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# Social capital, self-rated health and the importance of sleep

The case of Iceland in 2007 and 2009

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## **Abstract**

The frequently studied concept of social capital has often been related to health, but the conceptualisation and measurement of the concept is an on-going debate. The main aim of this thesis is to study the relationship of four different indicators of social capital; informal social capital, formal social capital, trust towards institutions and trust towards others, with self-rated physical health and self-rated mental health in Iceland in 2009, shortly after a harsh economic crash. Insomnia symptoms will be studied as a possible mediator or moderator in the relationship. Furthermore, longitudinal data on informal social capital will be used to see the causal effect of social capital on health and to see if informal social capital decreased after the economic collapse. Population-based panel data from Iceland in 2007 and 2009 will be used to perform both cross-sectional analysis ( $n = 3,243$ ) and longitudinal analysis ( $n = 3,131$ ). The main results are that the four indicators of social capital all relate differently to physical and mental self-rated health, and insomnia symptoms seem to mediate the relationship between social capital and health, especially physical health. Surprisingly, informal social capital did increase during the economic collapse. The panel analysis further suggests that having poor informal social capital has causal effects on poor self-rated mental health when adjusted for symptoms of insomnia, age, gender, family status, education and smoking.

## *Key words*

Social capital, self-rated physical health, self-rated mental health, symptoms of insomnia, Iceland, cross-sectional study, longitudinal study.

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# 1. Introduction

Iceland, together with Scandinavian countries, is renowned for high levels of social capital and social trust (Rothstein & Stolle, 2003). The Icelandic economic miracle began in the mid-1990s but took a hard crash in late 2008. In October 2008 Iceland had the largest economic collapse any country has experienced in relative terms (The Economist, 2008). Within a few days in October 2008, 85% of the Icelandic bank-sector collapsed, as did the Icelandic króna (ISK). Inflation skyrocketed, many non-financial firms declared bankruptcy or laid off most of their workforce resulting in tripled unemployment rate. The finances of ordinary people were shattered as the value of the króna collapsed and the repayment of the widespread foreign-currency loans went through the ceiling. This was a very chaotic time for a nation of only 320 000 inhabitants. At the end of the second quarter in 2008 Iceland's external debt was €50 billion, about €160,000 per Icelandic resident, but Iceland's gross domestic product in 2007 was €8,5 billion (Statistics Iceland, 2008). The government resigned in late January after weeks of thousands of protestors in front of the parliament and a temporary new government was formed.

Social capital is related to GDP per capita – for example the levels of trust are higher in richer societies than poor. Positive economic development promotes trust, tolerance and well-being, but an economic collapse turns this in the opposite direction (Inglehart & Baker, 2000). Social capital, especially civic involvement, is expected to decline during economic crisis (Putman, 2000). Before the economic crisis in 2008 Iceland was in the group of most trustful societies in Europe; only Denmark, Norway and Finland were ranked higher. One could expect social capital to take a steep swift downwards after such a devastating economic collapse that happened in Iceland.

The purpose of this thesis is to study the relationship between four indicators of social capital and self-rated physical health on one hand, and self-rated mental health on the other in Iceland in 2009, shortly after an economic collapse. Various studies have found a relationship between social capital and health using cross-sectional data. This study will use both cross-sectional data and two-wave panel data to study the association between social capital and health. The measurement of social capital is an on-going debate and will be addressed in this thesis by using four indicators: informal social capital, formal social capital, trust towards institutions, and finally, trust towards others. Having symptoms of insomnia is studied as a possible explanatory

mechanism in the relationship between social capital and self-rated health, but sleep is the most important recovery mechanism available to humans. The effect of the sudden economic crisis on social capital and health are of special interest; the changes in informal social capital before and after the economic crisis will be studied along with the effect on physical and mental health.

The thesis is structured as follows. Chapter 1.1 outlines the complex concept of social capital and how it will be used in this study, along with results from previous studies on social capital in Iceland, and social capital and health. In chapter 1.2 the importance of good sleep is described. This is followed by results of various studies on the association between sleep and health on one hand, and on social capital and sleep on the other. In chapter 1.3 the aims and hypotheses of the study are outlined.

In chapter 2 the data, participants and variables used in the study are described. Methods and statistical analysis are described step by step. Results are reported in chapter 3 and the results are discussed and put in context to previous knowledge in chapter 4.

## *1.1 Social Capital*

The use of social factors is not a new phenomenon in explaining variance in health. A long-standing body of studies has highlighted the association between various socio-demographic characteristics and social behaviour and health (e.g. Wilkinson & Marmot, 2003). It is a well-known phenomenon in public health sciences that social support and social ties are of significance for mortality, health and well-being (e.g. Berkman & Syme, 1979).

Social capital is an important social determinant to health, especially at the individual level (Rostila, 2008); however, the relationship between social capital and health is complex and multidimensional. Different types of social capital seem to be variously related to different types of health issues (Nygqvist, 2009). The concept of social capital has its roots in classical sociology (e.g. Durkheim's classical work on social integration and suicide from 1897/1997) but was reintroduced in the 1980s by Bourdieu (1986), Coleman (1988), and Putnam (1993, 2000). The frequently studied concept has gotten a lot of attention from other disciplines but has also been criticised

for being vague, ill-defined and having major measurement problems (Levi, 1996; van Deth et al., 1999; Paldam, 2000 cited in Rothstein & Stolle, 2003; Nyqvist, 2009).

In a broad sense, social capital is a measure of social cohesion. Social capital can be described as resources realized through relationships (Schuller et al., 2000). According to Putman (2000) social capital does refer to “connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them” (Putman, 2000: 19). The core idea is that social networks have value; social capital can affect the productivity of individuals, just as physical or human capital (Putman, 2000). Material and non-material returns in the form of higher wages or better employment, democracy or equality improvements, increased happiness or even improvements in health may be generated from social capital (Glaeser et al., 2002).

Furthermore, social capital has both individual and collective features. Within the individual approach social capital is seen as a resource that an individual is able to access that would otherwise not be accessible. This includes information, ideas, support and services (Nyqvist, 2009), but also companionship, a helping hand and a shoulder to cry on. The collective features of social capital refer to how civic participation, high general trust in people and trust in society’s institutions can benefit the society as a whole in attaining mutual goals such as higher economic performance or democracy building (Putman, 1993, 2000; Fukuyama, 1999).

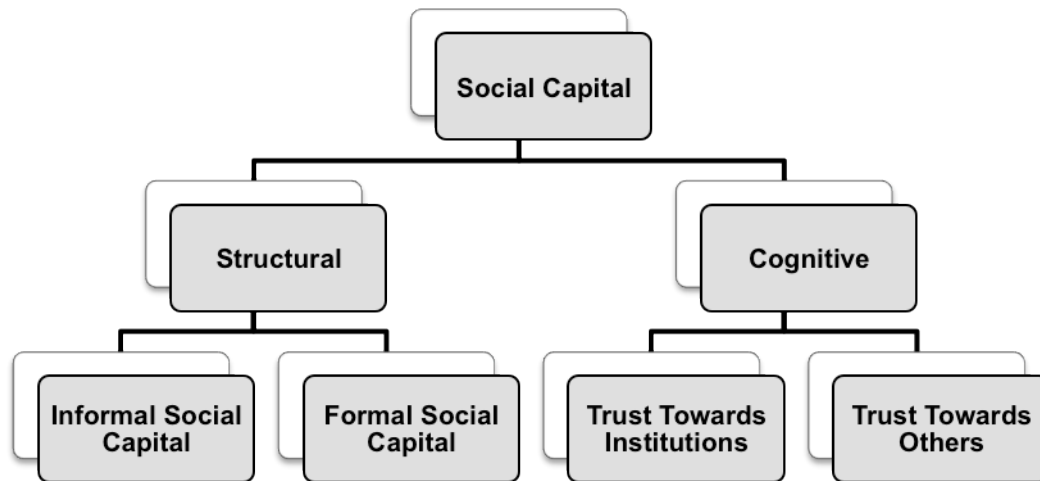
### *1.1.1 Structural and Cognitive Social Capital*

The conceptualisation of social capital varies by author, level of investigation and theoretical traditions. It is important to establish how social capital will be defined and measured (Adam and Roncevic, 2003). Health researchers using social capital usually put emphasis on social network and ties, voluntary associations, trust and norms of reciprocity (Nyqvist, 2009). The indicators in this particular study can be seen in Figure 1.

