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Healthier Together?

Social capital, Health behaviour and Health

ACADEMIC DISSERTATION

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"The most valuable of all capital is that invested in human beings."

Alfred Marshall, Principles of Economics

Abstract

The conceptualization and operationalization of social capital varies according to discipline and level. In this study, social capital is measured at the individual level assuming that an individual's investment in group activity reflects social capital seen as a resource related to social networks and group membership. Individual benefits are accessed through social connections in varied groups and society. Thus the resources do not reside within the individual but rather in the structure of person's social networks. Social capital was measured on three dimensions in this study: 1) social support, 2) social networks and participation and 3) trust and reciprocity. The association between these dimensions and health were examined. Health was investigated as health behaviour, self-rated health, psychological well-being and mortality.

This study utilised the data of the Health 2000 Survey conducted in 2000–2001. Of people aged 30 and over, 89% participated in the home interview and 80% in the general health examination. The study material presents the whole population unusually well. The National Institute for Health and Welfare (THL) (formerly the National Public Health Institute, KTL) had the overall responsibility for the project. In addition, the project organization involved a wide range of research and funding agencies. This survey contains a rich armoury of questions about health and illnesses, health behaviour, capacity for work, functional capacity and use of health services. Furthermore, it includes a broad selection of questions used in measuring social capital.

The results found an accumulation of social capital and general welfare for the same groups: the highest levels of social capital were found among the young, well-educated and married people. However, all socio-demographic subgroups seem to benefit from social capital. Regardless of all socio-demographic characteristics, high levels of social capital were associated with good health, associations which varied among different health-related behaviours, but social participation had a strong statistical association with all components of health and all health behaviours. Regardless of chronic diseases people with high levels of social capital felt healthier than those with low levels. The positive association between social capital and survival was statistically significant among men and suggestive among women. These findings indicate that social capital contributes to health.

Health inequalities between population sub-groups are still substantial. Health could be promoted and health inequalities reduced by developing tools for increasing social participation especially in those groups lacking social capital—and who often also suffer from several health problems.

Keywords: individual-level social capital, trust, participation, social networks, social support, self-rated health, psychological health, health behaviours, mortality, distribution of social capital, education, living arrangements

Tiivistelmä

Sosiaalista pääomaa on määritelty monin eri tavoin tutkimusperinteestä ja tutkimusalasta riippuen. Tässä tutkimuksessa sosiaalinen pääoma on määritelty sosiaalisten verkostojen kautta syntyväksi resurssiksi, joka voi tuottaa hyötyä, esimerkiksi hyvää terveyttä. Sosiaalista pääomaa tarkastellaan tässä yksilönäkökulmasta. Vaikka sosiaalinen pääoma syntyy sosiaalisissa rakenteissa, yksilöt hyötyvät siitä. Tässä tutkimuksessa sosiaalista pääomaa mitattiin kolmen eri ulottuvuuden avulla: 1) sosiaalinen tuki, 2) sosiaaliset verkostot ja osallistuminen sekä 3) luottamus ja vastavuoroisuus. Tutkimuksessa tarkasteltiin näiden ulottuvuuksien yhteyttä elintapoihin, koettuun terveyteen, psyykkiseen hyvinvointiin ja kuolleisuuteen.

Tutkimus perustuu vuosina 2000–2001 toteutetun Terveys 2000 -tutkimuksen aineistoon. Suomen 30 vuotta täyttänyttä väestöä edustavasta 8028 henkilön otoksesta 89 % osallistui haastatteluun ja 80 % laajaan terveystarkastukseen. Tutkimuksesta vastasi THL (silloinen KTL). Lisäksi sen suunnitteluun ja toteutukseen osallistui laaja kansallinen verkosto. Tutkimus sisälsi monipuolisen valikoiman kysymyksiä terveydentilasta, elintavoista, työ- ja toimintakyvystä sekä terveyspalveluiden käytöstä. Tutkimuksessa oli myös laaja valikoima sosiaalisen pääoman mittaamisessa käytettyjä kysymyksiä.

