05)	5.13 (0.04)	5.51 (0.06)	5.72 (0.09)
Perceptions of neighborhood care	4.87 (0.05)	5.04 (0.05)	5.38 (0.07)	5.61 (0.11)
Perceptions of neighborhood familiarity	5.18 (0.05)	5.45 (0.05)	5.93 (0.06)	5.99 (0.09)
Structural social capital, weighted % (SE)				
Composite score				
No	26.9 (1.6)	18.2 (1.3)	23.5 (2.1)	23.9 (2.9)
1 or more	73.1 (1.6)	81.8 (1.3)	76.5 (2.1)	76.1 (2.9)
Participation in the local community				
No	41.5 (1.7)	27.3 (1.5)	29.3 (2.2)	27.5 (3.0)
1 or more	58.5 (1.7)	72.7 (1.5)	70.7 (2.2)	72.5 (3.0)
Participation in organization				
No	51.0 (1.8)	48.3 (1.7)	58.9 (2.3)	71.9 (2.9)

1 or more	49.0 (1.8)	51.7 (1.7)	41.1 (2.3)	28.1 (2.9)

[a]: unweighted sample size
[b]: weighted sample size

Table 5.2 Logistic regression model analysis of the association between the risk of clinical depression and network social capital respectively in 1997 TSCS

	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[d]		Model 5[e]		Model 6[f]	
	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|
Network social capital												
Composite score	-0.35 (0.12)	0.004	-0.08 (0.05)	0.10	0.09 (0.08)	0.31						
Extensity	-0.18 (0.05)	0.0001	-0.10 (0.05)	0.06			0.06 (0.08)	0.47				
Upper reachability	-0.11 (0.04)	0.01	-0.08 (0.05)	0.10					0.09 (0.09)	0.30		
Range	-0.11 (0.04)	0.01	-0.05 (0.05)	0.26							0.09 (0.08)	0.30
Age												
Age 35-49					-0.10 (0.13)	0.41	-0.10 (0.13)	0.42	-0.11 (0.13)	0.39	-0.11 (0.13)	0.39
Age 50-64					-0.21 (0.17)	0.21	-0.25 (0.17)	0.15	-0.19 (0.17)	0.26	-0.20 (0.17)	0.23
Age $\geq$65					0.26 (0.21)	0.22	0.19 (0.23)	0.42	0.35 (0.20)	0.08	0.29 (0.21)	0.17
Network social capital (NSC)*Age												
NSC*Age 35-49					-0.19 (0.12)	0.11	-0.15 (0.12)	0.18	-0.21 (0.12)	0.08	-0.15 (0.12)	0.21
NSC*Age 50-64					-0.27 (0.13)	0.03	-0.36 (0.14)	0.01	-0.21 (0.13)	0.10	-0.23 (0.13)	0.07
NSC*Age $\geq$65					-0.47 (0.16)	0.003	-0.56 (0.19)	0.004	-0.38 (0.15)	0.01	-0.39 (0.15)	0.01

[a] Reflects independent crude models for the composite and individual components of network social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other individual components.

[b] Reflects independent fully adjusted (gender, age, marital status, religious status, employment, education and income) models for the composite and individual component score of network social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other individual components.

[c] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and composite score network social capital.

[d] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and the Extensity component of network social capital.

[e] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and the Upper reachability component of network social capital.

[f] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and the Range component of network social capital.

Table 5.3 Logistic regression model analysis of the association between the risk of clinical depression and cognitive social capital respectively in 1997 TSCS

	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[c]		Model 5[c]		Model 6[c]	
	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|
Cognitive social capital												
Composite score	-0.08 (0.01)	<.0001	-0.09 (0.01)	<.0001	-0.10 (0.02)	<.0001						
Trust in neighbors	-0.18 (0.03)	<.0001	-0.19 (0.03)	<.0001			-0.21 (0.05)	<.0001				
Neighborhood care	-0.23 (0.03)	<.0001	-0.23 (0.04)	<.0001					-0.24 (0.06)	0.0001		
Neighborhood familiarity	-0.19 (0.03)	<.0001	-0.20 (0.03)	<.0001							-0.21 (0.05)	<.0001
Age												
Age 35-49					-0.27 (0.46)	0.55	-0.33 (0.36)	0.36	-0.22 (0.44)	0.62	-0.13 (0.41)	0.76
Age 50-64					-0.38 (0.61)	0.53	-0.14 (0.46)	0.76	-0.29 (0.59)	0.62	-0.57 (0.58)	0.32
Age ≥65					0.29 (0.76)	0.70	0.24 (0.61)	0.69	0.75 (0.75)	0.32	0.38 (0.72)	0.60
Cognitive social capital (CSC)*Age												
CSC*Age 35-49					0.01 (0.03)	0.71	0.04 (0.07)	0.55	0.03 (0.09)	0.76	0.003 (0.08)	0.97
CSC*Age 50-64					0.02 (0.04)	0.61	0.002 (0.09)	0.98	0.04 (0.11)	0.70	0.08 (0.10)	0.41
CSC*Age ≥65					0.02 (0.04)	0.70	0.05 (0.11)	0.63	-0.03 (0.13)	0.84	0.02 (0.12)	0.84

[a] Reflects independent crude models for the composite and individual components of cognitive social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other individual components.

[b] Reflects independent fully adjusted (gender, age, marital status, religious status, employment, education and income) models for the composite and individual component score of cognitive social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other individual components.

[c] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and composite score cognitive social capital.

[d] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and cognitive social capital of trust in neighbors.

[e] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and cognitive social capital of neighborhood care.

[f] Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and the cognitive social capital of neighborhood familiarity.

Table 5.4 Logistic regression model analysis of the association between the risk of clinical depression and structural social capital respectively in 1997 TSCS

	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[c]		Model 5[c]	
	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|	Estimate (SE)	Pr > |t|
Structural social capital										
Composite score										
1 or more	-0.32 (0.10)	0.002	-0.24 (0.11)	0.03	-0.18 (0.17)	0.29				
Participation in the local community										
1 or more	-0.31 (0.09)	0.001	-0.28 (0.10)	0.01			-0.19 (0.15)	0.22		
Participation in organization										
1 or more	-0.19 (0.09)	0.03	-0.09 (0.10)	0.37					0.003 (0.15)	0.98
Age										
Age 35-49					-0.12 (0.24)	0.62	-0.02 (0.19)	0.90	-0.10 (0.17)	0.58
Age 50-64					-0.13 (0.29)	0.65	-0.07 (0.25)	0.79	-0.06 (0.21)	0.78
Age ≥65					0.96 (0.35)	0.01	0.79 (0.32)	0.01	0.62 (0.24)	0.01
Structural social capital (SSC)*Age										
SSC *Age 35-49					0.01 (0.26)	0.98	-0.12 (0.23)	0.61	-0.04 (0.22)	0.84
SSC *Age 50-64					-0.05 (0.31	0.86	-0.14 (0.29)	0.63	-0.27 (0.27)	0.32
SSC *Age ≥65					-0.68 (0.38)	0.08	-0.46 (0.36)	0.20	-0.56 (0.36)	0.12

[a] Reflects independent crude models for the composite and individual components of structural social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other individual components.

[b] Reflects independent fully adjusted (gender, age, marital status, religious status, employment, education and income) models for the composite and individual component score of structural social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other individual components.

^c Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and composite score structural social capital.

^d Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and structural social capital of participation in the local community.

^e Reflects the fully adjusted (gender, age, marital status, religious status, employment, education and income) model with the interaction between age and structural social capital of participation in organization.

Table 5.5 Logistic regression model analysis of the association between the risk of clinical depression and network social capital by age groups respectively in 1997 TSCS

	Age 20-34		Age 35-49		Age 50-64		Age ≥65	
	Model 1[a]	Model 2[b]	Model 1[a]	Model 2[b]	Model 1[a]	Model 2[b]	Model 1[a]	Model 2[b]
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Network Social Capital								
Composite score	1.02	1.10	0.88	0.90	0.77	0.84	0.71	0.70
	(0.87, 1.19)	(0.92, 1.30)	(0.75, 1.02)	(0.75, 1.08)	(0.64, 0.93)	(0.68, 1.03)	(0.56, 0.89)	(0.54, 0.92)
Extensity	0.97	1.07	0.86	0.91	0.68	0.74	0.61	0.60
	(0.83, 1.13)	(0.90, 1.26)	(0.74, 1.01)	(0.76, 1.09)	(0.55, 0.85)	(0.58, 0.94)	(0.44, 0.84)	(0.42, 0.85)
Upper reachability	1.06	1.10	0.87	0.88	0.82	0.90	0.79	0.78
	(0.89, 1.26)	(0.91, 1.31)	(0.75, 1.01)	(0.75, 1.04)	(0.69, 0.98)	(0.74, 1.08)	(0.64, 0.97)	(0.62, 0.99)
Range	1.03	1.10	0.91	0.94	0.82	0.88	0.75	0.76
	(0.88, 1.20)	(0.93, 1.29)	(0.78, 1.07)	(0.79, 1.13)	(0.68, 0.99)	(0.71, 1.08)	(0.60, 0.93)	(0.59, 0.97)

[a]: Reflects independent crude models for the composite and individual component score of network social capital

[b]: Reflects independent fully adjusted (gender, marital status, religious status, implement, education and income) models for the composite and individual component score of network social capital.

The prevalence of the risk of clinical depression
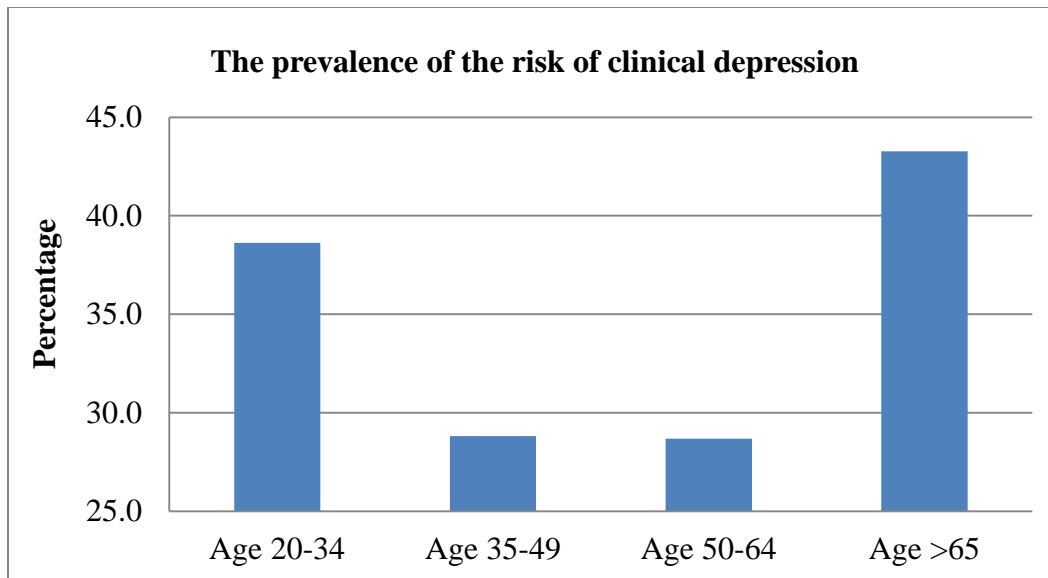
Figure 5.1 The prevalence of the risk of clinical across four age groups
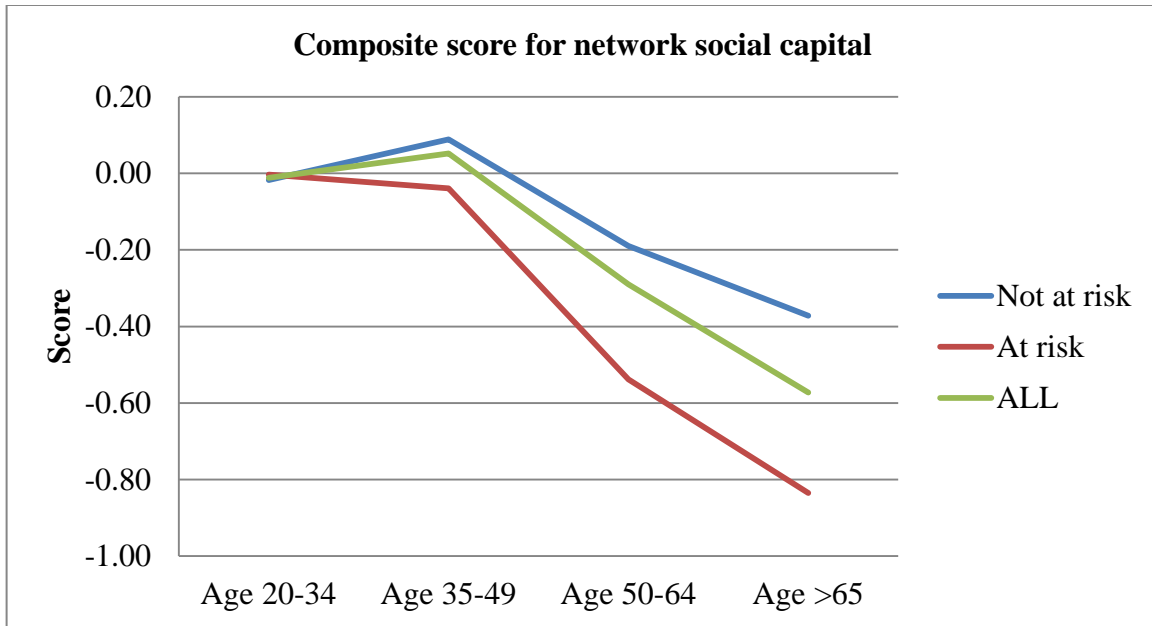
Figure 5.2 Age-based patterns of network social capital
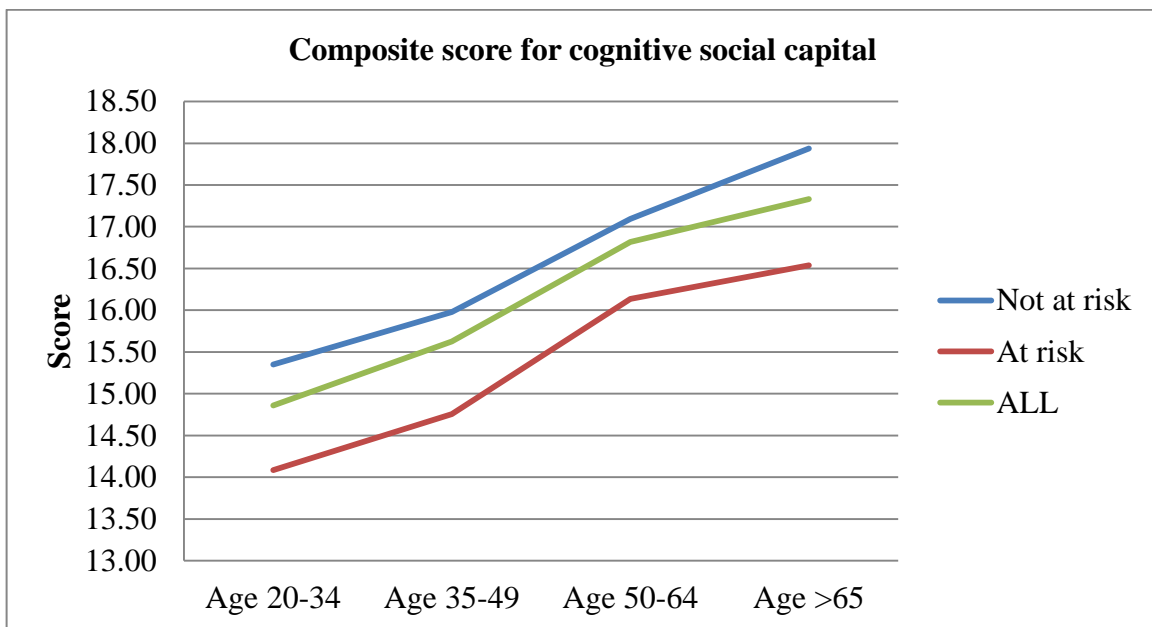
Figure 5.3 Age-based patterns of cognitive social capital
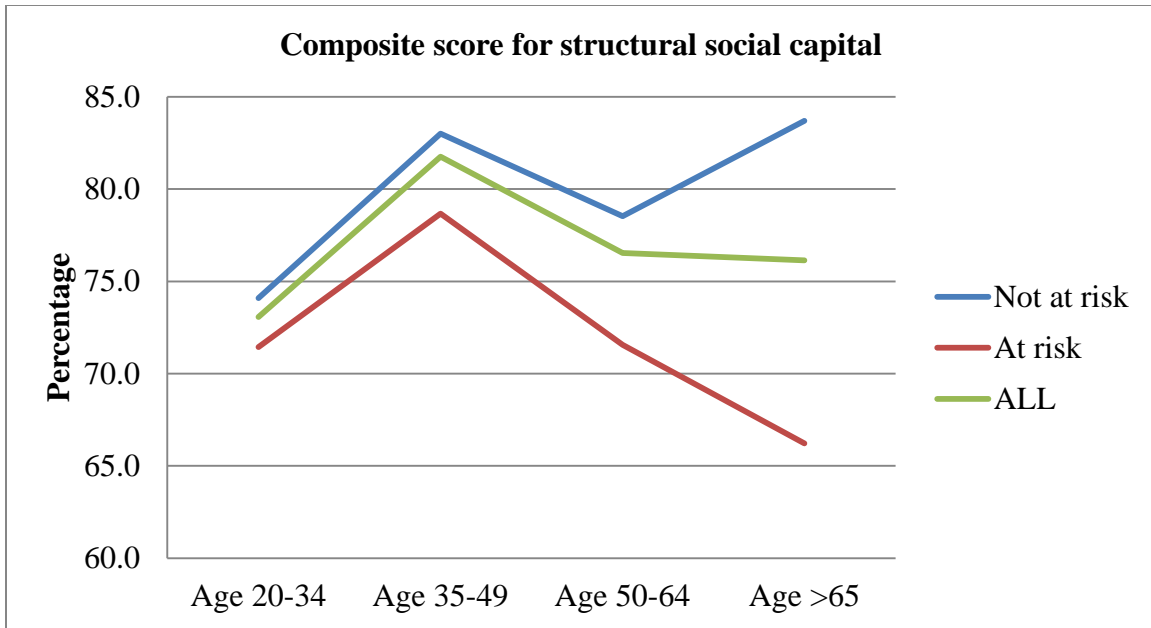
Figure 5.4 Age-based patterns of structural social capital