Social capital is often divided to structural and cognitive components, a procedure used in this particular study. Structural and cognitive social capital are empirically two distinctive concepts but yet closely related and mutually affect one another. By separation one is able to see how the components operate empirically. The structural component refers to rules, roles, behaviours, networks, relationships and organisations

that may link people together and bridge the gap between social groups. The cognitive component regards trust, values, attitudes and norms that yield mutual action (Stone, 2001 cited in Nyqvist, 2009).

Structural social capital taps into the connectedness of individuals within a given community and is divided to *informal* and *formal social capital*, as can be seen in Figure 1. Informal social capital (Bourdieu, 1986) concerns the quality and amount of relationships with close ones. Individuals belonging to an informal social network share social identity, they cooperate and trust each other, and exclusive identities and homogeneity are strengthened within this closed network.



**Figure 1: Components of Social Capital under study.**  
**Note: Modified from Islam et al., 2006, Figure 1.**

Formal social capital, on the other hand, concerns relationship created in formal organisations and participation in voluntary associations. According to Putman (2000) voluntary work is an important indicator of social capital. Formal networks are outward looking and constitute of people from diverse social backgrounds, which enables information flow across social groups (Putman, 2000). Volunteering tends to peak in late middle age and is especially common among parents of school-aged children. Informal social capital is at the lowest at the same time formal social capital is at the highest, but informal social capital blooms in young adulthood and rises again in retirement. Those who have strong social networks are more likely to volunteer than those who are socially isolated (Putman, 2000). People with higher

education and income tend to have more formal social capital than those less educated or with lower salaries. Married women and men have higher rates of formal social capital and experience reduction in informal social capital. Informal social contacts are stronger among singles and widows/widowers, and among women compared to men (Putman, 2000).

Cognitive social capital refers to the feeling of a sense of community. Trust is central to cognitive social capital, and is usually divided to *trust towards other people* and *trust towards institutions* (Figure 1). Numerous theorists (e.g. Putnam, 1993; Woolcock, 1998) have used trust as a principal element of social capital. The level of trust depends on cultural heritage, tradition, infrastructure, economic situation, and what Putman (2000) considered most important: ethnic diversity, people tend to distrust people from other races or social backgrounds. Changes in social trust can be observed in attitudes towards others and institutions. A society with high levels of trust allows for collective actions towards mutual benefits (Putnam, 1993). A distrustful society is less efficient than a society characterized by reciprocity (Putman, 2000).

### *1.1.2 Social Capital in Iceland*

Growiec (unpublished results) compared social capital among university students in 2005 and 2010 in Iceland to see the effect of the economic crisis. Growiec found that Icelandic university students were meeting less frequently with their friends, relatives and colleagues, but on the other hand were participating more in voluntary organizations and were more willing to take part in radical political activism in 2010 than in 2005. Iceland abandoned its position among Nordic countries when it came to trust towards other people in general and towards institutions in 2010; the only institution that kept being highly trusted was the police (Growiec, unpublished results; Félagsvísindastofnun & Hagfræðistofnun, 2009). Growiec found that although social ties had gotten poorer in Iceland, they remained astonishingly strong in comparison to other European countries and were helpful in coping emotionally with stress caused by the financial crisis.

The Icelandic society is small, open and casual in social relations. The media and personal relationships provide generally good conditions for individuals' and interests groups' voices to be heard. This is important when it comes to common concerns and



issues of equity, fairness and compassion, which is partially the reason for Iceland's high rates in social inclusion and political participation. As a result the high levels of social capital in the Icelandic society before the economic collapse provided fertile ground for solving immediate issues of concern in a pragmatic and positive way (Stefánsson, 2011).

### *1.1.3 Social Capital and Health*

To be able to understand an individual health one needs to take into account social aspects in the individuals environment, for example socioeconomic position, lifestyle, relationship with spouse and family, civil participation and trust between individuals and towards institutions in the society (Nyqvist, 2009). Systematic literature reviews on social capital and health studies can be found in several reports (see e.g. Kawachi et al., 2004; De Silva et al., 2005; Islam et al., 2006). The general conclusion drawn from numerous studies is that there is a significant relationship between good social capital and lower mortality/better health status (Islam et al., 2006) and inverse relation between cognitive and structural social capital and mental disorders (De Silva et al., 2005).

Health can be influenced by social capital directly through the individuals' characteristics and activities, or indirectly through political and social environment (Rostila, 2008). It would be a simplification to say that the overall conclusion on the relationship between social capital and health is strong and existent. Studies using several indicators of social capital find different associations depending on the health outcome (Liukkonen et al., 2004 cited in Nyqvist, 2009; Lindström, 2004; Veenstra et al., 2005; Ziersch et al., 2005).

Numerous studies using social capital have found it to be related to various health outcomes such as cardiovascular disease, mortality, mental health and self-rated health (e.g. Berkman & Glass, 2000; Bolin et al., 2003; Poortinga, 2006). Studies in the US show that individuals living in a community with high levels of voluntary participation and high levels of social trust have better health (Kawachi et al., 1999; Subramanian et al., 2001; Kim & Kawachi, 2007). Self-rated health is commonly used in social capital research and is a good indicator of overall health (Manderbacka, 1998). Lindström (2004) found that individuals in Southern Sweden with low trust had significantly higher odds ratios of both bad self-reported general health and self-

reported psychological health than people with high trust, the same results were found for low social participation in comparison to high social participation. Rose (2000) found in a population-based sample of Russians that involvement or exclusion from formal and informal networks, friends to rely on when ill and general trust to be related to both physical and emotional self-reported health. Hyyppä and Mäki (2001b; 2003 cited in Nyqvist, 2009) found in studies on Swedish- and Finnish speakers in Finland that friendship ties and voluntary participation were significantly associated with self-rated health.

Other studies have found a weak or no relationship between social capital and health; Veenstra (2000) found little evidence of the relationship of socialisation with family members and friends, belonging to a small and supportive group, voluntary participation, trust towards governments and trust towards other people with overall self-rated health in a Canadian province. Veenstra et al (2005) found participation in voluntary associations to be inversely related to self-rated health and emotional distress in Canada before, but not after controlling for various socio-demographic factors.

Most of the studies on social capital and health are cross-sectional, in other words: there is no way of knowing the causality of the relationship. Good health is the source for being able to be socially active, which in turn can increase resources that benefit physical or mental health (Kawachi & Berkman, 2000). In cross-sectional studies there is no way of telling if poor social capital is the cause for poor health, or if the health status caused having poor social capital. It has been stressed as important to distinguish the cause from consequences when it comes to social capital (Portes, 1998; Woolcock, 1998).