Tutkimuksessa havaittiin, että sosiaalinen pääoma kasautui muun hyvinvoinnin tavoin: sosiaalista pääomaa oli eniten nuorilla, hyvin koulutetuilla ja naimisissa olevilla. Kuitenkin kaikki väestöryhmät näyttivät hyötävän sosiaalisesta pääomasta. Riippumatta sosiodemografisista taustatekijöistä runsas sosiaalinen pääoma oli yhteydessä hyvään terveyteen. Yhteydet eri elintapoihin vaihtelivat, mutta sosiaalinen osallistuminen oli voimakkaasti yhteydessä kaikkiin hyvän terveyden osatekijöihin ja elintapoihin. Sen yhteys kuolleisuuteen oli miehillä tilastollisesti merkitsevä ja naisilla lähes merkitsevä. Kroonisista sairauksista huolimatta ne, joilla oli paljon sosiaalista pääomaa, kokivat terveytensä paremmaksi verrattuna niihin, joilla sosiaalista pääomaa oli vähän. Tämä viittaa siihen, että sosiaalinen pääoma edistää terveyttä.

Terveyserot eri väestöryhmien välillä ovat edelleen suuria. Terveyttä olisi mahdollista edistää ja terveyseroja vähentää kehittämällä keinoja sosiaalisen osallistumisen lisäämiseen erityisesti niissä väestöryhmissä, joissa sosiaalista pääomaa on vähän – ja joilla usein on myös paljon terveysongelmia.

Avainsanat: yksilötason sosiaalinen pääoma, luottamus, osallistuminen, sosiaaliset verkostot, sosiaalinen tuki, koettu terveys, psyykinen terveys, elintavat, kuolleisuus, sosiaalisen pääoman jakautuminen, koulutus, asumisjärjestelyt

Sammanfattning

Socialt kapital har definierats på många olika sätt beroende på forskningstradition och forskningsområde. I denna avhandling har socialt kapital definierats som en resurs som uppstår via sociala nätverk och som kan producera nytta, till exempel god hälsa. Socialt kapital granskas här ur individens synvinkel. Även om socialt kapital uppstår i sociala strukturer drar individerna nytta av det. I denna avhandling mättes socialt kapital med hjälp av tre olika dimensioner: 1) socialt stöd, 2) sociala nätverk och deltagande samt 3) tillit och ömsesidighet. I avhandlingen granskades dessa dimensioners förhållande till levnadsvanor, självupplevd hälsa, psykiskt välbefinnande och mortalitet.

Datamaterialet består av undersökningen Hälsa 2000, som ordnades från hösten 2000 till våren 2001 i hela Finland. Till undersökningen valdes ett representativt urval av finländare över 30 år. Av personerna i urvalet deltog 89 % i en intervju och 80 % i en hälsoundersökning. Institutet för hälsa och välfärd, THL, (då Folkhälsoinstitutet, KTL) var huvudansvarigt för undersökningen, men många andra organisationer inom social- och hälsovårdsbranschen deltog också. Undersökningen innehåller ett stort urval av frågor om hälsotillstånd, levnadssätt, arbets- och funktionsförmåga och användning av hälsovårdstjänster samt flera frågor som har använts för att mäta om socialt kapital.

I avhandlingen fann man att socialt kapital ackumulerades på samma vis som övrigt välbefinnande: unga, högutbildade och gifta personer hade mest socialt kapital. Alla befolkningsgrupper såg emellertid ut att dra nytta av socialt kapital. Oberoende av sociodemografiska bakgrundsfaktorer hade stort socialt kapital ett samband med god hälsa. Sambandet med olika levnadsvanor varierade, men socialt deltagande hade ett starkt samband med alla delfaktorer för god hälsa och goda levnadsvanor. Dess samband med mortalitet var statistiskt signifikant bland män och nästan signifikant bland kvinnor. Trots kroniska sjukdomar upplevde de som hade ett stort socialt kapital att de hade bättre hälsa jämfört med dem som hade litet socialt kapital. Detta tyder på att socialt kapital främjar hälsa.

Hälsoskillnaderna mellan olika befolkningsgrupper är fortfarande stora. Det skulle vara möjligt att främja hälsa och minska hälsoskillnader genom att utveckla metoder för att öka socialt deltagande särskilt i de befolkningsgrupper som har litet socialt kapital – och som ofta också har många hälsoproblem.