CHAPTER 6

A MULTILEVEL ANALYSIS OF THE ASSOCIATION BETWEEN SOCIAL CAPITAL

AND THE RISK OF CLINICAL DEPRESSION AMONG TAIWANESE ADULTS

6.1 Introduction

Social capital is a multidimensional and a multilevel concept that describes social

relationships within societies or between groups of people (9, 10, 169). The public health

literature commonly conceptualizes social capital with three distinct pathways to

influence health. Network social capital refers to resources accessed within social

networks for personal benefit (17). Cognitive social capital reflects subjective perceptions

of the quality of social relationships such as trust, support, norms, and reciprocity (152).

Structural social capital refers to the objective quantity of social relationships and

activities, such as membership in associational activities or institutions and community

participation, that link people and groups together (152). In general, empirical evidence

suggests that people with a diverse and broad range of social capital may have more

positive mental health outcomes (28, 90). Much of this evidence comes from studies

conducted in the U.S., the UK, and Canada. However, in Taiwan, which is a heavily

influenced by Confucian traditions, cultural emphasis on family relationships, and (178,

179) and an advancing social participation starting at the end of 20th century (184), the

association between social capital and health may be different from the association observed in western countries (170, 185, 186).

The literature also highlights two levels of analysis for measuring social capital: individual and contextual (79). Individual-level social capital, based on Bourdieu, conceptualizes social capital as a benefit arising principally through the scope and influence of an individual's social network (29). It is measured by individual perceptions of the quality of those relationships, their participation in social organizations or activities and their resources embedded within their social network. Numerous studies have documented the independent association between depression and social capital as an individual- and or group-level concept (12, 20, 28, 31, 32). In contrast, contextual-level social capital, derived from Putman, emphasizes a collective aspect of social capital and has a shared property based on community activities and not of individuals alone (10, 30). Although there is increasing evidence suggesting that contextual level social capital is linked to better health outcomes the debate continues within the social capital literature as to whether social capital is most relevant at the individual, contextual, or at both levels (33, 34). Studies only including one level of social capital may incorrectly estimate or obscure real contextual effects or real differences in individuals (34).

The results from multi-level studies are largely mixed all over the world. One study found that both individual-level cognitive social capital and neighborhood-level structural social capital were significant predictors of depression but not neighborhood-level cognitive social capital and individual-level structural social capital (131). A greater understanding of the multilevel mechanisms linking social capital and depression can potentially guide the development of effective intervention and prevention programs

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to improve or prevent depressive symptoms by targeting "people" or "places" or both (35). A recent review showed that multilevel studies of social capital and health were mainly conducted in Western countries and was limited in Eastern countries such as Japan, China, and Taiwan (27). Increasingly, studies that have explored the association between contextual- and individual-level social capital and depression by multilevel analyses were conducted in Japan (187), Korea (188), and China (189). However, in Taiwan, the examination of this issue still remains inconclusive and need to explore how contextual- and individual-level network, cognitive and structural social capital associate with the risk of clinical depression.

The present study addresses several gaps in the literature by considering how contextual- and individual-level network, cognitive, and structural may influence depressive symptoms in Taiwan. Using a population-based sample from the 1997 Taiwan Social Change Survey (TSCS) we would like to explore whether there are the independent association between depressive symptoms and contextual- and individual-level network, cognitive and structural social capital respectively. Generalizing from the previous results of the protective association of both contextual- and individual-level social capital on depression conducted in other countries (130, 131), we hypothesize that both contextual- and individual-level network, cognitive and structural social capital would be associated with the risk of clinical depression.

6.2 Methods

Data

The Taiwan Social Change Survey (TSCS) is a multi-cycle, long-term, nationally representative cross-sectional survey. The survey collects data on social issues relating to

family, culture, religion, politics, social networks and social class, in addition to self-reported health and behavioral characteristics among residents in Taiwan. The TSCS is conducted by the Institute of Sociology, Academia Sinica, and sponsored by the Ministry of Science and Technology, Republic of China. The detailed survey procedure of the TSCS have been published elsewhere (85, 135). Briefly, TSCS used a stratified random sampling method to select adults 20 to 74 years old for participation in the survey. Data were collected by face-to-face interviews using a structured questionnaire. All participants were given full instruction of the study and informed consent was obtained from each participant. The ethics committee of the National Science Council of Taiwan approved this survey.

We used data from the third survey of the third cycle, which was conducted from June to November 1997. This 1997 TSCS dataset is unique because it is the only data that contains the best available information to measure all three dimensions of social capital (network, cognitive, and structural social capital in Taiwan; only cognitive and structural social capital were captured in more recent TSCS dataset. A total of 2,835 participants with in 55 neighborhoods completed the questionnaire a response rate of 94%. Respondents were excluded if they were missing information on the outcome (n=85) or the exposure (n=161), yielding a final analytic sample of 2598 adults.

Measurements

Outcome variable

Depressive symptoms were measured using the 20-item Center for Epidemiological Studies Depression Scale (CES-D) (136) . The Chinese version of CES-D was translated directly from the 20-item CES-D by two psychiatrists (141) and has

been widely used in Taiwan (142-145, 161). Prior studies have shown that the Chinese version of the CES-D is a reliable (Cronbach's alpha of 0.86) and validly measures depressive symptoms with high sensitivity (92%) and specificity (91.0%) (141). Participants were asked the frequency of experiencing each symptom in the past week. Item responses were on a 4-point scale to indicate the frequency of the symptoms (0: less than one day in the past week; 1=: 1-2 days in the past week; 2: 3-4 days in the past week; 3: 5-7 days in the past week). After summing the score for each item together, CES-D scores ≥ 15 were categorized as being at risk for clinical depression and <15 as not being at risk for clinical depression (146, 161).

Exposure variable

Social capital was conceptualized along three dimensions: network, structural, and cognitive. The TSCS position generator with a list of 15 ordered occupational positions (84, 85) assessed network social capital. Each participant was asked "Of your relatives, friends, and acquaintances, are there any who have the jobs listed in the following table?" The choices for the 15 positions were ranged from housemaids/cleaning workers to physicians. Network social capital was measured along three variables: (1) extensity – the total number of occupations which was identified by each participant; (2) upper reachability – the highest prestige occupation that each participant could access; and (3) range – the difference between highest and lowest prestige occupation that each participant could access) (16, 85). The three variables were standardized (i.e. means = 0; and standard deviation =1) for comparability. As a result of the high correlation between these variables, an individual-level composite network social capital score was constructed by the weighted sum of the three network social capital variables. The

weights were the standardized scoring coefficients form the first component of a principal components analysis because of 84% of the variability could be accounted by the first component. High internal reliability justified the use of the composite score (Cronbach's alpha = 0.90).

There were two components of cognitive social capital: trust in neighbors and perception of neighborhood reciprocity. Trust in neighbors was measured with one question: "For the aspect of trust, how would you describe people who live around you?" Perceived neighborhood reciprocity was measured using two items: (1) care and (2) familiarity. To assess care, respondents were asked "For the aspect of care, how would you describe the people who live around you?" To assess familiarity, respondents were asked "For the aspect of familiarity, how would you describe the people who live around you?" Respondents were asked to rank the responses from the three questions using a 7-point scale, ranging from not trust, care, or be familiar with people who live around you (code 1) to trust, care, or be familiar with people who live around you (code7). An individual-level composite cognitive social capital score was calculated by summing together the scores from the three variables; it was used as a continuous variable in the main analyses. The three items of the composite score were highly correlated with each other ($p < 0.0001$) and demonstrated high internal reliability (Cronbach's alpha = 0.86).

Structural social capital was operationalized as: participation in organizations and participation in the local community.   Participation in organizations was assessed by the following question: "Have you attended an organization or club activity in the past 1 year?" Respondents indicated whether they participated in one or more of the following types of organizations, including religious, political, social movement, social service,

alumni, occupational, and "other, if any." Participation in the local community was based

on one question: "Have you attended a local community event in the past 1 year?"

Respondents indicated whether they participated in one or more of the following types of

events: li's/village's meeting (a li is a geographical division created by the Taiwan Census

Bureau), activity held by li/village, activity held by school, temple fair, church activity

and activity held by other club/organization. For each variable of structural social capital,

it would be categorized into two levels: (1) no participation and (2) participation in one or

more. The composite score for individual-level structural social capital was measured as a

categorical variable with two levels: (1) participation in neither the organization nor the

local community; and 2) participation in at least one organization or local community.

In this study, the contextual-level social capital was operationalized by the

neighborhood-level social capital. A neighborhood was defined by a township/district

which is created by visible boundaries such as streets and rivers and the smallest

geographic area which was provided by the TSCS. Neighborhood-level network,

cognitive and structural social capital were measured by aggregating individual-level

network, cognitive and structural social capital in this study. The neighborhood-level

network social capital composite score was calculated by the average of the individual-

level network social capital composite score in each neighborhood. Meanwhile, the

neighborhood-level cognitive social capital composite score was also measured by the

average of the individual-level cognitive social capital composite score in each

neighborhood. Also, each variable of neighborhood-level network and cognitive social

capital was accessed by the same way. In order to measure the neighborhood-level

structural social capital composite score, the percentage of people who participated in at

least one organization or local community activity in each neighborhood was calculated. The neighborhood-level structural social capital of participation in the local community activity was derived by the percentage of people who participated in at least one local community activity in each neighborhood. The neighborhood-level structural social capital of participation in the organization was calculated by the percentage of people who participated in at least one organization in each neighborhood.

Confounders / covariates

We included several potential individual-level confounders that have been used in prior studies examining social capital and depression (19). Demographic factors included age (continuous), gender (men and women), marital status (currently married, single and formerly married), and religious belief (religious belief and no religious belief). Three commonly used socioeconomic variables were included: employment (not currently employed, currently employed and retired), education (junior high school or below, senior high school and junior college or above) and income status (no income, less than NT$19 999, NT$20 000 to NT$39 999 and over NT$40 000).

Furthermore, the variables, derived from the 2000 Taiwan Population and Housing Census, were used to adjusted neighborhood characteristics in multilevel analyses in this study included: the percentages of residents with less than a middle school education, the percentage of no employment, the percentage of divorced/separated, the percentage of residents younger than 15 and the percentage of residents older than 65.

Data analyses

Descriptive statistics for continuous variables were reported by weighted means

and standard deviations, and categorical variables were reported by weighted percentages and standard deviations. The distribution of individual-level demographic factors, socioeconomic status, neighborhood-level characteristics as well as both individual- and neighborhood-level three dimensions of social capital were assessed for being at risk for clinical depression versus not; comparisons were assessed using the Chi-square test for categorical variables and t-test for continuous variables.

A series of multilevel logistic regression models were used to evaluate whether there are independent associations between the three dimensions of neighborhood-level social capital and depressive symptoms separately. The null model (M0) only had the constant term in the fixed and random parts which represented a two-level null (empty) model of individuals (level 1) nested within neighborhoods (level 2) with no predictor variables in the fixed and the random parts of the model. Next, for each dimension, following models were constructed: Model 1 (crude): neighborhood-level composite social capital score; Model 2 (adjusted): Model 1 + individual-level demographic factors (including age, marital status, and religion status) and socioeconomic status (including educational, income, and employment); Model 3 (adjusted): Model 2 + neighborhood-level characteristics; Model 4 (fully adjusted): Model 3 + individual-level composite social capital score. The individual components for each dimension of neighborhood-level social capital were also compared in separate models. All statistical analyses applied sampling weights to adjust for complex sampling frame and were conducted using Statistical Analysis System (SAS), version 9.3 and the significant level was p-value < 0.05.

6.3 Results

       Characteristics for the study population are presented in Table 6.1. Nearly 34% of all participants were at risk for clinical depression based on a CESD cutoff of >=15. Most participants were currently married, had religious beliefs, and were currently employed. Comparing different levels in education and income, more people had only junior high school or lower educational level and had income NT$20 000 to NT$39 999. In this study, the higher number of network or cognitive social capital represented higher perception of network or cognitive social capital. For structural social capital, more than 77% of respondents participated in at least one local community activity or organization.

       The comparisons between groups at risk and not at risk for clinical depression were presented in Table 6.2. Participants at risk for clinical depression were less likely to be married, employed, and have an income higher than $20000 as compared to participants not at risk for clinical depression. Furthermore, individual-level network and cognitive social capital scores were significantly lower among participants at risk for clinical depression compared to those not at risk. Meanwhile, in the individual-level structural social capital, participants at risk for clinical depression had significantly lower percentage in participating at least one activity in the local community or one organization than those not at risk. For neighborhood-level cognitive social capital, scores were significantly lower among participants at risk for clinical depression compared to those not at risk, except for trust in neighbors. However, in neighborhood-level of network and structural social capital, there was no significant difference between groups at risk and not at risk for clinical depression. Also, none of neighborhood characteristics

were significant differences between groups at risk and not at risk for clinical depression, except for percentage less than junior high.