By examining the long-term exposure of poor social contacts Rostila (2008) found that having deteriorating informal and formal contacts and poor ties throughout the 1990s seemed to have strong effects on poor health. There is a need for more longitudinal research in the area.

## *1.2 Sleep and Sleep Disturbances*

An individual spends about one third of his life in bed, but falling asleep and maintaining sleep can be problematic for many people. Sleep is the most important recovery mechanism available to humans and a precondition for daily functioning and

health. Research into sleep quality is important mainly because sleep complaints are common in modern society with great costs, and because poor sleep quality can be a symptom of, or a cause for many medical disorders (Nasermoaddeli et al., 2005).

Various socio-demographic factors can influence sleep, such as culture, social relationships, race/ethnicity, employment, education, workplace environment, and neighbourhood context (Hale, 2005; Hale & Do, 2007; Burgard & Ailshire, 2009; Hill, Burdette & Hale, 2009; Krueger & Friedman, 2009 cited in Hale, 2010).

Åkerstedt (2006) reviewed numerous studies and found that people suffering from sleep disturbances are in increased risk of cardiovascular disease, high blood pressure, migraine, lung disorder, and also have higher rates of accidents, sickness absence, burnout syndrome, and more health care consumption than others. Just as poor sleep might have harming effects on health have several studies shown a strong association between good quality and sufficient sleep duration and good physical health (Bliwise, 1992; Léger, 2000; Groeger et al., 2004) and psychological well-being (Shaver & Paulsen, 1993; Lewin & Dahl, 1999).

### *1.2.1 Insomnia*

Insomnia is the most common sleep disorder and manifests in problems initiating and maintaining sleep (American Academy of Sleep Medicine, 2005). Insomnia is an expensive and major public health issue (Léger & Bayon, 2010). The criteria for insomnia is usually set as problems occurring several times per week, involving at least one of the following: sleep latency, repeated awakenings and premature awakenings (Kryger et al., 1994). Insomnia prevalence depends on the criteria used and population under study, however a general consensus drawn from population-based studies from different countries is that 30 % of adults suffer from at least one symptom of insomnia (Roth, 2007).

Stress is the primary cause of insomnia according to the International Classification of Sleep Disorders (American Academy of Sleep Medicine, 2005). Increase in negative life events has been demonstrated to be a precipitating factor of insomnia (Healey et al., 1981; Cernovsky, 1984 cited in Bixler et al., 2009). A major life event such as a hasty economic crisis might cause individuals to experience difficulties falling asleep, repeated awakenings and premature awakenings.

Suffering from insomnia has various negative effects on individuals' life and the society as a whole but sleep is essential for mental functioning, physical health and long-term well-being. Individuals with insomnia symptoms are more likely to report poor self-rated health (Léger & Bayon, 2010). In adulthood insomnia can interfere with every aspect of functional life, e.g. work, family and social life (Ohayon, 2002; Reimer & Flemons, 2003). There is no way of telling if insomnia is the cause or result of worsened health status from cross-sectional studies, but people suffering from insomnia are at more risk for certain diseases and use medical services more frequently than those who do not suffer from insomnia (Léger & Bayon, 2010).

### *1.2.2 Social Capital and Sleep*

A cross-sectional study in two culturally different samples (Japan and Britain) found that in both populations people that took part in voluntary activities had significantly fewer sleep complaints, same results were found for visiting friends and relatives. The results showed that social capital is positively associated with sleep quality, which Nasermoaddeli et al. think would consequently lead to better general health (Nasermoaddeli et al., 2005).

Lack of social support is a risk indicator for disturbed sleep, difficulty awakening and not feeling rested (Fabsitz et al., 1997 cited in Åkerstedt, 2006; Åkerstedt et al., 2002). Social network may influence self-esteem, sense of belonging, and give support in highly stressful situations. Social capital may therefore be a buffer against health damaging stress (Nyqvist, 2009), but stress is the most acknowledged cause for sleep disorders. Troxel et al (2010) offer support for the notion that sleep disorders are partly caused by social determinants. They suggest that sleep is a part of the causal chain between social experience and health.

### *1.3 Aim and Research Questions*

The study examines whether there is an association between social capital and health in Iceland shortly after a harsh economic crash. The overall aim is to study whether social capital is associated with self-rated physical and mental health in Iceland by using cross-sectional data from 2009. Previous studies find varying associations between social capital indicators and health outcomes. Four indicators of social capital will be used to see how they relate to physical health and mental health. Sleep has repeatedly been confirmed as central to health. Symptoms of insomnia are studied to see if sleep is of importance when explaining the association between social capital and self-rated health. Furthermore, two-wave data is used to see the effect of different combinations of informal social capital over chaotic period of economic crisis on physical and mental health in Iceland after the crisis.

There are four hypotheses:

- H<sub>1</sub> An association can be found between the four different indicators of social capital and self-rated physical and mental health in Iceland, 2009.
- H<sub>2</sub> Experiencing symptoms of insomnia either mediates or moderates the relationship between social capital and self-rated health.
- H<sub>3</sub> Informal social capital is reduced after experiencing unexpected and harsh economic crisis.
- H<sub>4</sub> Having poor informal social capital during or after an economic crisis causes poor physical and mental health in 2009.

## 2. Methods

### 2.1 Data Material

To date, *The Health and Well Being of Icelanders* has been carried out two times by The Public Health Institute of Iceland, in 2007 and 2009. The panel survey is meant to form a foundation to regular measurements on health, conditions and quality of life in Iceland with focus on the primary factors for health, e.g. lifestyle and living conditions (Jónsson et al., 2011). A stratified random sample of 9,807 Icelanders aged 18-79 was selected for the survey. The sample was stratified on age and residency, resulting in overrepresentation of the countryside and older age groups. All analysis was done with weighted sample to adjust for the oversample and to allow for generalisation to the Icelandic population. The weight obtained percentage as the population age, gender and living region was in 2007.

The response rate was 60,8 % in the 2007 wave. After a thorough evaluation of non-response rate for the 2007 data Jónsson et al (2011) concluded that the sample reflected the Icelandic population quite well and non-responses were at random. Follow-up study was conducted already in autumn 2009 to examine changes in lifestyle, socioeconomic status, well-being and health after the economic collapse in 2008. All of the 2007 participants received the 2009 questionnaire and 69,3 % participated, which corresponds to 4,078 individuals or 42,1 % of the original sample taking part in 2009. The mean age in 2009 was 44 years and 51,2 % of the sample was male. The working samples in this study are however lower, or 3,243 in the cross-sectional analysis and 3,131 in the panel analysis, due to internal missing.

Attrition is concerning in longitudinal studies; a bias is possible if the non-respondents are systematically different from the respondents. Attrition bias is caused by loss of participants, in this case a loss of participants from the first wave (2007) to the second (2009). Attrition analysis (see Miller & Hollist, 2007 for method) was conducted by the thesis author that revealed that the non-respondents in 2009 are systematically different in age, physical and mental health from the participants 2007; the non-respondents are younger and in worse mental and physical health, although the difference was not large.