Nyckelord: socialt kapital på individnivå, tillit, deltagande, sociala nätverk, socialt stöd, självupplevd hälsa, psykisk hälsa, levnadsvanor, mortalitet, fördelning av socialt kapital, utbildning, boendearrangemang

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List of original papers

- I Tarja Nieminen, Tuija Martelin, Seppo Koskinen, Jussi Simpura, Erkki Alanen, Tommi Härkänen, Arpo Aromaa. Measurement and socio-demographic variation of social capital in a large population-based survey. *Social Indicators Research* 2008;85:405–423.
- II Tarja Nieminen, Tuija Martelin, Seppo Koskinen, Hillevi Aro, Erkki Alanen, Markku T. Hyyppä. Social capital as a determinant of self-rated health and psychological well-being. *International Journal of Public Health* 2010;55:531–542.
- III Tarja Nieminen, Ritva Prättälä, Tuija Martelin, Tommi Härkänen, Markku T. Hyyppä, Erkki Alanen, Seppo Koskinen. Social capital, health behaviours and health: a population-based associational study. *BMC Public Health* 2013, 13:613.
- IV Tarja Nieminen, Tommi Härkänen, Tuija Martelin, Katja Borodulin, Seppo Koskinen. Social capital and all-cause mortality among Finnish men and women aged 30–79. Accepted for publication in *European Journal of Public Health* 2015.

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Abbreviations

BMI	Body mass index (kg/m ²)
CI	Confidence interval
CVD	Cardiovascular diseases
GHQ-12	12-item General Health Questionnaire
HDL	High-density lipoprotein cholesterol
HR	Hazard ratio
LDL	Low-density lipoprotein cholesterol
OECD	The Organization for Co-operation and Development
OR	Odds ratio
SES	Socio-economic status
SRQ20	Self-reporting questionnaire

1 Introduction

Social capital has been widely discussed in research as well as in politics for twenty years. It has been suggested as facilitating coordination and cooperation in society and to increasing well-being (1-6). The concept of social capital has been defined in many different ways in both collective and individual terms but most of the definitions include the same elements. In short, social capital focuses on social structure or social networks which are characterised by norms of trust and reciprocity and which lead to benefits.

Still, because social capital does not have an undisputed meaning, so the definition and operationalization depend on the discipline and level of investigation, that is, whether social capital is examined at the individual or at the collective level. Some researchers see social capital as a feature of individual actors within the social structure while others think it is a feature of social structure itself. (7, 8). There is a broad selection of measures from single indicators to various dimensions of social capital. Measurement of social capital has been under development but is still facing challenges.

Summing up the controversies in this field, one can mention the level of social capital (individual vs. collective), the scale on which social capital matters for health outcomes (e.g., neighbourhood or nation), definitional and measurement difficulties (for example, whether social capital includes trust or social support) and the dark side of social capital.

An increasing amount of literature has linked social capital to various health outcomes and well-being. It has been suggested that high levels of social capital are associated with good health and decreased mortality (9-19). Health consequences according to the various dimensions of social capital may also vary. As social capital has been measured in numerous ways, the comparison between the results is difficult even between similar health outcomes and also in trying to analyse the whole gamut of the various aspects of health.

Several studies have found that common physical and mental disorders are more prevalent among people belonging to lower socio-economic groups. Health behaviours and mortality also polarize unequally by socio-demographic characteristics. However, social capital may modify these associations.

The general aim of this thesis is to shed light on the potential role of social capital as a determinant of health and health behaviour. The sub-studies examine the associations between individual-level social capital and various aspects of health by taking several well-known social determinants and biological risk factors affecting health into consideration. The method of measuring social capital was developed in the first sub-study, and it follows through all the sub-studies making it possible to evaluate the results as an entity. Another aim was to describe how social capital

varies between socio-demographic sub-groups in the adult population. Although it is often pointed out that not all social capital is good capital (20, 21), this study focuses on its benefits. The following literature review and results concentrate on the associations between social capital and various health outcomes, mainly at the individual level.

2 Social capital: definition, measurement and variation by socio-demographic factors

2.1 Development and definition of social capital

2.1.1 Short history of social capital

Social capital was first articulated in 1916 by Lyda J. Hanifan, a state supervisor of rural schools in West Virginia, who discussed the importance of community involvement for schools more from the practical than theoretical point of view. He emphasized the importance of community participation for success in school.