Table 6.3 to 6.5 presented the associations between being at risk for clinical depression and neighborhood-level as well as individual-level composite score of network, cognitive and structural social capital, controlling for demographic, socioeconomic variables (age, marital status, religious status, work, education and income) and neighborhood characteristics. None of neighborhood-level composite network, cognitive and structural social capital score was associated with being at risk for clinical depression after controlling for potential confounders at both neighborhood- and individual-level. However, people with higher individual-level composite network (OR = 0.91, 95% C.I. = 0.89, 0.98), cognitive (adjusted: OR = 0.90, 95% C.I. = 0.82, 0.94) social capital score was associated with a lower odds of being at risk for clinical depression after controlling for potential confounders at both neighborhood- and individual-level. Meanwhile, in the individual-level structural social capital, participation in at least one local community activities or organization had lower odds of being at risk for clinical depression than no participants (OR = 0.78, 95% C.I. = 0.63, 0.97) after controlling for potential confounders at both neighborhood- and individual-level.

The associations between being at risk for clinical depression and each variable in neighborhood-level as well as individual-level network, cognitive and structural social capital, controlling for demographic, socioeconomic variables (age, marital status, religious status, work, education and income) and neighborhood characteristics were showed from Table 6.6 to 6.13. Similar to previous results, none of each variable in neighborhood-level composite network, cognitive and structural social capital score was

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associated with being at risk for clinical depression after controlling for potential confounders at both neighborhood- and individual-level. However, higher scores in individual-level network social capital of extensity (OR = 0.88, 95% C.I. = 0.79, 0.97), cognitive social capital of trust in neighbors (OR = 0.79, 95% C.I. = 0.74, 0.85), perceptions of neighborhood care (OR = 0.83, 95% C.I. = 0.78, 0.88) and perceptions of neighborhood familiarity (OR = 0.82, 95% C.I. = 0.77, 0.87) were associated with lower odds of being at risk for clinical depression after controlling for potential confounders at both neighborhood- and individual-level. Meanwhile, individual-level structural social capital of participated in at least one local community activities (OR = 0.72, 95% C.I. = 0.60, 0.88) was also significantly associated with lower risk of being at risk for clinical depression after controlling for potential confounders.

6.4 Discussion

The results from this study suggest that the processes determining the causes and consequences of social capital are different across different levels. In this study, we did not observe an association between contextual-level social capital and risk for clinical depression. However, results showed that higher level of individual-level network, cognitive and structural social capital were associated with the lower odds of being at risk for clinical depression.

Out study results are consistent with several prior studies which showed there is no association between contextual-level social capital and health outcomes. For example, the Veenstra's study used multilevel analyses to explore the effect of contextual- and individual-level social capital on depression (131). In the Veenstra's study, results demonstrated that only individual-level social capital (e.g. trust in community members,

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political trust and participation in voluntary associations) were associated with depression but contextual-level social capital indicators of the number of voluntary organizations per capita and average levels of community and political trust were not. Meanwhile, in the Yuasa et al.' study (187), results also showed that all contextual-level social capital indicators, which was represented by area-level general trust, informal social interaction and formal group participation, were not associated with self-rated depression among older Japanese after controlling for individual-level social capital, demographic and socioeconomic factors in multilevel analyses. However, there are also some studies showed that contextual-level social capital was associated with depression even after adjusting for individual-level social capital in multilevel analyses. For example, Tomita and Burns' study showed that both individual-level social capital of social trust and neighborhood-level social capital were associated with depression after adjusting all confounders (130).

Our findings may be incompatible with these studies for several reasons. First, social capital is a culturally and socially contextual concept (15, 190). Taiwanese culture has been greatly affected by Confucianism and patriarchy, so that family is especially an important social context and a key source of gaining various forms of social support, including emotional and material support (176). Even a personal social network could be originated in their extended-family networks (176, 191). Taiwan's civic participation was severely suppressed during the Japanese colonial period (1895–1945) and the Kuomintang (People's Party) authoritarian regime (1946–1987) (176). Taiwan advanced from an authoritarian to a democratic regime and the country's society turned more autonomous away from the state after the ending of Martial Law in 1987 (184) and the

democracy was advancing in Taiwan at that time point. Therefore, Participation in voluntary organizations and volunteering activities increased significantly in Taiwan when the Kuomintang regime began to lose power in the mid-1980s (183). Therefore, the unique cultural and historical characteristic of Taiwan may result in the lack of contextual association in Taiwan.

Second, it is possible that not all types of social capital have an important contextual effect. It seems that individual-level cognitive social capital might be more important than contextual-level for mental disorders (192). For example, the Veenstra's study explored the effect of contextual-level and individual-level social capital on depression simultaneously in multilevel analyses (131). This study found that two individual-level cognitive social capital indicators of political trust and trust in community members were both significant predictors of depression but the contextual-level cognitive social capital indicator of community-level political and community trust was not. In addition, in South Korea, the multilevel study from Han and Lee also showed that individual-level cognitive social capital of trust were negatively associated with depression but there is no relationship was found between contextual-level cognitive social capital of household-level trust and depression (188). The potential explanation is that once people could perceive cognitive social capital , such as trust, in their context, it is possible that they could generate positive affective states, including feelings of security and self-esteem, through cognitive social capital to reduce a risk of mental disorders (101). Therefore, people would not be able to get the benefit from cognitive social capital unless they could really perceive it which means individual perception of cognitive social capital might be more important than cognitive social capital as the context characteristic.

However, study results of exploring the association between contextual- and individual-level structural social capital and depression are mixed. There are results showed that structural social capital could be associated with mental disorders either at the contextual level (192) or individual level (187) but the other studies indicated that neither contextual level nor individual level of structural social capital was associated with depression (131, 188).

Third, it is possible that the association between contextual-level social capital and depression is modified by individual-level demographic or neighborhood-level characteristics. The association between social capital and health can be generated through an interaction between individuals and their social environment (33). Several recent studies suggest the impact of contextual-level social capital may be stronger among vulnerable populations. For example, Stafford et al., found no association between neighborhood-level social capital and common mental disorders. However, neighborhood-level social capital was associated with common mental disorders among individuals who lived in socioeconomically deprived neighborhoods (32). There is a need to consider the extent to which individual- or contextual-level characteristics related to vulnerability (i.e. poverty or economic level) can modify the association contextual-level social capital and health. This is important because strategies of focusing on individual- or contextual-level characteristics may be able to target high-risk population groups that may potential benefit from contextual-level social capital.

Limitations and Strengths

Findings from this analysis must be considered within the context of several limitations. Since we used a cross-sectional study design to analyze the associations in

this study, confirmation of a causal relationship between social capital and depressive symptoms is not possible. Further, we cannot rule out reverse causality, where contextual-level social capital was aggregate from individual-level social capital an individual's mental health status could influence measures of individual-level social capital. Individuals with elevated scores for depressive symptoms may be more likely to rate their community lower for any dimension of social capital.

Furthermore, measurement error in social capital may have also impacted our study findings. Each dimension of social capital was based on self-report and therefore subject to response and recall bias. However, since all participants used the same approach to measure social capita and this bias could be random happened among participants, it would not bias our results. Furthermore, in this study, results may not have avoided same source bias because contextual-level social capital was based on aggregate measures of individual-level social capital. Operationalizing contextual-level social capital in this manner may not truly reflect social capital at the contextual level and could be an artifact of individual social capital perceptions (19) . Therefore, further multilevel studies are needed to be careful with the approach of measuring the contextual-level social capital. In addition, this study may have used the inaccurate geographic level of aggregation to think of contextual social capital among Taiwanese. Contextual-level social capital was conceptualized for neighborhoods, which was defined as a township/district in this study. No association between neighborhood-level social capital and the risk of clinical depression could be results of failing defined geographic level of aggregation to think of contextual-level social capital. Since there are several studies that have used state-level (193), county-level (194), and zip-code level (195), there are

variations in how context can be defined and this may have influenced the findings of our study. Recent studies have additionally examined the influence of contextual-level social capital for households (188) and workplaces (129) on depression. It is possible that these other context, (i.e. household or workplace) may also be important for risk of depression.

This study has several strengths. First, the TSCS is a nationally representative and the results are highly generalizable to the overall population in Taiwan. Second, this study simultaneously controlled potential confounders from both at the individual and contextual levels. Third, social capital is measured in a comprehensive way, including three dimensions and two levels of social capital. To our knowledge, this is the one of the first studies to compare the associations between network, cognitive and structural social capital at both contextual- and individual-level and risk for clinical depression. By examining the multidimensional and multilevel nature of social capital, we deepen our understanding of the mechanisms linking social capital and risk for clinical depression. Furthermore, by using multilevel analyses, we could distinctly differentiate the independent association between contextual- and individual social capital and depression.

Conclusion

This study adds to the limited body of research on multilevel analyses of contextual- and individual-level social capital and depression in Taiwan. Understanding whether the health benefits of social capital are individual or contextual are important because it will influence whether the target of health preventions or interventions should be 'people' or 'places' (Subramanian, Lochner, & Kawachi, 2003). Our results suggest that individual-level social capital, regardless of dimension, was independently associated with being a risk for clinical depression in Taiwan after adjusting for neighborhood- and

individual-level potential confounders as well as neighborhood-level social capital. A greater understanding of the multilevel mechanisms linking social capital and depression may further our understanding of the relationship between social capital and depression symptoms but also potentially guide the development of effective intervention and prevention programs to improve or prevent depressive symptoms by focusing on improving individual perception of social capital.

Table 6.1 Distribution of demographic factors, socioeconomic status and social capital, 1997 Taiwan Social Change Survey (TSCS)

	All n^a=2598 N^b=2576
Individual-level	
Depression, weighted % (SE)	33.8 (1.0)
Age, weighted mean (SE)	40.5 (0.3)
Gender	
Men	49.8 (1.0)
Women	50.2 (1.0)
Marital status, weighted % (SE)	
1=Currently married	67.9 (1.0)
2=Single	25.8 (0.9)
3=Formerly married	6.3 (0.5)
Religious status, weighted % (SE)	
1=Religious belief	77.5 (0.9)
2=No religious belief	22.5 (0.9)
Employment, weighted % (SE)	
1=Not currently employed	26.4 (0.9)
2=Currently employed	70.2 (0.9)
3=Retired	3.5 (0.3)
Education, weighted % (SE)	
1=Junior high school or below	49.2 (1.0)
2=Senior high school	28.6 (0.9)
3=Junior college or above	22.2 (0.8)
Income, weighted % (SE)	
1=No income	27.4 (0.9)
2=Less than $19 999	17.6 (0.8)
3=$20 000 to $39 999	30.8 (1.0)
4=Over $40 000	24.2 (0.9)
Network social capital, weighted mean (SE)	
Composite score	-0.08 (0.02)
The quantity of network social capital - Extensity	-0.08 (0.02)
The quality of network social capital - Upper reachability	-0.07 (0.02)
The diversity of network social capital - Range	-0.07 (0.02)
Cognitive social capital, weighted mean (SE)	
Composite score	15.65 (0.08)
Trust in neighbors	5.08 (0.03)
Perceptions of neighborhood care	5.11 (0.03)
Perceptions of neighborhood familiarity	5.47 (0.03)
Structural social capital, weighted % (SE)	
Composite score	
No	23.0 (0.9)
1 or more	77.0 (0.9)
Participation in the local community	
No	33.3 (1.0)
1 or more	66.7 (1.0)
Participation in organization	
No	52.9 (1.0)
1 or more	47.1 (1.0)
Neighborhood-level	
Network social capital, weighted % (SE)	
Composite score	-0.08 (0.01)

The quantity of network social capital - Extensity	-0.08 (0.01)
The quality of network social capital - Upper reachability	-0.07 (0.01)
The diversity of network social capital - Range	-0.07 (0.01)
Cognitive social capital, weighted mean (SE)	
Composite score	15.65 (0.03)
Trust in neighbors	5.11 (0.01)
Perceptions of neighborhood care	5.08 (0.01)
Perceptions of neighborhood familiarity	5.47 (0.01)
Structural social capital, weighted mean (SE)	
Percentage of participation in at least one local community activity or organization	77.01 (024)
Percentage of participation in at least one the local community activity	66.70 (0.29)
Percentage of participation in at least one organization	47.05 (0.30)
Percentage of age less than 15, weighted mean (SE)	22.36 (0.05)
Percentage of age more than 65, weighted mean (SE)	8.46 (0.06)
Percentage divorced and separated, weighted mean (SE)	2.28 (0.01)
Percentage less than junior high, weighted mean (SE)	44.59 (0.18)
Percentage no employment, weighted mean (SE)	32.40 (0.05)

[a]: unweighted sample size

[b]: weighted sample size

Table 6.2 Comparison between not at risk and at risk of clinical depression in demographic factors, socioeconomic status and three dimensions of social capital for 1997 Taiwan Social Change Survey (TSCS)

	All		
	Non at risk **n[a] =1764** **N[b]=1705**	**At risk** **n=834** **N=871.72433**	
	Mean (SE)	**Mean (SE)**	**p-value[c]**
Individual-level			
Age	40.8 (0.3)	39.7 (0.5)	0.07
	Weighted % (SE)	**Weighted % (SE)**	**p-value**
Marital status			<.0001
1=Currently married	73.0 (1.2)	57.8 (1.8)	
2=Single	22.4 (1.1)	32.4 (1.7)	
3=Formerly married	4.6 (0.5)	9.8 (1.1)	
Religious status			0.17
1=Religious belief	78.4 (1.0)	75.9 (1.6)	
2=No religious belief	21.6 (1.0)	24.1 (1.6)	
Employment			
1=Not currently employed	22.2 (1.1)	34.4 (1.7)	<.0001
2=Currently employed	74.2 (1.1)	62.3 (1.8)	
3=Retired	3.5 (0.4)	3.3 (0.6)	
Education			0.39
1=Junior high school or below	50.0 (1.3)	47.8 (1.8)	
2=Senior high school	28.7 (1.1)	28.5 (1.6)	
3=Junior college or above	21.4 (1.0)	23.7 (1.5)	
Income			<.0001
1=No income	24.5 (1.1)	33.0 (1.7)	
2=Less than $19 999	15.5 (0.9)	21.7 (1.5)	
3=$20 000 to $39 999	32.4 (1.2)	27.8 (1.6)	
4=Over $40 000	27.7 (1.1)	17.5 (1.4)	
	Mean (SE)	**Mean (SE)**	**p-value**
Network social capital			
Composite score	-0.03 (0.02)	-0.17 (0.04)	0.002
The quantity of network social capital - Extensity	-0.03 (0.02)	-0.19 (0.03)	<.0001
The quality of network social capital - Upper reachability	-0.03 (0.03)	-0.14 (0.04)	0.02
The diversity of network social capital - Range	-0.03 (0.02)	-0.14 (0.04)	0.02
Cognitive social capital			
Composite score	16.08 (0.09)	14.82 (0.14)	<.0001
Trust in neighbors	5.23 (0.04)	4.78 (0.06)	<.0001
Perceptions of neighborhood care	5.24 (0.03)	4.85 (0.05)	<.0001
Perceptions of neighborhood familiarity	5.61 (0.03)	5.20 (0.06)	<.0001
	Weighted % (SE)	**Weighted % (SE)**	**p-value**
Structural social capital			
Composite score			0.003
No	21.0 (1.0)	26.9 (1.6)	
1 or more	79.0 (1.0)	73.1 (1.6)	
Participation in the local community			0.001
No	30.9 (1.2)	38.0 (1.8)	
1 or more	69.1 (1.2)	62.0 (1.8)	