Attrition analysis (see Miller & Hollist, 2007 for method) of the cross-sectional sample (n=4,078 → 3,243) reveals that the excluded, due to missing values on some of the key variables used in the study, are more likely to have both poor physical (OR

1.5,  $p=0.00$ ) and mental health (OR 1.4,  $p=0.02$ ) than the working sample. Analysis of attrition for the panel analysis ( $n=4,078 \rightarrow 3,131$ ) gives naturally an almost equal outcome. It shows that the excluded have higher odds of poor physical (OR 1.5,  $p=0.00$ ) and mental health (OR 1.3,  $p=0.09$ ) than the included.

### *2.1.1 Ethical Approval*

The National Bioethics Committee in Iceland approved *The Health and Wellbeing of Icelanders* in 2007 (permit number 07-081) and in 2009 (permit number 09-094). The use of the unidentifiable data for this particular study was approved by The National Bioethics Committee (permit number 12-026) in February 2012.

## *2.2 Variables*

### *2.2.1 Dependent Variables*

*Self-rated physical health* and *self-rated mental health* are the main outcome variables in this study. Self-rated health is commonly used in research and is an accurate predictor of individual's future risk of death (Graham, 2007). This study distinguishes between physical and mental self-rated health. The participants answered the question 'How do you grade your physical health? Is it very good, good, fair or bad?' Individuals answering fair or bad were considered in poor physical health (coded as 1) and individuals in very good and good were considered in good physical health (coded as 0). Same procedure was used for mental health. The variables' descriptive can be seen in Table 3.2.

### *2.2.2 Independent Variables*

The structural components of social capital: *informal social capital* and *formal social capital* were measured with dummy variables, and the cognitive components: *trust towards institutions* and *trust towards others* with continuous variables. Descriptive for all variables can be seen in Table 3.2. Informal social capital was the only social capital indicator measured at both 2007 and 2009, the other indicators were measured in 2009.

*Informal social capital* was measured with three questions regarding spouse, family members, friends, and work/school friends:

'How easy is it for you to trust the following for personal matters?'

‘How easy is it for you to get help from the following to solve a problem?’

‘How pleased or displeased are you with your relationship with the following?’

Respondents choose between: ‘not relevant’, ‘very hard/very displeased (1)’, ‘rather hard/rather displeased (2)’, ‘either or (3)’, ‘rather easy/rather pleased (4)’, ‘very easy/very pleased (5)’. About 20 % of the sample answered ‘not relevant’ when it came to questions regarding spouse or work/school friends. This is a large part of the sample and measures were taken to include them in the analysis. Those who marked ‘not relevant’ when it came to spouse or work/school friends were assigned the neutral value ‘either or’. The rationale is that individuals who don't have a spouse or work/school friends don't necessarily have less informal social capital than those who do; in fact, single people have more informal social capital than married people, who have more formal social capital (Putman, 2000). However, those who marked ‘not relevant’ regarding family or friends got the value ‘very hard/very displeased’: those who don't have a family or friends are very likely to have less informal social capital than those who have a family or friends. Factor analysis with varimax rotation was conducted and items scored from 0,54 to 0,75 in both 2007 and 2009 and Cronbach's alpha was above 0.83 in 2007 and 0.88 in 2009. Consequently variables representing informal social capital at 2007 and 2009 were created. To qualify as having good informal social capital (value 0), the respondent has to have a score of 48 or higher, which corresponds to rather easy/rather pleased or very easy/very pleased from the 12 questions.

The indicator *formal social capital* was based on Putman's (2000) idea and has been used before in empirical studies (e.g. Rostila, 2008). Formal social capital was measured by doing unpaid voluntary work in the past 12 months. Having done so at least once is considered having good formal social capital (coded as 0), otherwise as having poor formal social capital (coded as 1).

*Trust towards institutions* is a continuous variable and was measured with the following question ‘How much trust do you have to the following institutions’: ‘The parliament’, ‘The state church’, ‘University of Iceland’, ‘The media’ and ‘Police’. Answering alternatives: ‘very much (1)’, ‘much (2)’, ‘neither much nor little (3)’, ‘little (4)’, and ‘very little (5)’. Respondents score was measured as the mean score of the questions, the higher the score the poorer the trust towards institutions. Factor



analysis was conducted and items scored from 0,61 to 0,69 and Cronbach's alpha 0,61.

*Trust towards others* was measured with six questions: 'Generally most people can be trusted', 'Generally you have to be very careful interacting with other people', 'Most people would take advantage of me if they had the chance', 'Most people try to be fair', 'Most people try to be helpful', and finally 'Most of the time people only care of their own interests'. Answers on a 5-point Likert ranged from 'totally agree (1)' to 'totally disagree (5)'. Scores were measured at the mean value of the six items, higher score represents lower trust towards other people. After reversing the negatively phrased items, a factor analysis was conducted. Items had values from 0,67 to 0,75 in factor analysis and Cronbach's alpha showed 0,8 which enough for computing into one variable.

The indicators formal social capital, trust towards institutions and trust towards others were only available for the 2009 wave, but informal social capital will be used in panel analysis as well as in the cross-sectional analysis.

*Symptoms of insomnia* was measured with following items: 'How often in the past 3 months have you experienced the following': 'Had trouble sleeping'; 'Awakening after falling asleep and have difficulties falling asleep again'; 'Awakened couple of times during the night'; 'Had a good night sleep'. Respondent were given the possibilities to answer: 'never (1)', 'seldom (2)', 'sometimes (3)', 'often (4)', and 'always (5)' for each item. After reversing the last question a factor analysis with varimax rotation was conducted and items scored from 0.67 to 0.84 and Cronbach's alpha was 0.74. Consequently a continuous variable was created representing symptoms of insomnia in 2009, which will be used in both cross-sectional and panel analysis. Individuals' average score represents the level of insomnia symptoms, where higher score represents more symptoms of insomnia, see Table 3.2 for descriptive.

### 2.2.3 Control Variables

The distribution of all variables can be seen in Table 3.2. *Age* was measured in 2009, and used in 7-year age groups. Females were coded as 1 and males as 0. *Highest educational attainment* was grouped into four categories: 'junior college level' and 'university level education' and 'other education', with 'compulsory school education' as a reference category. More detailed categorisation can be found in

Appendix A. *Family status* was created to measure living circumstances. Four dummies were created from variables of marital status and having children: ‘Cohabiting, with children’ as the reference group, ‘cohabiting, without children’, ‘living alone, with children’ and ‘living alone, without children’. Single, divorced, widowed and not cohabitating were coded as living alone, while those cohabitating or married were coded as cohabitating. A dummy variable was created for *smoking*: never smoked, smoke seldom than weekly and quit smoking are non-smokers (0); those who smoke daily or weekly are smokers (1). See Appendix B for operationalization regarding missing values for smoking.

### 2.3 *Statistical Analysis*

All analysis was done with SPSS 19.0 for Mac. To study the relationship between various social capital indicators and physical health on one hand, and mental health on the other in 2009 two multivariate binary logistic regressions were performed. Results are presented in odds ratios (OR) and 95% confidence intervals (95% CI).

To study the long-term effect of different combinations of informal social capital on health two multivariate binary logistic regressions were conducted. The regression for physical health in 2009 included only people in good physical health in 2007, and the regression for mental health in 2009 included only people in good mental health in 2007. Different combinations of informal social capital in 2007 and 2009 were used to examine the effect of social capital during an economic crisis on self-rated health. Unfortunately due to data restrictions was informal social capital the only social capital indicator used in the panel analysis.