‘If [an individual] may come into contact with his neighbour, and they with other neighbours, there will be an accumulation of social capital, which may immediately satisfy his social needs and which may bear a social potentiality sufficient to the substantial improvement of living conditions in the whole community’ (22).

Social capital was then forgotten for decades. Although it was discussed by Jacobs and Loury, they are not cited as often as some later scholars (23-25) and even though the earlier old classics in social sciences such as Durkheim (26, 27) had examined some components related to social capital in the late 19th century, the notion of social capital was established in the public domain later.

In sociology, the appeal of social capital may partly stem from the fact that it offers an alternative to economic theories (25). Economic development or growth has been perceived to depend not only on physical capital but also on intangibles such as human and social capital. The notion of social capital has offered a shared framework for both economists and sociologists.

Although an American sociologist, Mark Granovetter, never explicitly used the concept of social capital, his article on ‘strong and weak ties’, published in 1973, has promoted the development of the theory of social capital. He discussed how individuals can gain access to resources through their weak ties which mean acquaintances and other similar informal relationships.

‘...those to whom we are weakly tied are more likely to move in circles different from our own and will thus have access to information different from that which we receive.’ (28)

This idea about information as a resource in networks later became a defining feature of social capital. For example, it has had an influence on the thinking of Coleman and Putnam. (25). After a fallow period, social capital appeared again and became better-known through the writings of Bourdieu, Coleman and Putnam (1, 29, 30) during the 1980s and 1990s. Since then, the research and discussion on social capital have expanded rapidly.

As the notion of social capital began to develop internationally, publications in sociology and economics led the way. The range of disciplines gradually expanded and changed so that by 1998 health was one of the leading disciplines. (31)

Social capital became popular in the sciences generally in the 1990s. In Finland, the discussion of this notion began in 1997 with an article freely translated as ‘Social capital: A notion worth examining’ (32). This was followed by others (16, 33) during the same decade. (31). Soon this term became popular in the media and was in frequent everyday use. The enthusiasm began in the 2000s as can be seen in the rapid growth in the number of articles.

Bourdieu, Coleman and Putnam are probably mentioned most often when discussing the development of and publicity on social capital. However, they define social capital in different ways. The French sociologist Pierre Bourdieu formulated social capital as

‘... the aggregate of the actual and 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 collectivity-owned capital, ‘credential’ which entitles them to credit, in various senses of the word’ (29).

According to James Coleman, Bourdieu’s American colleague, social capital was defined by its function:

‘It 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’ (1)

Robert Putnam, an American political scientist, considered social capital as the property or networks of a community, not possessed by individuals. He and his co-writers define it in the following way:

‘...social capital refers to features of social organization, such as trust, norms, and networks, that can improve the efficiency of a society by facilitating coordinated actions’ (30)

Putnam regarded a society with high levels of social participation, trust in others and reciprocity as a source of mutual benefits that increase the interaction between people and facilitate co-operation.

Bourdieu emphasised the relationships that give individuals access to resources possessed by other members of the network. Both the quality and the quantity of those resources matter. Coleman regarded families as the basis for the creation of social capital, which leads to opportunities and the educational success of the children. Coleman suggested that when an individual does something for another, he/she trusts this will be reciprocated in the future. He also stressed the collectivity and the better flow of information in social networks. He thought that social capital was an important resource for individuals and for the wider community (public good). He considered that social capital was a characteristic of the social structure which benefited all those who were part of it. For both Bourdieu and Coleman, the primary units of analysis were individuals and small groups. However, Coleman's ideas were somewhere between those of Bourdieu and Putnam in regard to the two levels of social capital.

Putnam and with his co-writers highlight social capital as a phenomenon that facilitates coordinated actions between individuals and in society, which makes societies work better. It is a public good. Besides benefiting the person making the investment, social capital may benefit others within the social network, as well as others outside the immediate network. (3, 30). Fukuyama (34) interprets social capital much as Putnam does at the macro level. He sees social capital the ability of people to work together for common purposes. He considers that a family business is typical of low-trust societies where the family members do not trust outsiders, whereas wealthy business based on professional management is typical of high-trust societies. This example is in accordance with Putnam's studies of northern and southern Italy (30).

These scholars see social capital as productive facilitating certain actions and enabling the achievement of actions that would not be possible without social structures and relationships.