	Mean (SE)	Mean (SE)	p-value
Participation in organization			0.03
No	51.4 (1.3)	56.0 (1.8)	
1 or more	48.6 (1.3)	44.0 (1.8)	
	Mean (SE)	**Mean (SE)**	**p-value**
Neighborhood-level			
Network social capital			
Composite score	-0.08 (0.01)	-0.07 (0.01)	0.24
The quantity of network social capital - Extensity	-0.09 (0.01)	-0.07 (0.01)	0.23
The quality of network social capital - Upper reachability	-0.07 (0.01)	-0.06 (0.01)	0.36
The diversity of network social capital - Range	-0.07 (0.01)	-0.06 (0.01)	0.20
Cognitive social capital			
Composite score	15.70 (0.04)	15.55 (0.06)	0.03
Trust in neighbors	5.12 (0.01)	5.09 (0.02)	0.10
Perceptions of neighborhood care	5.09 (0.01)	5.04 (0.02)	0.03
Perceptions of neighborhood familiarity	5.49 (0.02)	5.43 (0.02)	0.02
Structural social capital			
Percentage of participation in at least one local community activity or organization	77.14 (0.28)	76.76 (0.45)	0.47
Percentage of participation in at least one the local community activity	66.73 (0.33)	66.65 (0.53)	0.90
Percentage of participation in at least one organization	47.24 (0.36)	46.69 (0.52)	0.38
Percentage of age less than 15	22.38 (0.06)	22.30 (0.08)	0.39
Percentage of age more than 65	8.47 (0.07)	8.43 (0.10)	0.77
Percentage divorced and separated	2.26 (0.02)	2.31 (0.02)	0.08
Percentage less than junior high	44.88 (0.22)	44.01 (0.32)	0.03
Percentage no employment	32.36 (0.07)	32.50 (0.09)	0.21

[a]: unweighted sample size

[b]: weighted sample size

[c]: The p-value of the comparison of depression and non-depression groups

Table 6.3 Multilevel logistic regression model analysis of the association between the risk of clinical depression and network social capital respectively in 1997 TSCS

	Model 1 OR (95% C.I.)	Model 2 OR (95% C.I.)	Model 3 OR (95% C.I.)	Model 4 OR (95% C.I.)
Neighborhood-level variables				
Network social capital	1.20 (0.88, 1.65)	1.24 (0.88, 1.76)	1.02 (0.65, 1.59)	1.12 (0.71, 1.78)
Neighborhood-level characteristics				
Percentage of age less than 15			1.00 (0.92, 1.09)	1.00 (0.92, 1.09)
Percentage of age more than 65			1.01 (0.94, 1.08)	1.01 (0.94, 1.08)
Percentage divorced and separated			0.96 (0.74, 1.25)	0.95 (0.73, 1.24)
Percentage less than junior high			0.98 (0.96, 1.01)	0.99 (0.96, 1.01)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level variables				
Composite score of Network social capital				0.90 (0.82, 0.98)
Gender				
Male		0.62 (0.51, 0.76)	0.63 (0.52, 0.77)	0.62 (0.51, 0.76)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.44 (0.31, 0.62)	0.43 (0.30, 0.62)	0.44 (0.31, 0.63)
2=Single		0.85 (0.55, 1.30)	0.83 (0.54, 1.28)	0.82 (0.54, 1.26)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.97 (0.79, 1.20)	0.97 (0.79, 1.20)	0.99 (0.80, 1.22)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.73, 2.15)	1.27 (0.74, 2.18)	1.30 (0.75, 2.23)
2=Currently employed		0.76 (0.43, 1.37)	0.78 (0.44, 1.40)	0.79 (0.44, 1.42)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.90 (0.68, 1.19)	0.92 (0.70, 1.22)	0.87 (0.65, 1.16)
2=Senior high school		0.96 (0.74, 1.23)	0.97 (0.75, 1.24)	0.95 (0.74, 1.22)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.10 (0.72, 1.68)	1.11 (0.72, 1.71)	1.05 (0.68, 1.62)
2=Less than $19 999		1.71 (1.26, 2.31)	1.76 (1.30, 2.40)	1.66 (1.21, 2.27)
3=$20 000 to $39 999		1.17 (0.90, 1.51)	1.19 (0.91, 1.54)	1.15 (0.88, 1.49)

4=Over $40 000	1.00	1.00	1.00

Table 6.4 Multilevel logistic regression model analysis of the association between the risk of clinical depression and cognitive social capital respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Cognitive social capital	0.94 (0.89, 1.01)	0.94 (0.88, 1.01)	0.97 (0.88, 1.07)	1.06 (0.96, 1.18)
Neighborhood-level characteristics				
Percentage of age less than 15			1.00 (0.92, 1.09)	1.00 (0.92, 1.09)
Percentage of age more than 65			1.01 (0.94, 1.08)	1.01 (0.95, 1.08)
Percentage divorced and separated			0.94 (0.71, 1.23)	0.95 (0.72, 1.25)
Percentage less than junior high			0.99 (0.97, 1.01)	0.99 (0.97, 1.01)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Composite score of Cognitive social capital				0.91 (0.89, 0.94)
Gender				
Male		0.63 (0.52, 0.76)	0.63 (0.52, 0.77)	0.63 (0.52, 0.77)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.01 (1.00, 1.02)
Marital status				
1=Currently married		0.43 (0.30, 0.61)	0.43 (0.30, 0.62)	0.45 (0.32, 0.65)
2=Single		0.83 (0.54, 1.27)	0.83 (0.54, 1.27)	0.87 (0.57, 1.34)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.97 (0.79, 1.20)	0.97 (0.79, 1.20)	1.02 (0.82, 1.26)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.74, 2.17)	1.27 (0.74, 2.18)	1.29 (0.75, 2.24)
2=Currently employed		0.77 (0.43, 1.38)	0.78 (0.44, 1.40)	0.79 (0.44, 1.41)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.90 (0.68, 1.19)	0.93 (0.70, 1.23)	0.97 (0.73, 1.29)
2=Senior high school		0.96 (0.75, 1.23)	0.97 (0.75, 1.24)	0.97 (0.75, 1.25)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.10 (0.72, 1.69)	1.12 (0.73, 1.71)	1.14 (0.74, 1.76)
2=Less than $19 999		1.76 (1.29, 2.38)	1.77 (1.30, 2.41)	1.83 (1.34, 2.25)
3=$20 000 to $39 999		1.18 (0.90, 1.53)	1.19 (0.92, 1.54)	1.25 (0.96, 1.63)

4=Over $40 000	1.00	1.00	1.00

Table 6.5 Multilevel logistic regression model analysis of the association between the risk of clinical depression and structural social capital respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Structural social capital	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Neighborhood-level characteristics				
Percentage less than 15			1.00 (0.92, 1.09)	1.00 (0.92, 1.09)
Percentage more than 65			1.01 (0.94, 1.08)	1.01 (0.94, 1.08)
Percentage divorced and separated			0.96 (0.73, 1.25)	0.96 (0.73, 1.25)
Percentage less than junior high			0.98 (0.97, 1.00)	0.98 (0.97, 1.00)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Composite score of Structural social capital				
No				1.00
1 or more				0.78 (0.63, 0.97)
Gender				
Male		0.62 (0.51, 0.75)	0.63 (0.52, 0.77)	0.63 (0.52, 0.77)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.44 (0.31, 0.62)	0.43 (0.30, 0.62)	0.44 (0.31, 0.63)
2=Single		0.85 (0.55, 1.29)	0.83 (0.54, 1.28)	0.84 (0.55, 1.29)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.98 (0.79, 1.21)	0.97 (0.78, 1.20)	0.99 (0.80, 1.23)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.73, 2.16)	1.27 (0.74, 2.19)	1.29 (0.75, 2.22)
2=Currently employed		0.75 (0.42, 1.35)	0.78 (0.44, 1.40)	0.80 (0.45, 1.43)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.88 (0.67, 1.16)	0.92 (0.70, 1.22)	0.91 (0.68, 1.20)
2=Senior high school		0.95 (0.74, 1.21)	0.97 (0.75, 1.24)	0.95 (0.74, 1.22)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.07 (0.70, 1.63)	1.11 (0.72, 1.70)	1.11 (0.72, 1.70)

2=Less than $19 999	1.68 (1.24, 2.28)	1.76 (1.30, 2.40)	1.75 (1.28, 2.38)
3=$20 000 to $39 999	1.16 (0.89, 1.50)	1.19 (0.91, 1.54)	1.17 (0.90, 1.52)
4=Over $40 000	1.00	1.00	1.00

Table 6.6 Multilevel logistic regression model analysis of the association between the risk of clinical depression and network social capital of extensity respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Network social capital - Extensity	1.22 (0.88, 1.68)	1.25 (0.89, 1.76)	1.06 (0.69, 1.62)	1.19 (0.77, 1.84)
Neighborhood-level characteristics				
Percentage of age less than 15			1.00 (0.92, 1.09)	1.00 (0.92, 1.09)
Percentage of age more than 65			1.00 (0.94, 1.08)	1.01 (0.94, 1.08)
Percentage divorced and separated			0.96 (0.74, 1.25)	0.95 (0.73, 1.24)
Percentage less than junior high			0.99 (0.96, 1.01)	0.99 (0.97, 1.01)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Network social capital - Extensity				0.88 (0.79, 0.97)
Gender				
Male		0.62 (0.51, 0.76)	0.63 (0.52, 0.77)	0.63 (0.52, 0.77)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.44 (0.31, 0.62)	0.43 (0.30, 0.62)	0.44 (0.31, 0.62)
2=Single		0.85 (0.56, 1.30)	0.83 (0.55, 1.28)	0.81 (0.53, 1.24)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.97 (0.79, 1.20)	0.97 (0.78, 1.20)	0.99 (0.80, 1.23)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.25 (0.73, 2.14)	1.27 (0.74, 2.18)	1.31 (0.76, 2.26)
2=Currently employed		0.76 (0.43, 1.36)	0.78 (0.44, 1.40)	0.80 (0.45, 1.43)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.90 (0.68, 1.19)	0.92 (0.70, 1.23)	0.87 (0.65, 1.16)
2=Senior high school		0.95 (0.74, 1.22)	0.97 (0.75, 1.24)	0.95 (0.74, 1.22)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.10 (0.72, 1.68)	1.12 (0.73, 1.71)	1.02 (0.66, 1.57)
2=Less than $19 999		1.71 (1.26, 2.31)	1.76 (1.30, 2.40)	1.63 (1.19, 2.22)
3=$20 000 to $39 999		1.17 (0.90, 1.51)	1.19 (0.91, 1.54)	1.13 (0.87, 1.47)

4=Over $40 000	1.00	1.00	1.00

Table 6.7 Multilevel logistic regression model analysis of the association between the risk of clinical depression and network social capital of upper reachability respectively in 1997 TSCS

	Model 1 OR (95% C.I.)	Model 2 OR (95% C.I.)	Model 3 OR (95% C.I.)	Model 4 OR (95% C.I.)
Neighborhood-level				
Network social capital - Upper reachability	1.16 (0.83, 1.63)	1.18 (0.83, 1.69)	0.92 (0.57, 1.50)	1.01 (0.62, 1.66)
Neighborhood-level characteristics				
Percentage of age less than 15			1.01 (0.92, 1.10)	1.01 (0.92, 1.10)
Percentage of age more than 65			1.01 (0.94, 1.09)	1.01 (0.94, 1.09)
Percentage divorced and separated			0.96 (0.74, 1.25)	0.96 (0.73, 1.24)
Percentage less than junior high			0.98 (0.96, 1.00)	0.98 (0.96, 1.01)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Network social capital - Upper reachability				0.91 (0.83, 1.00)
Gender				
Male		0.62 (0.51, 0.76)	0.63 (0.52, 0.77)	0.62 (0.51, 0.76)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.44 (0.31, 0.62)	0.43 (0.30, 0.62)	0.44 (0.31, 0.63)
2=Single		0.85 (0.56, 1.29)	0.83 (0.55, 1.28)	0.83 (0.54, 1.27)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.98 (0.79, 1.21)	0.97 (0.79, 1.20)	0.98 (0.79, 1.21)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.73, 2.16)	1.28 (0.74, 2.19)	1.28 (0.75, 2.20)
2=Currently employed		0.76 (0.43, 1.36)	0.78 (0.44, 1.40)	0.79 (0.44, 1.41)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.90 (0.68, 1.19)	0.92 (0.70, 1.22)	0.88 (0.66, 1.17)
2=Senior high school		0.95 (0.74, 1.23)	0.96 (0.75, 1.24)	0.95 (0.74, 1.22)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.09 (0.71, 1.66)	1.11 (0.72, 1.70)	1.08 (0.70, 1.66)
2=Less than $19 999		1.70 (1.26, 2.31)	1.76 (1.30, 2.40)	1.70 (1.24, 2.31)
3=$20 000 to $39 999		1.16 (0.90, 1.51)	1.19 (0.91, 1.54)	1.17 (0.90, 1.51)

4=Over $40 000	1.00	1.00	1.00

Table 6.8 Multilevel logistic regression model analysis of the association between the risk of clinical depression and network social capital of range respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Network social capital - Range	1.23 (0.87, 1.73)	1.28 (0.89, 1.84)	1.05 (0.66, 1.68)	1.13 (0.70, 1.82)
Neighborhood-level characteristics				
Percentage of age less than 15			1.00 (0.92, 1.09)	1.00 (0.92, 1.09)
Percentage of age more than 65			1.01 (0.94, 1.08)	1.01 (0.94, 1.08)
Percentage divorced and separated			0.96 (0.74, 1.25)	0.96 (0.73, 1.25)
Percentage less than junior high			0.99 (0.96, 1.01)	0.98 (0.96, 1.01)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Network social capital - Range				0.92 (0.84, 1.01)
Gender				
Male		0.62 (0.51, 0.76)	0.63 (0.52, 0.77)	0.62 (0.51, 0.76)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.44 (0.31, 0.62)	0.43 (0.30, 0.62)	0.44 (0.31, 0.62)
2=Single		0.85 (0.56, 1.29)	0.83 (0.54, 1.28)	0.83 (0.54, 1.27)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.97 (0.79, 1.20)	0.97 (0.79, 1.20)	0.98 (0.79, 1.21)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.73, 2.16)	1.27 (0.74, 2.18)	1.28 (0.75, 2.21)
2=Currently employed		0.76 (0.43, 1.37)	0.78 (0.44, 1.40)	0.79 (0.44, 1.42)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.90 (0.68, 1.19)	0.92 (0.70, 1.22)	0.89 (0.67, 1.19)
2=Senior high school		0.96 (0.74, 1.23)	0.97 (0.75, 1.24)	0.96 (0.74, 1.23)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.10 (0.71, 1.68)	1.11 (0.73, 1.71)	1.07 (0.70, 1.65)
2=Less than $19 999		1.71 (1.26, 2.31)	1.76 (1.30, 2.40)	1.70 (1.24, 2.32)
3=$20 000 to $39 999		1.17 (0.90, 1.52)	1.19 (0.91, 1.54)	1.17 (0.90, 1.51)