### 3. Results

It is reasonable to think that the four indicators of social capital are correlated and models of regression suffer from multicollinearity. The indicators of social capital are low to moderately correlated, as can be seen in Table 3.1. The weak correlations are surprising, which means that there is a random, non-linear relationship between the variables. The highest correlation is between trust towards institutions and trust towards others, but only 7,8 % ( $0,28^2$ ) of the variation in one variable can be explained by the other. The correlations between the four indicators of social capital and symptoms of insomnia can also be seen in Table 3.1, but these are low as well.

**Table 3.1: Spearman's Rho coefficients for social capital indicators and symptoms of insomnia**

	<b>Informal social capital</b>	<b>Formal social capital</b>	<b>Trust towards institutions</b>	<b>Trust towards others</b>	<b>Symptoms of insomnia</b>
<b>Informal social capital</b>	1.00				
<b>Formal social capital</b>	0.06 <sup>**a</sup>	1.00			
<b>Trust towards institutions</b>	0.15 <sup>**</sup>	0.02	1.00		
<b>Trust towards others</b>	0.18 <sup>**</sup>	0.13 <sup>**</sup>	0.28 <sup>**</sup>	1.00	
<b>Symptoms of insomnia</b>	0.17 <sup>**</sup>	0.02	0.12 <sup>**</sup>	0.16 <sup>**</sup>	1.00

\*\* = Correlation is significant at the 0.01 level

a = Phi is 0.05

Descriptive information of variables used in cross-sectional analysis can be found in Table 3.2. Regression (results not shown) showed that household income, occupational position and alcohol consumption were not significantly related to physical and mental self-rated health when all other independent and control variables were included. However age, gender, highest educational attainment, smoking and family status were significant. For that reason and to prevent over-adjustment the final analyses were not adjusted for household income, occupational position and alcohol consumption.

**Table 3.2: Description of variables in 2009 (n=3,243)**

	N	%	Mean	Mode	Std. dev	Min - Max
<b>Gender</b>	3243			0		
Male (0)	1661	51,2				
Female	1582	48,8				
<b>Age Distribution in 2009</b>	3243			3		
20-26 (0)	474	14,6				
27-34	525	16,2				
35-42	592	18,2				
43-50	561	17,3				
51-58	486	15,0				
59-66	325	10,0				
67-74	177	5,5				
75-81	104	3,2				
<b>Highest educational attainment</b>	3243			1		
Compulsory school (0)	766	23,6				
Junior College	1227	37,8				
University	1078	33,2				
Other education	172	5,3				
<b>Family Status</b>	3243			0		
Cohabiting, with Children (0)	2093	64,5				
Cohabiting, without Children	281	8,7				
Living alone, with Children	370	11,4				
Living alone, without Children	499	15,4				
<b>Smoker</b>	3243			0		
No (0)	2686	82,8				
Yes	558	17,2				
<b>Self-rated Physical Health</b>	3243			0		
Good (0)	2661	82,1				
Poor	582	17,9				
<b>Self-rated Mental Health</b>	3243			0		
Good (0)	2744	84,6				
Poor	500	15,4				
<b>Informal Social Capital</b>	3243			0		
Good (0)	2917	89,9				
Poor	327	10,1				
<b>Formal Social Capital</b>	3243			1		
Good (0)	1156	35,6				
Poor	2088	64,4				
<b>Trust Towards Others</b>	3243		2,50		0,59	1-5
<b>Trust Toward Institutions</b>	3243		2,99		0,59	1-5
<b>Insomnia Symptoms</b>	3243		2,48		0,75	1-5

### 3.1 Physical Health

To study the relationship between the four indicators of social capital and physical self-rated health a multivariate binary logistic regression was performed. Table 3.3 presents the association between the different indicators of social capital and insomnia on poor physical self-rated health in 2009 when adjusted for gender, age, education, family status and smoking.

The indicators of social capital are regressed separately in Models 1a - 1d. All indicators of social capital except formal social capital had significant relationship with poor self-rated physical health when regressed separately. An individual with poor informal social capital has 2.2 times the odds of having self-rated poor physical health compared to good informal social capital when controlled for background variables. Formal social capital is regressed in Model 1b; a person with poor formal social capital has only 1.2 times the odds of rating physical health poorly, this is however only significant at the 90% level. In Model 1c and 1d the cognitive indicators of social capital, trust towards institutions and trust towards others, are regressed. One unit increase in mistrust towards institutions increases the risk of poor physical health 1.6 times, and one unit increase in mistrust towards other people in society increases the risk 2.1 times of poor physical health, when controlled for age, gender, education, smoking and family status.

**Table 3.3: Binary logistic regression on the association between social capital, insomnia and interaction variables and poor physical health in 2009 in Iceland, when adjusted for age, gender, education, smoking and family status (n=3,243).**

	Model 1a	Model 1b	Model 1c	Model 1d	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Poor informal social capital	<b>2.20</b> (1.66 - 2.85)				<b>1.65</b> (1.24 - 2.18)	1.20 (0.89 - 1.61)
Poor formal social capital		1.20 (0.97 - 1.45)			1.06 (0.86 - 1.30)	1.01 (0.88 - 1.35)
Low trust towards institutions			<b>1.60</b> (1.37 - 1.88)		<b>1.30</b> (1.09 - 1.53)	1.16 (0.97 - 1.38)
Low trust towards others				<b>2.10</b> (1.76 - 2.45)	<b>1.80</b> (1.51 - 2.14)	<b>1.50</b> (1.24 - 1.79)
Symptoms of insomnia						<b>2.50</b> (2.18 - 2.86)

Odds ratios in boldface are significant at the 0.05 level.

Model 1a - 1d are adjusted for gender, age, education, smoking, family status and social capital.

Model 2 is models 1a + 1b + 1c + 1d.

Model 3 is model 2 + Symptoms of insomnia.

In Model 2 all the social capital indicators are regressed at the same time. The odds ratios for all indicators get lower.

Model 3 is adjusted for insomnia symptoms. Informal social capital becomes insignificant when insomnia symptoms are added to the model, resulting in neither of the structural parts having a significant association with self-rated physical health. Trust towards others is still significant, but trust towards institutions is only significant at the 90% level ( $p=0,07$ ). The risk of rating physical health poorly increases 2.5 times as symptoms of insomnia increase, underlining the importance of sleep for physical health. There is a significant interaction between formal social capital and insomnia symptoms (results not shown) indicating that having symptoms of insomnia increases the risk of rating physical health poorly due to poor formal social capital. The other indicators of social capital do not have a significant interaction with insomnia symptoms.

### *3.2 Mental Health*

To study the association between social capital and poor self-rated mental health in 2009 a multivariate binary logistic regression was conducted and adjusted for age, gender, family status, education and smoking, results shown in Table 3.4.

In Model 1a to 1d the odds ratios between the four different indicators of social capital and mental health are shown. Models 1a - 1d show significant odds ratios for all indicators, demonstrating that poor social capital is associated with poor mental self-rated health. Model 1a regresses informal social capital, which stands out with very high odds ratio; people with poor informal capital have 4.1 times the odds of rating their mental health poorly than people with good informal social capital when adjusted for age, gender, family status, education and smoking. The odds ratios for formal social capital and for trust towards institutions are respectively 1.4 and 1.7. Having low trust towards others has an odds ratio of 2.4 for poor self-rated mental health.

Model 2 regresses the four social capital indicators simultaneously. The odds ratios for all variables get lower, but formal social capital is the only one that becomes insignificant. Informal social capital still stands out with the highest odds ratio.