Many organizations – like the World Bank, the OECD and statistical offices in several countries – have also done meritorious work on the definition and measurement of social capital. One well-known and often-used ecological definition of social capital has been published by the OECD: 'networks together with shared norms, values and understandings that facilitate co-operation within and among groups' (4). The definitions used by these organizations vary according to their standpoints. The World Bank views social capital from the economic perspective arguing that social capital is critical for economic growth and sustainability, while the perspective of the OECD was developing countries.

Discussing the definition of social capital at the micro level, Alejandro Portes (see Chapter 2.1.2) and Nan Lin are scholars who are often mentioned. Lin sees social capital rather as an individual resource: 'resources embedded in a social structure that are accessed and/or mobilized in purposive actions' (35). According to Lin, the useful resources in social structures can be mobilized for the purposes of the members of these networks. Those resources may be financial resources or useful contacts that may profit the individual. The profit may be instrumental (wealth, power, reputation) or expressive (better health or quality of life). (36). About the same time, Glaeser also pointed out that the decisions to invest in social capital are made by individuals, not communities (37).

Social capital has been defined in numerous ways, albeit the definitions seem to have concentrated on the same core elements.

2.1.2 The two levels of social capital

From the outset, there seems to have been two major approaches to the level of defining social capital. Some scholars see it as a collective property, while the others see it as an individual property. Despite the varied views, some of the definitions of social capital mentioned earlier have become popular including those definitions by Putnam, the OECD and Lin.

Fulkerson and Thompson described these two different schools of social capital. The first school sees social capital as a process and a normative 'cure-all' (as in Coleman and Putnam), the other as a resource that may be used to create or maintain social inequality (as in Bourdieu, Portes and Lin). The 'normative social capitalists' view social capital as a universal explanation for patterns of development in terms of varying levels of norms of trust and reciprocity, cohesion and solidarity. They examine social capital from the perspective of social organization. The 'resource social capitalists' see social capital as investments that individuals make in their networks of relationships with the expectation of some kind of future return. As a resource, social capital can be converted interchangeably into some other form of capital. (25)

Portes saw similar features among the varied definitions in 'the ability of actors to secure benefits by virtue of membership in networks and other social structures' (38). Portes acknowledged social capital both at the individual and collective level. This dichotomy between ecological and individual social capital has remained a matter of debate until recently. However, the two levels do not necessarily rule each other out. The idea that social capital can be seen as a characteristic of individuals, the community or society has gained increasing support lately (39, 40).

2.1.3 Dimensions and forms of social capital

The one thing on which there seems to be a prevailing consensus is that social capital is a multidimensional phenomenon. The definition of the dimensions has

moved from a broad range towards the core dimensions including social networks, social participation, social trust, reciprocity and social support.

Social networks, which have been described as ties between individuals and groups, describe the degree of an individual's integration into social settings. Social integration can be defined as the extent of participation in social activities and social relationships. (41). Networks may be either formal or informal. Formal organisations include volunteer groups and associational activities while informal networks include friends, neighbours and work-related acquaintances. The volume of these networks can be described by their number and the frequency of the contacts. (42).

Social networks can be characterized as bonding, bridging and linking (43-45). Bonding refers to the homogenous groups of people with similar social identity, whose relationships comprise family members and close friends. Bridging social capital, which appears outside the immediate social network of an individual or a group, refers to dissimilarity—individuals in different groups, communities and across socio-economic status—which is covered by respect and mutuality. These more distant connections between people are characterized by weaker, but more cross-cutting ties: for example, business relationships and acquaintances. (43, 45, 46). Bonding social capital has been said to be good for 'getting by' and bridging social capital good for 'getting ahead' (47).