4=Over $40 000	1.00	1.00	1.00

Table 6.9 Multilevel logistic regression model analysis of the association between the risk of clinical depression and cognitive social capital of trust in neighbors respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Cognitive social capital - Trust in neighbors	0.87 (0.70, 1.09)	0.87 (0.69, 1.10)	0.98 (0.72, 1.34)	1.24 (0.90, 1.72)
Neighborhood-level characteristics				
Percentage of age less than 15			1.00 (0.92, 1.09)	1.00 (0.92, 1.09)
Percentage of age more than 65			1.01 (0.94, 1.08)	1.01 (0.94, 1.08)
Percentage divorced and separated			0.95 (0.73, 1.25)	0.97 (0.73, 1.27)
Percentage less than junior high			0.98 (0.97, 1.00)	0.98 (0.97, 1.00)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Cognitive social capital - Trust in neighbors				0.79 (0.74, 0.85)
Gender				
Male		0.62 (0.51, 0.76)	0.63 (0.52, 0.77)	0.63 (0.52, 0.77)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.01 (1.00, 1.02)
Marital status				
1=Currently married		0.43 (0.31, 0.62)	0.43 (0.30, 0.62)	0.45 (0.32, 0.65)
2=Single		0.84 (0.55, 1.28)	0.83 (0.54, 1.28)	0.86 (0.56, 1.31)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.98 (0.79, 1.21)	0.97 (0.79, 1.20)	0.98 (0.79, 1.22)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.74, 2.17)	1.27 (0.74, 2.18)	1.26 (0.73, 2.18)
2=Currently employed		0.77 (0.43, 1.37)	0.78 (0.44, 1.40)	0.77 (0.43, 1.39)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.89 (0.68, 1.18)	0.92 (0.70, 1.22)	0.94 (0.71, 1.25)
2=Senior high school		0.96 (0.74, 1.22)	0.97 (0.75, 1.24)	0.96 (0.74, 1.23)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.09 (0.71, 1.67)	1.11 (0.73, 1.71)	1.14 (0.74, 1.75)
2=Less than $19 999		1.73 (1.27, 2.34)	1.77 (1.30, 2.40)	1.79 (1.31, 2.44)
3=$20 000 to $39 999		1.17 (0.90, 1.52)	1.19 (0.91, 1.54)	1.22 (0.94, 1.59)

4=Over $40 000	1.00	1.00	1.00

Table 6.10 Multilevel logistic regression model analysis of the association between the risk of clinical depression and cognitive social capital of perceptions of neighborhood care respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Cognitive social capital - Perceptions of neighborhood care	0.85 (0.71, 1.01)	0.85 (0.71, 1.03)	0.93 (0.72, 1.19)	1.13 (0.87, 1.47)
Neighborhood-level characteristics				
Percentage of age less than 15			1.00 (0.92, 1.09)	1.00 (0.92, 1.09)
Percentage of age more than 65			1.01 (0.95 1.08)	1.01 (0.95, 1.08)
Percentage divorced and separated			0.95 (0.73, 1.23)	0.96 (0.73, 1.27)
Percentage less than junior high			0.98 (0.97, 1.01)	0.99 (0.97, 1.01)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.97, 1.07)
Individual-level				
Cognitive social capital - Perceptions of neighborhood care				0.83 (0.78, 0.88)
Gender				
Male		0.63 (0.51, 0.76)	0.63 (0.52, 0.77)	0.63 (0.52, 0.77)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.43 (0.31, 0.62)	0.43 (0.30, 0.62)	0.45 (0.31, 0.64)
2=Single		0.83 (0.54, 1.27)	0.83 (0.54, 1.27)	0.87 (0.56, 1.33)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.97 (0.79, 1.20)	0.97 (0.79, 1.20)	1.01 (0.82, 1.26)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.74, 2.17)	1.27 (0.74, 2.18)	1.29 (0.75, 2.23)
2=Currently employed		0.77 (0.43, 1.38)	0.78 (0.44, 1.40)	0.79 (0.44, 1.43)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.91 (0.69, 1.20)	0.93 (0.70, 1.23)	0.94 (0.71, 1.25)
2=Senior high school		0.96 (0.75, 1.23)	0.97 (0.75, 1.24)	0.96 (0.74, 1.23)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.10 (0.72, 1.68)	1.11 (0.73, 1.71)	1.15 (0.74, 1.76)
2=Less than $19 999		1.75 (1.29, 2.37)	1.77 (1.30, 2.41)	1.83 (1.31, 2.49)
3=$20 000 to $39 999		1.18 (0.91, 1.53)	1.19 (0.92, 1.54)	1.24 (0.96, 1.62)

4=Over $40 000	1.00	1.00	1.00

Table 6.11 Multilevel logistic regression model analysis of the association between the risk of clinical depression and cognitive social capital of perceptions of neighborhood familiarity respectively in 1997 TSCS

	Model 1 OR (95% C.I.)	Model 2 OR (95% C.I.)	Model 3 OR (95% C.I.)	Model 4 OR (95% C.I.)
Neighborhood-level				
Cognitive social capital - Perceptions of neighborhood familiarity	0.85 (0.73, 1.00)	0.84 (0.71, 1.00)	0.88 (0.67, 1.14)	1.07 (0.81, 1.42)
Neighborhood-level characteristics				
Percentage of age less than 15			1.00 (0.92, 1.08)	1.00 (0.92, 1.09)
Percentage of age more than 65			1.01 (0.95 1.08)	1.01 (0.95, 1.08)
Percentage divorced and separated			0.91 (0.68, 1.20)	0.91 (0.68, 1.22)
Percentage less than junior high			0.99 (0.97, 1.01)	0.99 (0.97, 1.01)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Cognitive social capital - Perceptions of neighborhood familiarity				0.82 (0.77, 0.87)
Gender				
Male		0.63 (0.52, 0.76)	0.63 (0.52, 0.77)	0.64 (0.52, 0.78)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (1.00, 1.01)
Marital status				
1=Currently married		0.43 (0.30, 0.61)	0.43 (0.30, 0.61)	0.44 (0.31, 0.63)
2=Single		0.83 (0.54, 1.27)	0.83 (0.54, 1.27)	0.86 (0.56, 1.32)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.97 (0.79, 1.20)	0.97 (0.79, 1.20)	1.01 (0.82, 1.26)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.73, 2.16)	1.26 (0.74, 2.17)	1.30 (0.75, 2.24)
2=Currently employed		0.78 (0.43, 1.39)	0.78 (0.44, 1.40)	0.78 (0.44, 1.40)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.91 (0.69, 1.20)	0.93 (0.70, 1.23)	0.99 (0.75, 1.32)
2=Senior high school		0.96 (0.75, 1.23)	0.97 (0.75, 1.24)	0.99 (0.77, 1.28)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.11 (0.72, 1.70)	1.12 (0.73, 1.71)	1.12 (0.73, 1.73)

2=Less than $19 999	1.77 (1.31, 2.41)	1.78 (1.31, 2.42)	1.83 (1.34, 2.49)
3=$20 000 to $39 999	1.18 (0.91, 1.53)	1.19 (0.92, 1.54)	1.23 (0.95, 1.60)
4=Over $40 000	1.00	1.00	1.00

Table 6.12 Multilevel logistic regression model analysis of the association between the risk of clinical depression and structural social capital of participation in the local community respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Structural social capital - Participation in the local community	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.01 (1.00, 1.01)	1.01 (1.00, 1.02)
Neighborhood-level characteristics				
Percentage of age less than 15			0.99 (0.91, 1.08)	0.99 (0.91, 1.08)
Percentage of age more than 65			1.00 (0.93, 1.07)	0.99 (0.93, 1.07)
Percentage divorced and separated			0.94 (0.72, 1.22)	0.93 (0.72, 1.22)
Percentage less than junior high			0.98 (0.96, 1.00)	0.98 (0.96, 1.00)
Percentage no employment			1.03 (0.98, 1.07)	1.03 (0.98, 1.07)
Individual-level				
Structural social capital - Participation in the local community				
No				1.00
1 or more				0.72 (0.60, 0.88)
Gender				
Male		0.62 (0.51, 0.75)	0.63 (0.52, 0.77)	0.63 (0.52, 0.77)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.44 (0.31, 0.62)	0.43 (0.30, 0.61)	0.44 (0.31, 0.63)
2=Single		0.85 (0.55, 1.30)	0.83 (0.54, 1.28)	0.84 (0.55, 1.29)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.98 (0.79, 1.21)	0.97 (0.78, 1.20)	1.01 (0.82, 1.25)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.73, 2.16)	1.28 (0.75, 2.20)	1.31 (0.76, 2.25)
2=Currently employed		0.75 (0.42, 1.34)	0.78 (0.44, 1.40)	0.80 (0.45, 1.44)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.88 (0.67, 1.16)	0.92 (0.70, 1.22)	0.93 (0.70, 1.23)
2=Senior high school		0.95 (0.74, 1.21)	0.96 (0.75, 1.24)	0.97 (0.75, 1.24)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.06 (0.70, 1.63)	1.11 (0.72, 1.70)	1.12 (0.73, 1.72)

2=Less than $19 999	1.68 (1.24, 2.27)	1.77 (1.34, 2.41)	1.78 (1.31, 2.43)
3=$20 000 to $39 999	1.16 (0.89, 1.50)	1.19 (0.92, 1.55)	1.19 (0.91, 1.54)
4=Over $40 000	1.00	1.00	1.00

Table 6.13 Multilevel logistic regression model analysis of the association between the risk of clinical depression and structural social capital of participation in organization respectively in 1997 TSCS

	Model 1	Model 2	Model 3	Model 4
	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)	OR (95% C.I.)
Neighborhood-level				
Structural social capital - Participation in organization	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.01 (0.99, 1.01)
Neighborhood-level characteristics				
Percentage of age less than 15			1.01 (0.93, 1.10)	1.01 (0.93, 1.10)
Percentage of age more than 65			1.01 (0.95, 1.08)	1.01 (0.93, 1.08)
Percentage divorced and separated			0.97 (0.74, 1.26)	0.97 (0.74, 1.25)
Percentage less than junior high			0.98 (0.97, 1.00)	0.98 (0.97, 1.00)
Percentage no employment			1.02 (0.98, 1.07)	1.02 (0.98, 1.07)
Individual-level				
Structural social capital - Participation in organization				
No				1.00
1 or more				0.92 (0.76, 1.12)
Gender				
Male		0.62 (0.51, 0.75)	0.63 (0.52, 0.77)	0.63 (0.52, 0.77)
Female		1.00	1.00	1.00
Age		1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)
Marital status				
1=Currently married		0.44 (0.31, 0.62)	0.43 (0.30, 0.61)	0.43 (0.31, 0.62)
2=Single		0.85 (0.55, 1.29)	0.83 (0.54, 1.27)	0.84 (0.55, 1.28)
3=Formerly married		1.00	1.00	1.00
Religious status				
1=Religious belief		0.98 (0.79, 1.21)	0.97 (0.79, 1.20)	0.98 (0.79, 1.21)
2=No religious belief		1.00	1.00	1.00
Employment				
1=Not currently employed		1.26 (0.73, 2.16)	1.28 (0.75, 2.20)	1.29 (0.75, 2.21)
2=Currently employed		0.75 (0.42, 1.34)	0.78 (0.44, 1.40)	0.78 (0.44, 1.40)
3=Retired		1.00	1.00	1.00
Education				
1=Junior high school or below		0.88 (0.67, 1.16)	0.92 (0.70, 1.22)	0.90 (0.68, 1.20)
2=Senior high school		0.95 (0.74, 1.22)	0.97 (0.75, 1.24)	0.96 (0.74, 1.23)
3=Junior college or above		1.00	1.00	1.00
Income				
1=No income		1.06 (0.69, 1.62)	1.10 (0.72, 1.69)	1.08 (0.71, 1.67)

2=Less than $19 999	1.67 (1.24, 2.26)	1.76 (1.29, 2.39)	1.73 (1.27, 2.36)
3=$20 000 to $39 999	1.15 (0.89, 1.49)	1.18 (0.91, 1.53)	1.17 (0.90, 1.52)
4=Over $40 000	1.00	1.00	1.00

CONCLUSIONS

This study adds to the limited body of research on social capital and depression in Taiwan. Studies exploring the association between network, cognitive and structural social capital and depression in Taiwan as well as the age-based patterns of those three dimensions of social capital and how those influenced on depression are limited. In addition, the examination of this issue still remains inconclusive and need to explore how contextual- and individual-level network, cognitive and structural social capital associated with depression. To our knowledge, this is the first study to comprehensively explore whether there are differences in the association between network, cognitive and structural social capital and the risk of clinical depression and also examine whether the associations are modified by gender and age-based patterns of social capital in Taiwan. Furthermore, this study examined the independent association between neighborhood-level social capital and the risk of depression after adjusting for individual-level social capital and other relevant confounders. There were several major findings of this study including the dimensions of social capital did not have the same relationship with being at a risk of clinical depression, age-based pattern of network social capital matters for being at risk for clinical depression in Taiwan and neighborhood-level social capital did not appear to have a major influence on the results in Taiwan.

First, cognitive and structural social capital was associated with being at a risk of clinical depression respectively but not network social capital in this study. People with higher composite scores for cognitive and structural social capital had lower odds of

being at risk for clinical depression compared to those with lower composite scores. Although composite scores of network social capital were not associated with being at risk for clinical depression, network extensity was associated with lower odds of being at risk for clinical depression. Furthermore, none of the analyzed interaction terms between each dimension of social capital and gender were statistically significantly after adjusting for potential confounders. Cognitive social capital has a direct protective association with being at a risk of clinical depression which is consistent with previous studies. However, the association between structural social capital and the risk of clinical depression may have been driven by participation in local community activity which may be more likely to be kinship-based that Taiwanese tend to be. The lack of association between network social capital score and the risk of clinical depression may be due to the measure capturing weaker social ties that do not influence the risk of clinical depression.

Second, this study suggested that age structures access to social capital and age-based patterns of social capital could vary by dimensions of social capital. Furthermore, only age-based pattern of network social capital matters for being at risk for clinical depression in Taiwan but not cognitive and structural social capital. The higher score of network social capital is associated with lower odds of being at risk for clinical depression only among older adults (age $\geq$ 65) but not among younger adults (age 20-64). Previous studies showed a decline in network social capital with advancing age (170) and managing life in retirement seems to be particularly important for older people. A person who could still stay in those older adults' network might truly be able to help. For example, individuals could eventually rid their networks of untrustworthy contacts and then people might get greater access of social support as increasing in average network

trust (26) which might have a benefit on depression especially among older population. The potential explanations for no age differences in the association between cognitive social capital and being at risk for clinical depression in Taiwan could be most Taiwanese have more close relationship to their family not to neighborhood. Furthermore, older population in Taiwan would be taken care by their family and might result in access to social capital from family. Since cognitive social capital was measured by trust, care and familiarity in neighborhood in this study, it might not be able to capture the importance of social capital from family in older population in Taiwan. In the cross-national study, Taiwanese reported relatively lower levels of organizational memberships comparing with the U.S. (170) and Taiwan has not had as strong a historical tradition of community participation in voluntary associations. Hence, not only young but also old population in Taiwan might only be affected by social participation, which was the indicates of structural social capital, for only short period and therefore age-based pattern of structural social capital did matter for being at risk for clinical depression in Taiwan.

Third, this study found no association between neighborhood-level network, cognitive as well as structural social capital and being at risk for clinical depression in Taiwan. The one possibility is that the unique authoritarian cultural and historical characteristic of Taiwan may result in the lack of contextual association in Taiwan. One possible explanation is that people might get benefits from social capital only when they could perceive it and so individual-level social capital might be more important than neighborhood-level. Although, we did not explore this in detail, it is possible the association between neighborhood-level social capital and the risk of clinical depression is modified by vulnerably personal or context characteristics, such as poverty or low

economic level. For example, based on Stafford et al., neighborhood-level social capital is only related to common mental disorders (CMD) in the presence of deprivation (32).