**Table 3.4: Odds Ratios from binary logistic regression on the association between social capital, insomnia and interaction variables and poor mental health in Iceland 2009, when adjusted for age, gender, education, smoking and family status (n=3,243).**

	<b>Model 1a</b>	<b>Model 1b</b>	<b>Model 1c</b>	<b>Model 1d</b>	<b>Model 2</b>	<b>Model 3</b>
	<b>OR</b>	<b>OR</b>	<b>OR</b>	<b>OR</b>	<b>OR</b>	<b>OR</b>
	<b>(95% CI)</b>	<b>(95% CI)</b>	<b>(95% CI)</b>	<b>(95% CI)</b>	<b>(95% CI)</b>	<b>(95% CI)</b>
Poor informal social capital	<b>4.10</b> <b>(3.19 - 5.36)</b>				<b>3.12</b> <b>(2.38 - 4.08)</b>	<b>2.42</b> <b>(1.81 - 3.23)</b>
Poor formal social capital		<b>1.40</b> <b>(1.10 - 1.70)</b>			1.18 (0.94 - 1.48)	1.25 (0.99 - 1.58)
Low trust towards institutions			<b>1.74</b> <b>(1.47 - 2.06)</b>		<b>1.29</b> <b>(1.08 - 1.55)</b>	1.14 (0.94 - 1.37)
Low trust towards others				<b>2.42</b> <b>(2.03 - 2.87)</b>	<b>1.92</b> <b>(1.59 - 2.31)</b>	<b>1.58</b> <b>(1.29 - 1.92)</b>
Symptoms of insomnia						<b>2.60</b> <b>(2.25 - 3.01)</b>

Odds ratios in boldface are significant at the 0.05 level.

Model 1a – 1d are adjusted for gender, age, education, smoking, family status and social capital.

Model 2 is models 1a + 1b + 1c + 1d.

Model 3 is model 2 + Symptoms of insomnia.

Having symptoms of insomnia are adjusted for in Model 3. This addition reduces the odds ratios of informal social capital, trust towards institutions (now insignificant) and trust towards other, but surprisingly does the odds ratio for formal social capital get higher. Just like for physical health, there is a significant interaction between formal social capital and insomnia symptoms (results not shown): a person experiencing further insomnia symptoms shows a stronger association between poor formal social capital and poor mental health.

### *3.3 Informal Social Capital before and after the Crisis*

One of the aims of the study was to see whether informal social capital had diminished during the economic crisis, and to see the effect of different combinations of informal social capital before and after the crises on health.<sup>1</sup> Table 3.5 shows the descriptive for the variables of the whole working sample used in the two-wave analysis.

<sup>1</sup>The working sample in the panel analysis is 3,131. However, the regressions in the panel analysis include only those in good health at baseline (2007), thus the sample size for the physical health regression is 2,550 and the mental health regression 2,664.

**Table 3.5: Descriptive for variables used in panel analysis, (n=3,131).**

	n	%
<b>Physical Health in 2009</b>	3131	
Good (0)	2587	82,6
Poor	543	17,4
<b>Mental Health in 2009</b>	3131	
Good (0)	2650	84,6
Poor	481	15,4
<b>Informal Social Capital 2007</b>	3131	
Good (0)	2772	88,5
Poor	359	11,5

Hypothesis 3 suggests that informal social capital is poorer after the economic crisis than it was before. Table 3.6 shows the composition of informal social capital before and after the economic collapse in 2008. Large proportion of the sample, 84,1 %, had good informal social capital in both 2007 and 2009 (good/good). Out of those who had good informal social capital in 2007 did only 4,4 % experience deteriorating informal social capital by 2009 (good/poor). Only 5,5 % of the sample had poor informal capital in both 2007 and 2009 (poor/poor), but 6% moved from having poor informal social capital in 2007 to having good in 2009 (poor/good).

**Table 3.6: Composition of informal social capital in 2007 and 2009, (n=3,131).**

<b>Informal Social Capital</b>		
	n	%
<b>2007/2009</b>	3131	
Good/Good (0)	2633	84,1
Good/Poor	139	4,4
Poor/Good	186	6,0
Poor/Poor	173	5,5

From those 359 (186+173) people whom had poor informal social capital in 2007 did 51,8 % (186/359) gain more informal social capital by 2009 but 48,2 % (173/359) continued to have poor informal ties. Higher percentage of the total sample had poor/good than good/poor, showing that more people actually improved their informal social capital during the crisis than worsened. Comparison of mean in 2007 and 2009 regarding informal social capital, before dichotomising the variables, shows that informal social capital in 2009 had a significantly higher mean than in 2007.



### *3.4 Long-term effects of Informal Social Capital on Health*

Results of the panel study's logistic regressions between different compositions of informal social capital and health are shown in Table 3.7. It shows the association between different compositions of informal social capital before and after the crisis, insomnia and self-rated health in 2009 when only including people in good health in 2007, controlling for age, gender, smoking, education and family status in 2009. The table reveals how long-term experience of poor, improved or deteriorating informal social capital affect self-rated physical and mental health and might give some idea of causality between social capital and health.

Beginning with the relationship between informal social capital and self-rated physical health. Those who had poor informal social capital in 2007 but good in 2009 (poor/good) or good in 2007 but poor in 2009 (good/poor) have almost two times the odds of rating their physical health poorly in 2009 in comparison to having good informal social capital at both time-points (good/good). The risk of rating physical health poorly for those having poor informal social capital at both time-points (poor/poor) is slightly higher than for those who have improving or deteriorating informal social capital. Those who experience poor informal ties both before and after the crises (poor/poor) are significantly more at risk (OR 2.3) of having poor self-rated physical health in comparison to having good informal ties at both time-points (good/good). This shows that to some extent that there is a causal relationship between poor informal social capital and poor physical health. When including symptoms of insomnia in Model 2 the significant effects of social capital on physical health disappear. There is not enough power to analysis the interaction effects of insomnia, but it is apparent that poor sleep quality is of importance for physical health.

Moving from physical health to the effect of informal social capital over two year period on mental health. The odds ratios for the categories of informal social capital regarding mental health are all significantly different from the reference group (good/good). Those who had poor informal social capital in 2007 but improved in 2009 (poor/good) have three times the odds of having poor mental self-rated health in comparison to having good informal social capital at both time-points (good/good). Having deteriorating informal social capital (good/poor) have almost four times the odds of rating their mental health poorly in 2009 in comparison to the reference group. Those having experienced poor informal ties through the two years (poor/poor)

are in high risk of rating mental health poorly: they have 5.9 times the odds of rating their mental health poorly in 2009, compared to having good informal social capital at both time-points (good/good). This is very high and supports the hypothesis that having poor informal social capital over a period of time increases the risk of having poor mental health. These results indicate that it is actually poor informal social capital that causes poor mental health, no vice versa.