Linking social capital covers the contacts between actors who are unequal in their power and access to the resources: for example, in the working life hierarchy. People interact across explicit, formal or institutionalized power or authority gradients in society but within the atmosphere of norms of respect and trusting relationships (45). These forms of social capital shape the mechanisms of social capital and explain the kinds of interactions individuals have within groups of mutual identity (43). These components overlap with horizontal networks (at the same social level) and vertical networks (at the different social level). Horizontal networks include people with equivalent status and power, whereas vertical networks include people with unequal power. This is related to Granovetter's strong and weak ties. Strong ties refer to intimate relationships that are close and regularly maintained, whereas weak ties are less intimate relationships with acquaintances. It is argued that strong ties provide social support and companionship, while weak ties are more important because they are more likely to provide access to diverse information and enable people to seek new resources. (28). Ferlander has followed in the footsteps of Putnam and Woolcock by describing the association between different forms of social capital discussed in the literature. According to these scholars, strong ties obtain with people emotionally close to oneself, while bonding ties refer to people similar to oneself. Weak ties occur with people emotionally distant from oneself, while bridging ties are with people different from oneself. Even close friends can however be dissimilar to each other when it comes to their

backgrounds. Bonding networks provide protection and social support, but bridging networks are more innovative and have access to a greater information flow. (3, 48, 49). This sounds similar to weak and strong ties. Still, it has been suggested by arguing that ties differ in degree rather than in kind that strong ties and bonding networks or weak ties and bridging networks are not synonyms (50).

Nyqvist has presented a synthesis of the various forms of social networks based on Ferlander (48, 51), see Table 1.

Table 1. Synthesis of different network ties.

Direction of ties	Type of ties	Strength of ties	
		Strong ties	Weak ties
Horizontal	Bonding ties (similar social backgrounds)	Close friends or immediate family with similar social characteristics	Members of homogenous groups
	Bridging ties (dissimilar social backgrounds)	Close friends or immediate family with different social characteristics	Members of diverse groups
Vertical	Linking ties (unequal hierarchical positions)	Ties between a caregiver and a care receiver	Ties between citizens and civil servants

Modified from Nyqvist (2009), Table 1, p. 22.

Participation can be described as a collective action. *Social participation* in diverse networks enables individuals to access resources that would not be possible otherwise. It may strengthen self-esteem and coping strategies. Civic participation includes both individual choices like voting or petition signing, and a collective action in the form of collaboration. (52). Participation keeps societies together and it may facilitate the empowerment and accountability of an individual. (53-56).

Most scholars consider *trust* an essential dimension of social capital. The literature on social capital mentions at least two forms of trust: social trust or interpersonal (trust between people) and institutional (trust in formal institutions or political system). Social trust has been divided further into trust in familiars within

established networks, and generalized trust that is extended to strangers. Trust is an individual trait acquired during early life but is also a socially constructed concept influenced by societal and cultural context. (42, 57). Trust is important for establishing the human relationships necessary for interaction with other people. It is a property of individuals as well as social systems. Social norms adjust trust in society, where trust may reduce insecurity.

Social relations create value through *reciprocity*, which is the willingness to help others. This includes the expectation of help in return in the future. Values influence the norms of reciprocity. (34, 43, 58).

Social support has been seen as a process of interaction in relationships which improves coping, esteem, belonging and competence. Perceived support is an individual's belief that social support, which may be psychological, physical or financial, is available. (59-61).

The dimensions of social capital have also been classified further being divided into structural and cognitive components. Structural social capital, which consists of networks that link people and groups together, refers to what people do. It is usually described as the intensity of activity in social networks, and social and civic participation. Structural social capital facilitates information sharing and collective action. The cognitive aspect, which derives from mental processes, is what people feel and their perceptions, including shared values, attitudes, norms, support, trust and reciprocity among members of the same group or community. It is considered to shape behaviour and contribute to co-operation. Although structural and cognitive forms appear together and are interrelated, they are also distinguishable and recommended to be examined separately if possible since their association with outcomes may vary (7, 44, 48, 62-65).

2.1.4 Related concepts

The concept of social capital can be seen to overlap with several other concepts, such as other forms of capital, social capacity, social cohesion and sense of coherence.

Different types of capital have been described. Adapted from Bourdieu (29), the forms of capital are often classified as economic, human and social. *Economic capital* includes monetary assets, labour, land, tools, etc. *Human capital* means knowledge, skills, social and personality attributes. Human capital was introduced by arguing that if workers are educated, trained and healthy, it is possible to utilize the conventional factors productively. (66, 67). That is, those skills and capacities can be put to productive use. They reside in people, whereas social capital resides in relationships. Human capital has been described as 'what you know', while social capital is 'who you know'. In contrast to economic and human capital, social capital benefits all individuals within the relevant social structure (68). Additionally, a fourth form of capital, *cultural capital*, has been mentioned sometimes. This means

values, history and traditions which link a specific group of people together, providing a sense of identity. (69).