Findings from this analysis must be considered within the context of several limitations. Since we used a cross-sectional study design to analyze the associations in this study, confirmation of a causal relationship between social capital and depression is not possible. It is possible that we may be observing reverse causality, where an individual's mental health status could influence measures of social capital. However, our findings are consistent with evidence from recent longitudinal studies assessing social capital and depression showing inverse associations (20). Another limitation is that there might be measurement error in the assessment of social capital. We do not have detailed measurement of source of social capital. For example, there is a possibility that Taiwanese access their social capital not only from neighborhood but also from other setting, such as workplace or family. Furthermore, the contextual measures of neighborhood-level social capital may be subject to methodological limitations. The contextual-level social capital in this study was based on aggregate measures of individual-level social capital which could be an artifact of individual social capital perceptions and led to same source bias. In addition, this study may have used the inaccurate geographic level of aggregation to think of contextual social capital among Taiwanese. No association between neighborhood-level social capital and the risk of clinical depression could be results of failing defined geographic level of aggregation to think of contextual-level social capital. It is possible that these other context, (i.e. household or workplace) may also be important for risk of depression. The other limitation is that we measured depressive symptoms was measured as a categorical

variable. Since the cut-off point we used in this study only represented people at a risk of clinical depression, we might not be able to detect the association between social capital and people with minor depressive symptoms.

This study has several strengths. First, the TSCS is nationally representative and the results are generalizable to the overall population in Taiwan. Second, social capital is measured in a comprehensive way. Although social capital is a multidimensional concept, many studies, particularly in Taiwan, did not examine social capital comprehensively. Compared to prior studies, the use of three dimensions of social capital is an advantage of this study, which will deepen our understanding of how different dimensions of social capital are associated with depression. Furthermore, this is the first study to comprehensively evaluate whether the association between three dimensions of social capital and depression, assess age-based patterns in social capital and examine whether these patterns modified the association between social capital and the risk of clinical depression. The use of both contextual- and individual-level social capital is an advantage of this study because It would have the ability to differentiate whether the ''places'' people live matters for depression, or whether the perception of individuals toward ''place'' matters for depression (20). Based on this, it will deepen our understanding of whether there is an independent association between contextual- or individual-level social capital and the risk of clinical depression.

Overall, the results from this study suggest that since cognitive and structural social capital was associated with being at risk for clinical depression in Taiwan, future prevention/intervention programs or policy could focus on building those two elements, such as trust in neighbor or social participation, in Taiwan. Furthermore, this study

showed that network social capital was associated with being at risk for clinical depression only among older population, future prevention/intervention programs or policy needs to consider improving older population' social network. Disaggregating this multidimensional and multilevel measure furthers our understanding of the relationship between social capital and the risk of clinical depression. Mental health promotion and intervention may wish to consider improving individual perception of social capital and participation in social activity as well as enlarging their social network, especially in older population. However, future study still needs to explore whether other context (i.e. household or workplace) of social capital may also be important for risk of depression.

REFERENCES

1.   Mathers C, Fat DM, Boerma J. The global burden of disease: 2004 update: World Health Organization; 2008.

2.   Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The Lancet. 2013;380(9859):2197-223.

3.   Health Promotion Administration. National Survey on Knowledge, Attitude and Practice of Health Promotion. In: Health Promotion Administration MoHaW, editor. Taipei2002.

4.   Shih Y, Hung Y, Chang H, Liu J, Lin H, Chang M, et al. The design, contents, operation and the characteristics of the respondents of the 2001 National Health Interview Survey in Taiwan. Taiwan J Public Health. 2003;22:419-30.

5.   Fu TS-T, Lee C-S, Gunnell D, Lee W-C, Cheng AT-A. Changing trends in the prevalence of common mental disorders in Taiwan: a 20-year repeated cross-sectional survey. The Lancet. 2013.

6.   Chong M-Y, Tsang H-Y, Chen C-S, Tang T-C, Chen C-C, Yeh T-L, et al. Community study of depression in old age in Taiwan Prevalence, life events and socio-demographic correlates. The British Journal of Psychiatry. 2001;178(1):29-35.

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7.   Chien I, Kuo C-C, Bih S-H, Chou Y-J, Lin C-H, Lee C-H, et al. The prevalence and incidence of treated major depressive disorder among National Health Insurance enrollees in Taiwan, 1996 to 2003. Canadian journal of psychiatry. 2007;52(1):28-36.

8.   Bourdieu P. Handbook of Theory and Research for the Sociology of Education: Greenwood Publishing Group; 1986.

9.   Coleman JS. Social capital in the creation of human capital. Am J Sociol. 1988:S95-S120.

10.   Putnam RD. Bowling alone: America's declining social capital. Journal of democracy. 1995;6(1):65-78.

11.   Valencia-Garcia D, Simoni JM, Alegría M, Takeuchi DT. Social capital, acculturation, mental health, and perceived access to services among Mexican American women. Journal of consulting and clinical psychology. 2012;80(2):177.

12.   Bassett E, Moore S. Social capital and depressive symptoms: The association of psychosocial and network dimensions of social capital with depressive symptoms in Montreal, Canada. Social science & medicine (1982). 2013;86:96-102.

13.   Mulvaney C, Kendrick D. Depressive symptoms in mothers of pre-school children--effects of deprivation, social support, stress and neighbourhood social capital. Social psychiatry and psychiatric epidemiology. 2005;40(3):202-8.

14.   Cheng H-L, Chiang T-L. Social Capital and Self-Rated Health in Taiwan. Taiwan Journal Public Health. 2002;21(4):289-95.

15.   Chuang Y-C, Chuang K-Y. Gender differences in relationships between social capital and individual smoking and drinking behavior in Taiwan. Social Science & Medicine. 2008;67(8):1321-30.

16.   Song L, Lin N. Social Capital and Health Inequality: Evidence from Taiwan. Journal of Health and Social Behavior. 2009;50(2):149-63.

17.   Carpiano RM. Toward a neighborhood resource-based theory of social capital for health: Can Bourdieu and sociology help? Social Science & Medicine. 2006;62(1):165-75.

18.   Lin N. Building a network theory of social capital. Connections. 1999;22(1):28-51.

19.   Harpham T, Grant E, Thomas E. Measuring social capital within health surveys: key issues. Health policy and planning. 2002;17(1):106-11.

20.   Fujiwara T, Kawachi I. A prospective study of individual-level social capital and major depression in the United States. Journal of epidemiology and community health. 2008;62(7):627-33.

21.   Norstrand JA, Glicksman A, Lubben J, Kleban M. The Role of the Social Environment on Physical and Mental Health of Older Adults. Journal of Housing For the Elderly. 2012;26(1-3):290-307.

22.   Forsman AK, Nyqvist F, Wahlbeck K. Cognitive components of social capital and mental health status among older adults: a population-based cross-sectional study. Scandinavian journal of public health. 2011;39(7):757-65. Epub 2011/09/29.

23.   Kim BJ, Auh E, Lee YJ, Ahn J. The impact of social capital on depression among older Chinese and Korean immigrants: similarities and differences. Aging & mental health. 2013. Epub 2013/06/19.

24.	Forsman AK, Nyqvist F, Schierenbeck I, Gustafson Y, Wahlbeck K. Structural and cognitive social capital and depression among older adults in two Nordic regions. Aging & Mental Health. 2012;16(6):771-9.

25.	Haines VA, Beggs JJ, Hurlbert JS. Neighborhood Disadvantage, Network Social Capital, and Depressive Symptoms. Journal of Health and Social Behavior. 2011;52(1):58-73.

26.	McDonald S, Mair CA. Social Capital Across the Life Course: Age and Gendered Patterns of Network Resources. Sociological Forum. 2010;25(2):335-59.

27.	Murayama H, Fujiwara Y, Kawachi I. Social capital and health: a review of prospective multilevel studies. Journal of epidemiology / Japan Epidemiological Association. 2012;22(3):179-87.

28.	De Silva MJ, McKenzie K, Harpham T, Huttly SRA. Social capital and mental illness: a systematic review. Journal of epidemiology and community health. 2005;59(8):619-27.

29.	Kawachi I, Subramanian SV, Kim D. Social capital and health: Springer; 2008.

30.	Putnam RD, Leonardi R. Making democracy work: Civic traditions in modern Italy: Princeton university press; 1993.

31.	Sund ER, Jørgensen SH, Jones A, Krokstad S, Heggdal M. The influence of social capital on self-rated health and depression–The Nord-Trøndelag health study (HUNT). Norsk epidemiologi. 2007;17(1).

32.	Stafford M, De Silva M, Stansfeld S, Marmot M. Neighbourhood social capital and common mental disorder: Testing the link in a general population sample. Health & place. 2008;14(3):394-405.

33.   Poortinga W. Social capital: an individual or collective resource for health? Social Science & Medicine. 2006;62(2):292-302.

34.   Kawachi I, Kim D, Coutts A, Subramanian S. Commentary: Reconciling the three accounts of social capital. International journal of epidemiology. 2004;33(4):682-90.

35.   Subramanian S, Lochner KA, Kawachi I. Neighborhood differences in social capital: a compositional artifact or a contextual construct? Health & place. 2003;9(1):33-44.

36.   American Psychiatric Association. Diagnostic and Statistical Manual-Text Revision (DSM-IV-TRim, 2000): American Psychiatric Association; 2000.

37.   Patel V, Abas M, Broadhead J, Todd C, Reeler A. Depression in developing countries: lessons from Zimbabwe. BMJ: British Medical Journal. 2001;322(7284):482.

38.   Kessler RC, Bromet EJ. The Epidemiology of Depression Across Cultures. Annual Review of Public Health. 2013;34(1):119-38.

39.   Katon WJ. Clinical and health services relationships between major depression, depressive symptoms, and general medical illness. Biological psychiatry. 2003;54(3):216-26.

40.   Van der Kooy K, van Hout H, Marwijk H, Marten H, Stehouwer C, Beekman A. Depression and the risk for cardiovascular diseases: systematic review and meta analysis. International journal of geriatric psychiatry. 2007;22(7):613-26.

41.   Wulsin LR, Singal BM. Do depressive symptoms increase the risk for the onset of coronary disease? A systematic quantitative review. Psychosomatic medicine. 2003;65(2):201-10.

42.   Ohira T, Iso H, Satoh S, Sankai T, Tanigawa T, Ogawa Y, et al. Prospective study of depressive symptoms and risk of stroke among Japanese. Stroke. 2001;32(4):903-8.

43.   Scherrer JF, Virgo KS, Zeringue A, Bucholz KK, Jacob T, Johnson RG, et al. Depression increases risk of incident myocardial infarction among Veterans Administration patients with rheumatoid arthritis. General hospital psychiatry. 2009;31(4):353-9.

44.   Carnethon MR, Kinder LS, Fair JM, Stafford RS, Fortmann SP. Symptoms of depression as a risk factor for incident diabetes: findings from the National Health and Nutrition Examination Epidemiologic Follow-up Study, 1971–1992. American journal of epidemiology. 2003;158(5):416-23.

45.   Gross AL, Gallo JJ, Eaton WW. Depression and cancer risk: 24 years of follow-up of the Baltimore Epidemiologic Catchment Area sample. Cancer causes & control. 2010;21(2):191-9.

46.   Wulsin LR, Vaillant GE, Wells VE. A systematic review of the mortality of depression. Psychosomatic medicine. 1999;61(1):6-17.

47.   Guze SB, Robins E. Suicide and primary affective disorders. The British journal of psychiatry : the journal of mental science. 1970;117(539):437-8.

48.   Goodwin FK, Jamison KR. Manic-depressive illness. 1990.

49.   Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. The Lancet. 2007;370(9590):851-8.

50.   Murray CJ, Lopez AD. Evidence-based health policy—lessons from the Global Burden of Disease Study. Science. 1996;274:740.

51.   Murray CJ, Lopez AD. The global burden of disease and injury series, volume 1: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Cambridge MA. 1996.

52.   Weissman MM, Bland RC, Canino GJ, et al. Cross-national epidemiology of major depression and bipolar disorder. JAMA. 1996;276(4):293-9.

53.   Kuehner C. Gender differences in unipolar depression: an update of epidemiological findings and possible explanations. Acta Psychiatrica Scandinavica. 2003;108(3):163-74.

54.   Seedat S, Scott KM, Angermeyer MC, Berglund P, Bromet EJ, Brugha TS, et al. Cross-national associations between gender and mental disorders in the WHO World Mental Health Surveys. Archives of general psychiatry. 2009;66(7):785.

55.   Eaton WW, Anthony JC, Gallo J, Cai G, Tien A, Romanoski A, et al. Natural history of diagnostic interview schedule/DSM-IV major depression: The Baltimore Epidemiologic Catchment Area follow-up. Archives of general psychiatry. 1997;54(11):993.

56.   Hwu H-G, Chang I-H, Yeh E-K, Chang C-J, Yeh L-L. Major depressive disorder in Taiwan defined by the Chinese diagnostic Interview Schedule. The Journal of nervous and mental disease. 1996;184(8):497-502.

57.   Liao S, Chen W, Lee M, Lung F, Lai T, Liu C, et al. Low prevalence of major depressive disorder in Taiwanese adults: possible explanations and implications. Psychological medicine. 2012;42(6):1227-37.

58. Van de Velde S, Bracke P, Levecque K. Gender differences in depression in 23 European countries. Cross-national variation in the gender gap in depression. Social Science & Medicine. 2010;71(2):305-13.

59. Andrade L, Caraveo-Anduaga JJ, Berglund P, Bijl RV, De Graaf R, Vollebergh W, et al. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. International journal of methods in psychiatric research. 2003;12(1):3-21. Epub 2003/06/28.

60. Chi I, Yip PS, Chiu HF, Chou KL, Chan KS, Kwan CW, et al. Prevalence of depression and its correlates in Hong Kong's Chinese older adults. The American journal of geriatric psychiatry. 2005;13(5):409-16.

61. Wong SY, Mercer SW, Woo J, Leung J. The influence of multi-morbidity and self-reported socio-economic standing on the prevalence of depression in an elderly Hong Kong population. BMC Public Health. 2008;8(1):119.

62. Blay SL, Andreoli SB, Fillenbaum GG, Gastal FL. Depression morbidity in later life: prevalence and correlates in a developing country. The American Journal of Geriatric Psychiatry. 2007;15(9):790-9.

63. 劉嘉年. 社會經濟狀況, 一般健康狀態, 健康行為與社區成年民眾憂鬱情緒的關係. 臺灣公共衛生雜誌. 2009;28(4):300-11.

64. Eriksson M. Social capital and health - implications for health promotion. Global Health Action. 2011.

65. De Silva MJ, Harpham T, Tuan T, Bartolini R, Penny ME, Huttly SR. Psychometric and cognitive validation of a social capital measurement tool in Peru and Vietnam. Social Science & Medicine. 2006;62(4):941-53.

66.   Moore S, Daniel M, Paquet C, Dubé L, Gauvin L. Association of individual network social capital with abdominal adiposity, overweight and obesity. Journal of Public Health. 2009;31(1):175-83.

67.   Bourdieu P, Passeron JC. Reproduction in Education, Society and Culture: SAGE Publications; 1990.

68.   Putnam RD. Bowling alone: The collapse and revival of American community. New York: Simon and Schuster; 2000.

69.   Whitley R, McKenzie K. Social capital and psychiatry: review of the literature. Harvard review of psychiatry. 2005;13(2):71-84.

70.   Field J. Social Capital: Taylor & Francis; 2008.

71.   Bourdieu P, Wacquant LJD. An Invitation to Reflexive Sociology: University of Chicago Press; 1992.

72.   Derose KP, Varda DM. Social capital and health care access: a systematic review. Medical care research and review : MCRR. 2009;66(3):272-306.

73.   Kawachi I, Subramanian SV, Kim D. Social capital and health: A decade of progress and beyond. In: Kawachi I, Subramanian SV, Kim D, editors. Social capital and health. New York: Springer; 2008.