**Table 3.7: Odds Ratios (OR) for poor physical health (n=2,550) and poor mental health (n=2,664) in 2009 by different combinations of informal social capital, and insomnia symptoms in 2009, adjusted for gender, age, education, smoking and family status in 2009. Two-wave data including only people in good health in 2007.**

	<b>Model 1 OR (95% CI)</b>	<b>Model 2 OR (95% CI)</b>
<b>Physical self-rated health</b>		
Informal Social Capital 2007/2009		
Good/Good	1.00	1.00
Poor/Good	<b>1.92 (1.10 - 3.35)</b>	1.60 (0.91 - 2.84)
Good/Poor	<b>1.95 (1.06 - 3.59)</b>	1.44 (0.77 - 2.70)
Poor/Poor	<b>2.30 (1.26 - 4.21)</b>	1.78 (0.95 - 3.32)
Symptoms of insomnia 2009		<b>2.16 (1.78 - 2.65)</b>
<b>Mental self-rated health</b>		
Informal Social Capital 2007/2009		
Good/Good	1.00	1.00
Poor/Good	<b>3.08 (1.85 - 5.14)</b>	<b>2.53 (1.48 - 4.32)</b>
Good/Poor	<b>3.70 (2.28 - 6.07)</b>	<b>2.54 (1.51 - 4.27)</b>
Poor/Poor	<b>5.91 (3.47 - 10.96)</b>	<b>5.10 (2.89 - 8.82)</b>
Symptoms of insomnia 2009		<b>2.49 (2.06 - 3.01)</b>

Model 1, adjusted for age, gender, education, family status, smoking in 2009

Model 2, model 1 + symptoms of insomnia in 2009

Insomnia is added to the regression in model 2. The odds ratios for all categories of informal social capital get lower but stay significant, unlike the odds ratios regarding poor physical health that all became insignificant. Having poor/poor informal capital has now 5.1 times the odds of rating mental health poorly when compared to good/good informal social capital. There is no power to analyse the interaction between different compositions of informal social capital and insomnia symptoms, but insomnia does not have the same effect on informal social capital and mental health as it does on informal social capital's relationship with physical health.

The results suggest causal effects of poor informal social capital on health. Health, especially mental, can be predicted by individuals' informal social capital over a period of two years. Having poor/poor informal social capital gives higher odds of rating mental health poorly than rating physical health poorly, indicating that informal social capital is of more importance when it comes to mental health than physical health. All compositions of informal social capital have stronger association to mental health than physical health, results that can be supported by the previous cross-sectional analysis (Tables 3.3 and 3.4) where informal social capital had much stronger association with mental self-rated health than physical self-rated health.

#### **4. Discussion**

The primary aim of this study was to analyse whether there was a relationship between social capital and self-rated health in Iceland shortly after a harsh economic collapse. The findings suggest more risk for people with poor social capital to rate physical and mental health poorly in Iceland in 2009 when controlled for socio-demographic factors. The findings show that symptoms of insomnia partially mediate the relationship between social capital and health, but only moderate the relationship for formal social capital and self-rated health. Having poor informal social capital before, during and after the economic crash has causal effects on poor mental health, but not poor physical health when adjusted for insomnia symptoms and the background variables. The results however demonstrate that sleep is very important for health and should be controlled for when studying social capital and self-rated health, especially physical self-rated health.

It is a challenge to study social capital. There is no consensus of how to measure the concept and what to include. A second aim was to see if different indicators of social capital related differently to self-rated physical health and self-rated mental health. This study confirmed the multidimensionality of social capital and how different indicators are differently related to different types of health outcomes (Lindström, 2004; Veenstra et al., 2005; Ziersch et al., 2005; Nyqvist, 2009).

Three of the four social capital indicators (informal, trust towards institutions and trust towards others) were significantly related to physical and mental health when analysed simultaneously, when adjusted for age, gender, education, family status and

smoking. Surprisingly, formal social capital was not significantly related to neither physical nor mental self-rated health.

Bolin et al (2003) found a significant relationship between having a close friend and good self-rated health; the same relationship is found in this study regarding mental health. Informal social capital had a strong relationship with self-rated health. Having poor relationships with close ones had a notable strong association with poor mental health, even when insomnia was adjusted for, but became insignificant to physical health when insomnia was controlled for. The relationship of informal social capital with physical self-rated health is partially mediated by insomnia symptoms, which support Troxel et al (2010) notion that sleep is a part of the chain between social experience and health. Quality of the relationship with spouse, close family, friends and work mates is very important for mental health.

Voluntary participation did not have a significant relationship with self-rated health when the other social capital indicators and background variables were controlled for. These results support Veenstra (2000) who did not find any significant relationship between voluntary participation and overall self-rated health, and Veenstra et al (2005) who did not find an association between voluntary work and health when controlled for socio-demographic factors. However, the results are in opposition to Rose (2000) and Hyyppä and Mäki (2001b; 2003 cited in Nyqvist 2009) findings that found a significant relationship between informal and formal social capital and self-rated health. Formal social capital is moderated by insomnia in the relationship with both physical and mental self-rated health. The results on informal and formal social capital are in harmony with Rostila's results from 2007 that "informal social contacts seemed to have much stronger effect on health than formal ties" (Rostila, 2008).

Rose (2000) and Lindström (2004) found a significant relationship between general trust and both physical and mental self-rated health. The two cognitive parts of social capital had a dissimilar relationship to self-rated physical and mental health. Trust towards institutions is significant and has similar odds ratio for both physical and mental health, but becomes insignificant when insomnia symptoms are controlled for. The relationship between trust towards institutions and health is partially mediated by symptoms of insomnia. However, trust towards others has a significant association with both physical and mental self-rated health even in the presence of

insomnia in the model. Trust towards others is the only social capital indicator that stays significant for physical health when insomnia was controlled for. Veenstra (2000) did not find any significant relationship between trust towards the government, towards all others, towards neighbours or people from same ethnic or religious group and overall health. This study finds trust towards the parliament, police, the state church, media and University of Iceland not to have a significant relationship to neither physical nor mental self-rated health, but trust towards other people in the society does. Veenstra results from 2000 can only be partly supported by the current conclusions.

Overall, social capital had a stronger association with mental self-rated health than physical self-rated health in 2009 in Iceland. Having good quality relationships with spouse, close family, friends and work mates and much trust towards other people in society decreases the risk of having poor mental health, when controlled for symptoms of insomnia, age, gender, education, family status and smoking. De Silva et al (2005) found that cognitive social capital had an inverse relationship with mental health, but did not find such a relationship for structural social capital. The current findings show that a part of cognitive and a part of structural social capital have an association with mental health and it is not possible to conclude that either cognitive or structural have more association with mental health. These results are consistent with previous findings suggesting that different components of social capital, such as cognitive and structural, may have a different impact on health (Harpham et al., 2004; Pollack & von Knesebeck, 2004; Poortinga, 2006 & cited in Nyqvist, 2009).

The largest economic collapse in relative terms in modern history happened in Iceland in 2008 (The Economist, 2008). Social capital is expected to diminish during an economic downfall (Inglehart & Baker, 2000; Putman, 2000). Hypotheses 3 suggested that informal social capital in Iceland would be poorer in 2009 than it was in 2007. Surprisingly, hypothesis 3 is rejected; respondents had significantly better informal social capital in 2009 than in 2007. Higher percentage of the sample actually improved their informal social capital by 2009 than kept having poor in both 2007 and 2009. In these hard times people increased the frequency and improved the quality of their relationships with partner, family, close friends and work/school friends. This conclusion is in contrast to theories (e.g. Inglehart & Baker, 2000;

Putman, 2000) and to Growiec (unpublished) findings that students had less informal social capital in 2010 than in 2005. Growiec used a sample of university students, but this particular study has a population representative sample. It is possible that students decreased their levels of informal social ties, but the overall population did not. Despite a total economic collapse, uncertainty regarding the future and rising unemployment people did not become isolated and lose informal ties. The crisis might actually have “pushed” people together, increasing the sense of community, cohesion and solidarity.