Social capacity forms in the dynamic interaction between an individual, various individual factors and social networks, the environment and society. Good social capacity facilitates the formation and maintenance of social relations, and hence the growth of social capital as well. (70).

Social cohesion is related to social capital, and is sometimes even used wrongly as its synonym. The concept of social cohesion was first used by the French sociologist Emile Durkheim (71), who considered it as an ordering feature of a society, defining it as the interdependence between the members of the society, shared loyalties and solidarity. Social cohesion is the feeling of a common identity, a sense of belonging to the same community. It has been called as bonds or glue that brings people together in society. Social cohesion has been described in terms such as belonging, inclusion, participation, recognition, legitimacy and respecting and tolerating differences in a pluralist society. However, it has been criticized as an ill-defined term. According to the Oxford Dictionary, 'cohere' means 'hold firmly together, form a whole'. (72-74). Social cohesion is a broader concept than social capital. According to OECD, the components of social cohesion are social inclusion (lack of poverty and income inequality), social capital (interpersonal trust and civic engagement) and social mobility (peoples' ability to change their position in society) (75).

Antonovsky's *sense of coherence* is a theoretical formulation providing an explanation for the role of stress in human functioning. The sense of coherence has three components: comprehensibility (the predictability and understandability of life events), manageability (things being manageable and within your control) and meaningfulness (the belief that things in life are interesting and can give satisfaction). Individuals with a strong sense of coherence perceive their lives as comprehensible, manageable and meaningful. Social relationships and social support strengthen the sense of coherence. Both the sense of coherence and social capital are concentrated on factors promoting health. According to Antonovsky, since all factors that facilitate effective coping are generalized resistance resources, a sense of coherence and social capital can be both construed as such resources. (76-79).

To summarise, these related concepts are related to each other but have distinctive features as well. Social capacity is needed for the formation of social capital. A strong sense of coherence in adulthood helps the coordination of other resources. Intersecting ties between groups build social cohesion. Social cohesion is not possible without social capital: in other words, social capital can be seen as a prerequisite for social cohesion. (80, 81).

2.2 Measurement of social capital

There have been several efforts to develop the measurement of social capital (3, 7, 82, 83). Due to the definitional fluctuation and both the multidisciplinary and multidimensional nature of social capital, the measurement of it has encountered challenges. There has been large variation in the ways of operationalising and measuring social capital, which has led to difficulty in the comparability of the results. Social capital has been measured by single indicators (30, 34), a variety of questions covering different dimensions (84, 85) and by indices of social capital (3, 86). Additionally, social prestige associated with the social position of network members and specific resources available in the respondent's network have been measured by a 'position generator' and 'resource generator' (83, 87, 88).

The difficulty of observing social capital directly has necessitated the use of proxy measures. Starting from a wide variety of questions, the key components have condensed down to social networks or social participation and trust and reciprocity. Social norms have also often been mentioned, but not often measured separately. Norms seem to be considered as included in the social structures or trusting social networks.

According to Ferlander, people get to know each other through participating in social networks, which offers a sense of solidarity, belonging, trust and reciprocity and makes it easier to get information. This is supposed to benefit the social network members (89). Social networks have been measured through their size and composition, or on the basis of the strength of ties.

The feelings of trust and reciprocity present in the networks are also widely used measures of social capital (88). Trust and reciprocity are important in social networks. The more people trust each other, the more they may obtain advantages through social networks (for example, a new job). Trust can mean trust either in other people or institutions and can be particularized or generalized; that is, trust between people personally known, or trust between people not personally known to one another. Probably the best-known measure of generalized trust is the question developed by Rosenberg: 'most people can be trusted or you can't be too careful in dealing with people'. (90, 91). This indicator is included in various questionnaires, such as the Social Capital Community Benchmark Survey (52, 92), the Social capital Questionnaire (55), the European Social Survey (93), the General Household Survey (94) and the World Values Survey (88).

While social support has often been used as one dimension of social capital (95), there are conflicting views of its role. Some theories exclude social support from social capital (96), whereas others see it as a product of social capital (38).