74.   Portes A, Vickstrom E. Diversity, social capital, and cohesion. Annual Review of Sociology. 2011;37:461-79.

75.   Bourdieu P. Les trois états du capital culturel. Actes de la recherche en sciences sociales. 1979;30(1):3-6.

76.   Bourdieu P. Le capital social: notes provisoires. Actes de la recherche en sciences sociales. 1980;21:2-3.

77.   Portes A, editor. The two meanings of social capital. Sociological forum; 2000: Springer.

78.   Nyqvist F, Forsman AK, Giuntoli G, Cattan M. Social capital as a resource for mental well-being in older people: A systematic review. Aging & mental health. 2012(ahead-of-print):1-17.

79.   Kawachi I. Commentary: social capital and health: making the connections one step at a time. International journal of epidemiology. 2006;35(4):989-93.

80.   McCallister L, Fischer CS. A procedure for surveying personal networks. Sociological Methods & Research. 1978;7(2):131-48.

81.   Campbell KE, Lee BA. Name generators in surveys of personal networks. Social Networks. 1991;13(3):203-21.

82.   Granovetter MS. The strength of weak ties. Am J Sociol. 1973:1360-80.

83.   Marsden PV. Core discussion networks of Americans. American sociological review. 1987:122-31.

84.   Lin N, Dumin M. Access to occupations through social ties. Social networks. 1986;8(4):365-85.

85.   Lin N, Fu Y-c, Hsung R-M. The position generator: measurement techniques for investigations of social capital. Social capital: theory and research New York: Aldine de Gruyter. 2001:57-81.

86.   Van der Gaag M, Snijders TA, Flap HD. Position Generator measures and their relationship to other Social Capital measures. Joint Working Paper of ICS Vrije Universiteit Amsterdam, University of Groningen, and Utrecht University, 2004.

87.   Lin N. Social networks and status attainment. Annual Review of Sociology. 1999:467-87.

88.   Kim D, Subramanian S, Kawachi I. Social capital and physical health. Social capital and health: Springer; 2008. p. 139-90.

89.   Macinko J, Starfield B. The utility of social capital in research on health determinants. Milbank Quarterly. 2001;79(3):387-427.

90.   Almedom AM. Social capital and mental health: An interdisciplinary review of primary evidence. Social Science & Medicine. 2005;61(5):943-64.

91.   World Health Organization. Promoting mental health. Concepts, emerging evidence, Practice. Summary Report. Geneva: World Health Organization; 2004.

92.   Hawe P, Shiell A. Social capital and health promotion: a review. Social Science & Medicine. 2000;51(6):871-85.

93.   Office of the Deputy Prime Minister. Mental health and social exclusion. London: Office of the Deputy Prime Minister; 2004.

94.   Carpiano RM, Hystad PW. "Sense of community belonging" in health surveys: What social capital is it measuring? Health Place. 2011;17(2):606-17.

95.   Moore S, Bockenholt U, Daniel M, Frohlich K, Kestens Y, Richard L. Social capital and core network ties: A validation study of individual-level social capital measures and their association with extra- and intra-neighborhood ties, and self-rated health. Health Place. 2011;17(2):536-44.

96.   Verhaeghe P-P, Pattyn E, Bracke P, Verhaeghe M, Van De Putte B. The association between network social capital and self-rated health: pouring old wine in new bottles? Health Place. 2012;18(2):358-65.

97.   Webber M, Huxley P, Harris T. Social capital and the course of depression: Six-month prospective cohort study. Journal of Affective Disorders. 2011;129(1-3):149-57.

98.   Berkman L, Glass T. Social integration, social networks, social support, and health. In: Berkman LF, Kawachi I, editors. Social Epidemiology. NY: Oxford University Press; 2000. p. 137–73.

99.   Kawachi I, Berkman LF. Social ties and mental health. Journal of Urban Health. 2001;78(3):458-67.

100.   Irwin J, LaGory M, Ritchey F, Fitzpatrick K. Social assets and mental distress among the homeless: Exploring the roles of social support and other forms of social capital on depression. Social Science & Medicine. 2008;67(12):1935-43.

101.   Phongsavan P, Chey T, Bauman A, Brooks R, Silove D. Social capital, socio-economic status and psychological distress among Australian adults. Soc Sci Med. 2006;63(10):2546-61.

102.   O'Connor M, Hawkins MT, Toumbourou JW, Sanson A, Letcher P, Olsson CA. The relationship between social capital and depression during the transition to adulthood. Australian Journal of Psychology. 2011;63(1):26-35.

103.   Kim SS, Chung Y, Perry MJ, Kawachi I, Subramanian SV. Association between interpersonal trust, reciprocity, and depression in South Korea: a prospective analysis. PloS one. 2012;7(1):e30602. Epub 2012/01/27.

104.   Abbott S, Freeth D. Social Capital and Health Starting to Make Sense of the Role of Generalized Trust and Reciprocity. Journal of Health Psychology. 2008;13(7):874-83.

105. Fone D, Dunstan F, Lloyd K, Williams G, Watkins J, Palmer S. Does social cohesion modify the association between area income deprivation and mental health? A multilevel analysis. International journal of epidemiology. 2007;36(2):338-45.

106. Kawachi I, Berkman LF. Social cohesion, social capital, and health. . In: Berkman LF, Kawachi I, editors. Social epidemiology. New York: Oxford University Press; 2000. p. 174-90.

107. Echeverría S, Diez-Roux AV, Shea S, Borrell LN, Jackson S. Associations of neighborhood problems and neighborhood social cohesion with mental health and health behaviors: The Multi-Ethnic Study of Atherosclerosis. Health & place. 2008;14(4):853-65.

108. Ziersch AM, Baum FE. Involvement in civil society groups: Is it good for your health? J Epidemiol Community Health. 2004;58(6):493-500.

109. Han S, Lee HS. Social Capital and Mental Health in Seoul, South Korea: A Multilevel Analysis of 4,734 People in 25 Administrative Areas. Journal of Community Psychology. 2013;41(5):644-60.

110. van Beljouw IM, Verhaak PF, Cuijpers P, van Marwijk HW, Penninx BW. The course of untreated anxiety and depression, and determinants of poor one-year outcome: a one-year cohort study. BMC Psychiatry. 2010;10(1):86.

111. O'Rand AM. Stratification and the life course: Life course capital, life course risks, and social inequality. Handbook of aging and the social sciences. 2006:145-62.

112. Kalmijn M. Longitudinal analyses of the effects of age, marriage, and parenthood on social contacts and support. Advances in Life Course Research. 2012;17(4):177-90.

113. Gray A. The social capital of older people. Ageing and Society. 2009;29(1):5.

114.   Schoen R, Tufis P. Precursors of nonmarital fertility in the United States. Journal of Marriage and Family. 2003;65(4):1030-40.

115.   Berry HL, Welsh JA. Social capital and health in Australia: an overview from the household, income and labour dynamics in Australia survey. Social Science & Medicine. 2010;70(4):588-96.

116.   d'Hombres B, Rocco L, Suhrcke M, McKee M. Does social capital determine health? Evidence from eight transition countries. Health economics. 2010;19(1):56-74.

117.   Sapag J, Aracena M, Villarroel L, Poblete F, Berrocal C, Hoyos R, et al. Social capital and self-rated health in urban low income neighbourhoods in Chile. J Epidemiol Community Health. 2008;62(9):790-2.

118.   Snelgrove JW, Pikhart H, Stafford M. A multilevel analysis of social capital and self-rated health: evidence from the British Household Panel Survey. Social Science & Medicine. 2009;68(11):1993-2001.

119.   Grundy E, Sloggett A. Health inequalities in the older population: the role of personal capital, social resources and socio-economic circumstances. Social science & medicine. 2003;56(5):935-47.

120.   Muckenhuber J, Stronegger WJ, Freidl W. Social capital affects the health of older people more strongly than that of younger people. Ageing and Society. 2013;33(05):853-70.

121.   Morrow-Howell N, Hinterlong J, Rozario PA, Tang F. Effects of volunteering on the well-being of older adults. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 2003;58(3):S137-S45.

122.   Veenstra G. Social capital, SES and health: an individual-level analysis. Social Science & Medicine. 2000;50(5):619-29.

123.   Nummela O, Sulander T, Karisto A, Uutela A. Self-rated health and social capital among aging people across the urban–rural dimension. International journal of behavioral medicine. 2009;16(2):189-94.

124.   Ichida Y, Kondo K, Hirai H, Hanibuchi T, Yoshikawa G, Murata C. Social capital, income inequality and self-rated health in Chita peninsula, Japan: a multilevel analysis of older people in 25 communities. Social science & medicine. 2009;69(4):489-99.

125.   Jennifer Yeh S-C, Lo SK. Living alone, social support, and feeling lonely among the elderly. Social Behavior and Personality: an international journal. 2004;32(2):129-38.

126.   Lewin A, Mitchell SJ, Rasmussen A, Sanders-Phillips K, Joseph JG. Do Human and Social Capital Protect Young African American Mothers From Depression Associated With Ethnic Discrimination and Violence Exposure? Journal of Black Psychology. 2011;37(3):286-310.

127.   Lofors J, Sundquist K. Low-linking social capital as a predictor of mental disorders: A cohort study of 4.5 million Swedes. Social Science & Medicine. 2007;64(1):21-34.

128.   Pridmore P, Thomas L, Havemann K, Sapag J, Wood L. Social capital and healthy urbanization in a globalized world. Journal of Urban Health. 2007;84(1):130-43.

129.   Kouvonen A, Oksanen T, Vahtera J, Stafford M, Wilkinson R, Schneider J, et al. Low workplace social capital as a predictor of depression - The Finnish public sector study. American Journal of Epidemiology. 2008;167(10):1143-51.

130.   Tomita A, Burns JK. A multilevel analysis of association between neighborhood social capital and depression: Evidence from the first South African National Income Dynamics Study. Journal of Affective Disorders. 2013;144(1-2):101-5.

131.   Veenstra G. Location, location, location: contextual and compositional health effects of social capital in British Columbia, Canada. Soc Sci Med. 2005;60(9):2059-71.

132.   Duncan C, Jones K, Moon G. Context, composition and heterogeneity: using multilevel models in health research. Social Science & Medicine. 1998;46(1):97-117.

133.   Hou P, Tu S, Liao P, Hung Y, Chang Y. The typology of townships in Taiwan: the analysis of sampling stratification of the 2005–2006 "Taiwan Social Change Survey". Survey Res Method Appl. 2008;23:7-32.

134.   Lo C-H. Research on types of the development of Taiwan townships. Taiwan Economic Monthly. 1992;190:41-68.

135.   Chu H-Y. Taiwan Social Change Survey Report (3-3). Taipei: Institute of Sociology, Academia Sinica.(in Chinese); 1998.

136.   Radloff LS. The CES-D scale a self-report depression scale for research in the general population. Applied psychological measurement. 1977;1(3):385-401.

137.   Murphy JM. Symptom scales and diagnostic schedules in adult psychiatry. Textbook in psychiatric epidemiology. 2002;2:273-332.

138.   Weissman M, Sholomskas D, Pottenger M, Prusoff B, Locke B. Assessing depressive symptoms in five psychiatric populations: a validation study. American journal of epidemiology. 1977;106(3):203.

139.   Roberts RE, Vernon SW. The Center for Epidemiological Studies Depression Scale: its use in a community sample. The American journal of psychiatry. 1983.

140.   Beekman AT, Deeg D, Van Limbeek J, Braam A, De Vries M, Van Tilburg W. Criterion validity of the Center for Epidemiologic Studies Depression scale (CES-D): results from a community-based sample of older subjects in The Netherlands. Psychological medicine. 1997;27(1):231-6.

141.   Chien C, Cheng T. Depression in Taiwan: epidemiological survey utilizing CES-D. Seishin shinkeigaku zasshi= Psychiatria et neurologia Japonica. 1985;87(5):335.

142.   Boey KW. Cross-validation of a short form of the CES-D in Chinese elderly. International journal of geriatric psychiatry. 1999;14(8):608-17.

143.   Cheng ST, Chan A. The center for epidemiologic studies depression scale in older Chinese: Thresholds for long and short forms. International journal of geriatric psychiatry. 2005;20(5):465-70.

144.   Cornman J, Goldman N, Glei D, Weinstein M, Chang M. Social ties and perceived support: two dimensions of social relationships and health among the elderly in Taiwan. Journal of aging and health. 2003;15(4):616.

145.   Yang HJ, Soong WT, Kuo PH, Chang HL, Chen WJ. Using the CES-D in a two-phase survey for depressive disorders among nonreferred adolescents in Taipei: a stratum-specific likelihood ratio analysis. Journal of Affective Disorders. 2004;82(3):419-30.

146.   Chien C, Cheng T. Depression in Taiwan: epidemiological survey utilizing CES-D. Seishin shinkeigaku zasshi= Psychiatria et neurologia Japonica. 1984;87(5):335-8.

147.   Van der Gaag M, Snijders TA, Flap HD. Position Generator measures and their relationship to other Social Capital measures. Social capital: An international research program. 2008:27-49.

148.   Treiman DJ. Occupational prestige in comparative perspective: Academic Press New York; 1977.

149.   Johnston RJ. Residential area characteristics: research method for identifying urban subareas-social area analysis and factorial ecology. In: Theodorson GA, editor. Urban Patterns: Studies in Human Ecology: Pennsylvania State University Press; 1982.

150.   O'brien RM. A caution regarding rules of thumb for variance inflation factors. Quality & Quantity. 2007;41(5):673-90.

151.   Kim D, Subramanian S, Kawachi I. Social capital and physical health: a systematic review of the literature. In: Kawachi I, Subramanian S, Kim D, editors. Social capital and health. NY: Springer; 2008. p. 139-90.

152.   Mitchell AD, Bossert TJ. Measuring dimensions of social capital: evidence from surveys in poor communities in Nicaragua. Social Science & Medicine. 2007;64(1):50-63.

153.   Moore S, Bockenholt U, Daniel M, Frohlich K, Kestens Y, Richard L. Social capital and core network ties: A validation study of individual-level social capital measures and their association with extra- and intra-neighborhood ties, and self-rated health. Health & place. 2011;17(2):536-44.

154.   Moore S, Gauvin L, Daniel M, Kestens Y, Bockenholt U, Dubé L, et al. Associations among park use, age, social participation, and neighborhood age composition in Montreal. Leisure Sciences. 2010;32(4):318-36.

155.   Lin N. Social capital: A theory of social structure and action: Cambridge University Press; 2001.

156.   Myer L, Stein DJ, Grimsrud A, Seedat S, Williams DR. Social determinants of psychological distress in a nationally-representative sample of South African adults. Social Science & Medicine. 2008;66(8):1828-40.

157.   Legh-Jones H, Moore S. Network social capital, social participation, and physical inactivity in an urban adult population. Social Science & Medicine. 2012;74(9):1362-7.

158.   Blakely T, Atkinson J, Ivory V, Collings S, Wilton J, Howden-Chapman P. No association of neighbourhood volunteerism with mortality in New Zealand: a national multilevel cohort study. International journal of epidemiology. 2006;35(4):981-9.

159.   Islam MK, Merlo J, Kawachi I, Lindström M, Gerdtham U-G. Social capital and health: Does egalitarianism matter? A literature review. International journal for equity in health. 2006;5(1):3.

160.   Iwase T, Suzuki E, Fujiwara T, Takao S, Doi H, Kawachi I. Do bonding and bridging social capital have differential effects on self-rated health? A community based study in Japan. Journal of epidemiology and community health. 2012;66(6):557-62.

161.   Fu C, Lee Y, Chen J. Association between depressive symptoms and twelve-year mortality among elderly in a rural community in Taiwan. Journal of the Formosan Medical Association= Taiwan yi zhi. 2003;102(4):234-9.