Previous studies (Growiec, unpublished; Félagsvísindastofnun & Hagfræðistofnun, 2009) have found trust towards institutions other than the police to diminish after the economic collapse in Iceland in 2008, but due to lack of data the comparison could not be made. Unfortunately, informal social capital was the only social capital indicator measured in 2007, but it would have been very interesting to see if there were any changes in voluntary participation, trust towards institutions and towards others in the society after the economic collapse.

Hypothesis 4 suggested that having poor informal social capital during or after an economic crisis causes poor physical and mental self-rated health. A panel study including only people in good health in 2007 showed that those who had poor informal social capital both before and after the crisis (poor/poor) had six times the odds of rating mental health poorly in 2009 and two times the odds of rating physical health poorly in 2009 in comparison to having good informal social capital both before and after the crisis (good/good), when controlled for age, gender, family status, education and smoking. This suggests that having poor informal social capital causes poor mental and physical health – not the other way around. These results are similar to what Rostila found for the Swedish population through the 1990s, although he was not able to conclude anything on the causal relationship because of the long time-period between the measurements (Rostila, 2008). Having increasing or deteriorating informal social capital increases the odds of rating mental health poorly more than three times compared to having good informal social capital at both time points. However, the effects are not as big for physical health; having poor/good or good/poor informal social capital increases the odds of rating physical health poorly almost two times in comparison to good/good. Having good social capital might give emotional support, increase self-esteem, promote healthy behaviour and enable

distribution of health information. Individuals missing this are more likely to have poor mental health than individuals rich of social capital.

The odds ratios of different compositions of informal social capital are much higher regarding mental health than physical health. The causal effects of informal social capital on physical health become non-significant when controlled for symptoms of insomnia, which supports Troxel et al (2010) notion that sleep is a part of the causal chain between social experience and health. However, having poor informal social capital is suggested to cause poor mental self-rated health, even when adjusted for insomnia, age, gender, education, family status and smoking. A similar relationship can be seen from cross-sectional analysis on physical and mental health in 2009.

Symptoms of insomnia are adjusted for in 2009 in the panel analysis, not at baseline. There are several reasons for this: The Pearson's correlation between insomnia symptoms in 2007 and 2009 was 0,67. There is reason to believe that the outcome variables (measured in 2009) would be more affected by suffering from insomnia symptoms at the time of measurement than two years earlier. By using the measurement of symptoms of insomnia in 2007 the sample size for the panel study would have been smaller due to internal missing values.

There are some weaknesses within this study. Attrition can be problematic in longitudinal studies as it can threaten the external validity of the study by making it hard to generalise to the population, and threaten internal validity through changing correlations between variables. In this particular study the author did an analysis on both the external and internal attrition and found that the non-respondents were in slightly worse physical and mental health than the included. A fraction of people in poor health is missing from the analysis, but it is uncertain how that affects the coefficients and results of the study.

Despite some weaknesses this study has some strengths. The study is population-based where the panel data was collected with only two years apart, which enables conclusions regarding causal relationships. The longitudinal data excludes the problem of reverse causality present in cross-sectional analyses. Self-rated health is an overall good predictor of health (Manderbacka, 1998) but this study reveals that social capital has different relationships with self-rated physical and mental health. Two indicators of self-rated health might be more accurate than one indicator of

overall self-rated health since social capital relates differentially to physical and mental self-rated health. The different results for social capital indicators demonstrates the importance of analysing them separately, not lumping different aspects together for analysis.

When studying the relationship between social capital and self-rated health, sleep should be taken into account. The introduction of insomnia symptoms reduced the odds ratios of social capital and for many made them insignificant. Having symptoms of insomnia diminishes the effect of social capital. Future studies on socio-demographic factors and health should take quality of sleep into account as a control variable. By looking at sleep as a mechanism through which social factors affect health broadens the scope of sleep research to include social, cultural and environmental factors. Population health and sleep can be improved by studying sleep through epidemiological perspective; it may create opportunities to design interventions, treatments and policies to improve sleep and thus health (Hale, 2010). Likewise might studies on social determinants and health improve by taking sleep into account as the most important recovery mechanism available to humans.

The changes in social capital and its relationship with health should be studied in other countries where the rates of social capital are not as high as in Iceland, for example in Ireland or Greece, who have also been going through an economic crisis. The relationship between social capital and health, and the changes in rates of social capital, might be different in a country where the degree of social capital is lower than in Iceland.



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## **Appendix A**

### **Highest educational attainment**

Respondents were asked for their highest educational attainment, apart from 10 point scale were respondent able to mark 'other' and write in their highest educational attainment. In Iceland the compulsory education is from 6-16 years of age. The reference group 'compulsory school education' is made from two answering possibilities representing those who highest educational attainment is finishing compulsory school, at age 16. Everyone who has finished industrial or technical degree, and degree on junior college level were gathered in the category of 'junior college degree'. Those who had finished bachelor, master's or doctor's degree in university were gathered in the 'university degree' category. Everyone who wrote in his or her highest educational attainment was marked as 'other education'.

## Appendix B

Jón Óskar Guðlaugsson and Stefán Hrafn Jónsson, the supervisors of *The Health and Wellbeing of Icelanders*, have done some improvements regarding missing values by imputing information from other variables. The improved variables were used in this study. The following are the syntax commands for 2007 data by Guðlaugsson and Jónsson from 20<sup>th</sup> may 2009; same commands can be used for 2009 data only by changing variables names. The syntax commands can be assessed through this website:

<http://www2.lydheilsustod.is/media/lydheilsa/heilsufarskonnun/VidaukiD.syntax.txt>

The English translation in the right column author has added.

### Smoke

2007: Do you smoke (variable s13).

\* s13 + upplýsingar úr öðrum reykingaspurningum.

\* s13 + information drawn from other variables on smoking.

missing values s13 s14 s15 s16 s18().

missing values s13 s14 s15 s16 s18().

recode s13 (1=5) (2=4) (3=3) (4=2) (5=1) (else=9999) into r13.

recode s13 (1=5) (2=4) (3=3) (4=2) (5=1) (else=9999) into r13.

var label r13 "Reykingar".

Var label r13 "Smoking".

val label r13

5 "Reykir daglega"

4 "Reykir a.m.k. vikulega"

3 "Reykir sjaldnar en vikulega"

2 "Hætt/ur að reykja"

1 "Hef/ur aldrei reykt".

Val label r13

5 "Smokes daily"

4 "Smokes at least weekly".

3 "Smokes less than weekly".

2 "Quit smoking".

1 "Has never smoked".

if s13 = 9999 and s14 lt 9 r13 = 2.

if s13 = 9999 and s14 = 9999 and s14x ne "" r13 = 2.

if s13 = 9999 and s14 lt 9 r13 = 2.

if s13 = 9999 and s14 = 9999 and s14x ne "" r13 = 2.

if s13 = 9999 and any(s15, 1, 2, 3, 4, 5, 6, 7, 8, 47, 48, 78) r13 = 2.

if s13 = 9999 and any(s18, 2, 3, 4, 5, 6, 47, 48) r13 = 5.

if s13 = 9999 and any(s15, 1, 2, 3, 4, 5, 6, 7, 8, 47, 48, 78) r13 = 2.

if s13 = 9999 and any(s18, 2, 3, 4, 5, 6, 47, 48) r13 = 5.

exe.

exe.

missing value r13 (9999).

missing values s13 s14 s15 s16 s18 (12 thru 9999).

missing value r13 (9999).

missing values s13 s14 s15 s16 s18 (12 thru 9999).