162.   Kutner MH, Nachtsheim CJ, Neter J. Applied Linear Regression Models: McGraw-Hill Higher Education; 2003.

163.   Lin N. A network theory of social capital. In: Castiglione D, van Deth JW, Wolleb G, editors. The handbook of social capital. Oxford, England: Oxford University Press; 2008. p. 50-69.

164.   Moore S, Daniel M, Gauvin L, Dubé L. Not all social capital is good capital. Health Place. 2009;15(4):1071-7.

165.   Ellison CG, George LK. Religious involvement, social ties, and social support in a southeastern community. Journal for the scientific study of religion. 1994:46-61.

166.   Sugihara Y, Sugisawa H, Shibata H, Harada K. Productive roles, gender, and depressive symptoms: evidence from a national longitudinal study of late-middle-aged Japanese. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 2008;63(4):P227-P34.

167.   Irwin M, Artin KH, Oxman MN. Screening for depression in the older adult: criterion validity of the 10-item Center for Epidemiological Studies Depression Scale (CES-D). Archives of Internal Medicine. 1999;159(15):1701-4.

168.   Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale: an updated literature review. Journal of Psychosomatic Research. 2002;52(2):69-77.

169.   Bourdieu P. Handbook of Theory and Research for the Sociology of Education Greenwood Publishing Group; 1986.

170.   McDonald S, Chen F, Mair CA. Cross-National Patterns of Social Capital Accumulation Network Resources and Aging in China, Taiwan, and the United States. American Behavioral Scientist. 2015:1-17.

171.   Kalmijn M. Shared friendship networks and the life course: An analysis of survey data on married and cohabiting couples. Social Networks. 2003;25(3):231-49.

172.   Wellman B, Wong RY-l, Tindall D, Nazer N. A decade of network change: Turnover, persistence and stability in personal communities. Social Networks. 1997;19(1):27-50.

173.   Bidart C, Lavenu D. Evolutions of personal networks and life events. Social Networks. 2005;27(4):359-76.

174.   Bassett E, Moore S. Mental health and social capital: Social capital as a promising initiative to improving the mental health of communities. In: Rodriguez-Morales AJ, editor. Current Topics in Public Health2013. p. 685-707.

175.   Cannuscio C, Block J, Kawachi I. Social capital and successful aging: The role of senior housing. Annals of Internal Medicine. 2003;139(5_Part_2):395-9.

176.   Chen D-S. Taiwan's social changes in the patterns of social solidarity in the 20th century. The China Quarterly. 2001;165:61-82.

177.   Pollack CE, von dem Knesebeck O. Social capital and health among the aged: comparisons between the United States and Germany. Health Place. 2004;10(4):383-91.

178.   Son J. Social capital and institutional constraints: A comparative analysis of China, Taiwan and the US. New York, NY: Routledge; 2012.

179.   Inglehart R, Baker WE. Modernization, cultural change, and the persistence of traditional values. American Sociological Review. 2000:19-51.

180.   Son J, Lin N, George LK. Cross-national comparison of social support structures between Taiwan and the United States. Journal of Health and Social Behavior. 2008:104-18.

181.   Yi C-C, Chen Y-H. Present Forms and Future Attitudes of The Elderly Parental Support in Taiwna. Journal of Population Studies. 1998;19:1-32.

182.   Chiao C, Weng L-J, Botticello AL. Social participation reduces depressive symptoms among older adults: An 18-year longitudinal analysis in Taiwan. BMC Public Health. 2011;11(1):292.

183.   Jie C. Burgeoning transnationalism of Taiwan's social movement NGOs. Journal of Contemporary China. 2001;10(29):613-44.

184.   Kuo WH. Democratization and the Political Economy of Taiwan. International Journal of Politics, Culture, and Society. 1997;11(1):5-24.

185.   Marsh RM. Social capital, guanxi, and the road to democracy in Taiwan. Comparative Sociology. 2003;2(4):575-604.

186.   Marsh RM. Social capital and democracy in a new democracy. The Sociological Quarterly. 2005;46(4):593-615.

187.   Yuasa M, Ukawa S, Ikeno T, Kawabata T. Multilevel, cross-sectional study on social capital with psychogeriatric health among older Japanese people dwelling in rural areas. Australasian journal on ageing. 2014;33(3):E13-E9.

188.   Han S, Lee H-S. Social Capital and Depression Does Household Context Matter? Asia-Pacific Journal of Public Health. 2013:1-11.

189.   Gao J, Weaver SR, Dai J, Jia Y, Liu X, Jin K, et al. Workplace social capital and mental health among Chinese employees: a multi-level, cross-sectional study. 2014.

190.   Yamaoka K. Social capital and health and well-being in East Asia: a population-based study. Social science & medicine. 2008;66(4):885-99.

191.   Bian Y. Bringing strong ties back in: Indirect ties, network bridges, and job searches in China. American Sociological Review. 1997:366-85.

192.   De Silva MJ, Huttly SR, Harpham T, Kenward MG. Social capital and mental health: a comparative analysis of four low income countries. Social Science & Medicine. 2007;64(1):5-20.

193.   Kawachi I, Kennedy BP, Lochner K, Prothrow-Stith D. Social capital, income inequality, and mortality. American journal of public health. 1997;87(9):1491-8.

194.   Kim D, Subramanian S, Gortmaker SL, Kawachi I. US state-and county-level social capital in relation to obesity and physical inactivity: a multilevel, multivariable analysis. Social Science & Medicine. 2006;63(4):1045-59.

195.   Eriksson M, Ng N. Neighbourhood Social Capital and Women's Self-Rated Health – Is There an Age Pattern? A Multi-Level Study from Northern Sweden. Social Capital as a Health Resource in Later Life: The Relevance of Context: Springer; 2015. p. 127-43.

APPENDIX A – CENTER FOR EPIDEMIOLOGIC STUDIES DEPRESSION SCALE

(CES-D)

These items are about how you may have felt or behaved recently. For each item, click on the option that best describes your feelings or behavior over the last week.

0 = Rarely or none of the time (less than 1 day)

1 = Some or a little of the time (1-2 days)

2 = Occasionally or a moderate amount of time (3-4 days)

3 = Most or all of the time (5-7 days)

 Over the last week…

No	Question	Score			
1	I was bothered by things that usually don't bother me	0	1	2	3
2	I did not feel like eating; my appetite was poor	0	1	2	3
3	I felt that I could not shake off the blues even with help from my family or friends	0	1	2	3
4	I felt that I was just as good as other people	0	1	2	3
5	I had trouble keeping my mind on what I was doing	0	1	2	3
6	I felt depressed	0	1	2	3
7	I felt that everything I did was an effort	0	1	2	3
8	I felt hopeful about the future	0	1	2	3
9	I thought my life had been a failure	0	1	2	3
10	I felt fearful	0	1	2	3
11	My sleep was restless	0	1	2	3
12	I was happy	0	1	2	3
13	I talked less than usual	0	1	2	3
14	I felt lonely	0	1	2	3
15	People were unfriendly	0	1	2	3
16	I enjoyed life	0	1	2	3
17	I had crying spells	0	1	2	3

No	Question	Score			
18	I felt sad	0	1	2	3
19	I felt that people disliked me	0	1	2	3
20	I could not get "going"	0	1	2	3

NOTE: Items 4,8,12 and 16 are reverse scored.

APPENDIX B – COMPARISON BETWEEN NOT AT RISK AND AT RISK OF

CLINICAL DEPRESSION USING THE CUT-OFF POINT OF CES-D $\geq$ 16 IN

DEMOGRAPHIC FACTORS, SOCIOECONOMIC STATUS AND THREE DIMENSIONS

OF SOCIAL CAPITAL FOR 1997 TAIWAN SOCIAL CHANGE SURVEY (TSCS)

	All		
	Not at risk	At risk	
	n^a =1871	n=727	
	N^b=1815	N=761.78	
	Mean (SE)	Mean (SE)	p-value[c]
Age	40.8 (0.3)	39.6 (0.5)	0.05
	Weighted % (SE)	Weighted % (SE)	p-value
Gender			<.0001
Men	53.9 (1.3)	40.1 (1.9)	
Women	46.1 (1.3)	59.9 (1.9)	
Marital status			<.0001
1=Currently married	72.4 (1.1)	57.1 (1.9)	
2=Single	23.0 (1.1)	32.4 (1.8)	
3=Formerly married	4.6 (0.5)	10.5 (1.2)	
Religious status			0.28
1=Religious belief	78.2 (1.0)	76.1 (1.7)	
2=No religious belief	21.8 (1.0)	23.9 (1.7)	
Employment			<.0001
1=Not currently employed	22.8 (1.0)	34.8 (1.7)	
2=Currently employed	73.5 (1.1)	62.3 (1.8)	
3=Retired	3.7 (0.4)	2.9 (0.6)	
Education			0.28
1=Junior high school or below	50.2 (1.3)	46.8 (1.9)	
2=Senior high school	28.3 (1.1)	29.5 (1.8)	
3=Junior college or above	21.5 (1.0)	23.7 (1.6)	
Income			<.0001
1=No income	25.0 (1.1)	33.2 (1.8)	
2=Less than $19 999	15.7 (0.9)	22.1 (1.7)	
3=$20 000 to $39 999	31.8 (1.2)	28.4 (1.7)	
4=Over $40 000	27.5 (1.1)	16.4 (1.4)	

	Mean (SE)	Mean (SE)	p-value
Network social capital			
Composite score	-0.04 (0.02)	-0.17 (0.04)	0.008
The quantity of network social capital - Extensity	-0.04 (0.02)	-0.18 (0.04)	0.0008
The quality of network social capital - Upper reachability	-0.04 (0.02)	-0.14 (0.04)	0.04
The diversity of network social capital - Range	-0.04 (0.02)	-0.14 (0.04)	0.04
Cognitive social capital			
Composite score	16.00 (0.09)	14.84 (0.15)	<.0001
Trust in neighbors	5.21 (0.03)	4.86 (0.05)	<.0001
Perceptions of neighborhood care	5.20 (0.04)	4.78 (0.06)	<.0001
Perceptions of neighborhood familiarity	5.58 (0.03)	5.21 (0.06)	<.0001
	Weighted % (SE)	Weighted % (SE)	p-value
Structural social capital			
Composite score			0.005
No	21.3 (1.0)	26.9 (1.6)	
1 or more	78.7 (1.0)	73.1 (1.6)	
Participation in the local community			0.003
No	31.3 (1.1)	38.0 (1.9)	
1 or more	68.7 (1.1)	62.0 (1.9)	
Participation in organization			0.04
No	51.5 (1.2)	56.3 (1.9)	
1 or more	48.5 (1.2)	43.7 (1.9)	

[a]: unweighted sample size

[b]: weighted sample size

[c]: The p-value of the comparison of depression and non-depression groups

APPENDIX C – LOGISTIC REGRESSION MODEL ANALYSIS OF THE ASSOCIATION

BETWEEN SOCIAL CAPITAL AND THE RISK OF CLINICAL DEPRESSION USING

THE CUT-OFF POINT OF CES-D $\geq$ 16 IN 1997 TSCS

	Model 1[a]	Model 2[b]
	OR (95% C.I.)	OR (95% C.I.)
Network social capital		
Composite score	0.89 (0.81, 0.97)	0.93 (0.84, 1.03)
Extensity	0.86 (0.78, 0.94)	0.92 (0.83, 1.02)
Upper reachability	0.91 (0.83, 0.99)	0.94 (0.85, 1.03)
Range	0.91 (0.83, 0.99)	0.96 (0.87, 1.05)
Cognitive social capital		
Composite score	0.93 (0.91, 0.95)	0.93 (0.90, 0.95)
Trust in neighbors	0.81 (0.76, 0.87)	0.82 (0.76, 0.88)
Neighborhood care	0.85 (0.80, 0.89)	0.84 (0.79, 0.89)
Neighborhood familiarity	0.85 (0.80, 0.90)	0.84 (0.79, 0.90)
Structural social capital		
Composite score		
No	1.00	1.00
1 or more	0.74 (0.60, 0.91)	0.80 (0.64, 1.00)
Participation in the local community		
No	1.00	1.00
1 or more	0.74 (0.62, 0.90)	0.78 (0.64, 0.95)
Participation in organization		
No	1.00	1.00
1 or more	0.83 (0.69, 0.99)	0.89 (0.74, 1.09)

[a] Reflects independent crude models for the composite and individual components of social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other social capital scores.
[b] Reflects independent fully adjusted (gender, age, marital status, religious status, employment, education and income) models for the composite and individual component score of social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other social capital scores.

APPENDIX D – LOG-BINOMIAL REGRESSION MODEL ANALYSIS OF THE

ASSOCIATION BETWEEN SOCIAL CAPITAL AND THE RISK OF CLINICAL

DEPRESSION USING THE CUT-OFF POINT OF CES-D $\geq$ 16 IN 1997 TSCS

	Model 1[a]	Model 2[b]
	OR (95% C.I.)	OR (95% C.I.)
Network social capital		
Composite score	0.88 (0.81, 0.96)	0.93 (0.84, 1.02)
Extensity	0.86 (0.78, 0.93)	0.92 (0.83, 1.02)
Upper reachability	0.91 (0.84, 0.99)	0.94 (0.86, 1.03)
Range	0.91 (0.84, 0.99)	0.95 (0.87, 1.05)
Cognitive social capital		
Composite score	0.93 (0.91, 0.95)	0.92 (0.90, 0.95)
Trust in neighbors	0.81 (0.76, 0.87)	0.82 (0.77, 0.88)
Neighborhood care	0.84 (0.80, 0.89)	0.84 (0.79, 0.89)
Neighborhood familiarity	0.85 (0.80, 0.90)	0.84 (0.79, 0.90)
Structural social capital		
Composite score		
No	1.00	1.00
1 or more	0.73 (0.60, 0.89)	0.80 (0.65, 0.99)
Participation in the local community		
No	1.00	1.00
1 or more	0.74 (0.62, 0.88)	0.78 (0.64, 0.94)
Participation in organization		
No	1.00	1.00
1 or more	0.83 (0.70, 0.98)	0.89 (0.74, 1.08)

[a] Reflects independent crude models for the composite and individual components of social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other social capital scores.
[b] Reflects independent fully adjusted (gender, age, marital status, religious status, employment, education and income) models for the composite and individual component score of social capital. Composite and individual components of social capital were estimated separately and did not mutually adjust for other social capital scores.

APPENDIX E – DISTRIBUTION OF NEIGHBORHOOD CHARACTERISTICS AND

SOCIAL CAPITAL AMONG 55 NEIGHBORHOODS, 1997 TAIWAN SOCIAL CHANGE

SURVEY (TSCS)

	All neighborhood n=55 weighted mean (SE)
Average of percentage of age less than 15	22.20 (0.31)
Average of percentage of age more than 65	8.77 (0.40)
Average of percentage divorced and separated	2.28 (0.09)
Average of percentage less than junior high	44.84 (1.33)
Average of percentage no employment	32.53 (0.36
Network social capital	
Composite score	-0.07 (0.04)
The quantity of network social capital - Extensity	-0.07 (0.04)
The quality of network social capital - Upper reachability	-0.07 (0.04)
The diversity of network social capital - Range	-0.06 (0.04)
Cognitive social capital	
Composite score	15.79 (0.23)
Trust in neighbors	5.15 (0.06)
Perceptions of neighborhood care	5.12 (0.08)
Perceptions of neighborhood familiarity	5.52 (0.09)
Structural social capital	
Average of percentage of participation in at least one	77.82 (1.80)
Average of percentage of participation in at least one the local community activity	68.18 (2.12)
Average of percentage of participation in at least one organization	47.16 (2.14)