Collective level social capital dominated the research at the beginning of 'the big bang' of social capital. Individual level social capital also appeared later. Since then, there has been an on-going debate about the "right" level of social capital (see Chapter 2.1.2). Empirical findings have supported both theories (39, 97). The

community level studies often aggregate the individual answers in surveys to the area level. Some studies have also used register-based area-level data about voting, crime rates or number of associations (98, 99).

Social capital has been measured in many ways, the questions used to measure it varying according to the discipline and the level of social capital (individual or collective). Naturally, the content of the surveys and the availability of suitable questions have also had an impact on the measurement opportunities. Table 2 compiles examples of the variables commonly used in previous research and projects designed to measure social capital at the different levels and under different dimensions around the world. The dimensions can be classified in various ways. They may be separate or imbricated, and include more or fewer questions than are listed under each dimension in Table 2. (3, 88, 91, 100-102). Some of the variables are clearly for the individual or community level examination of social capital, while some are quite similar for both levels. One example of the individual level is 'Number of cultural, leisure, social groups belonged to', and for the community level 'Civic and social organizations per 1000 population'. The list of measures of social capital in Table 2, and reports of where they have been used is not comprehensive.

One challenge for measurement has been the difficulty of separating the form, source, and consequences of social capital (34, 38). For example, some dimensions may be both sources and consequences, like trust, which may be needed in developing social networks, but on the other hand it can increase in networks as well.

Table 2. Examples of measures of social capital.

Dimension of social capital	Questions used in measurement of social capital (sources)
Social networks	<ul style="list-style-type: none"> • Frequency of seeing and speaking to relatives, friends and neighbours (1-5) • Virtual networks – frequency and intensity of contact (1) • Number of friends (1-3) • How many close friends or relatives live nearby (1)
Social participation	<ul style="list-style-type: none"> • Number of cultural, leisure, social groups belonged to; frequency and intensity (1-4, 6) • Involvement with voluntary organizations; frequency and intensity (1-5) • Religious activity (1-3,5)
Civic and political participation	<ul style="list-style-type: none"> • Perceptions of ability to influence events (1) • Being well informed about local or national affairs (1) • Contact with public officials or political representatives (1-3) • Involvement with local action groups; frequency (1,5) • Propensity to vote, voting (1-4) • Turnout in elections (7) • Civic and social organizations per 1000 population (7) • Mean number of group memberships (7) • Number of non-profit organizations per 1000 population (7)
Trust and reciprocity and shared norms and values	<ul style="list-style-type: none"> • Trust in other people (1-5, 7) • Trust in institutions (1-6) • People will do favours and vice versa (5) • Perception of shared values (1-3) • Beliefs about personal safety when walking alone in local area after dark (3)
Social support	<ul style="list-style-type: none"> • Who can be relied on to provide help; who provides help to whom (3, 6) • Perceived control over life (1) • Satisfaction with life (1-2)
Level of empowerment	<ul style="list-style-type: none"> • Perceived control over life (1,5) • Self-esteem and confidence (8) • Satisfaction with life (1)
Views of the local area	<ul style="list-style-type: none"> • Views of physical environment (1) • Facilities in the area (1) • Enjoyment of living in the area (1) • Fear of crime (2-3) • Safety in the neighbourhood after dark (2-3)

Sources:

- 1) Harmonised Question set of Social Capital Questions (103)
- 2) Economic and Social Research Institute (104)
- 3) Australian Bureau of Statistics (ABS): Aspects of social capital (105)
- 4) Framework for the measurement of social capital in Statistic New Zealand (106)
- 5) World Value Survey (107)
- 6) General Social Survey (GSS) (94)
- 7) Putnam's Social Capital Index (3)
- 8) Canadian Community Health Survey (CCHS) (108)

2.3 Socio-demographic variation of social capital

The distribution of social capital varies according to socio-demographic factors. While some of the results are quite consistent, there seem to be differences in results on the association between different socio-demographic factors, dimensions of social capital and type of country even in Europe; for example, between transition and non-transition countries. (109). Some examples of these results are presented in this chapter.

Age has been found to be associated with the levels of social capital. It has been suggested that both general and institutional trust increases with age, while social support decreases (110). A positive impact of age on formal networks and a negative impact on informal networks have been shown. It has been assumed that ageing people tend to join organizations increasingly but lack of time for them both may simultaneously decrease informal networks. (111, 112).

Gender differences have been found as well. Women are slightly more likely than men to know and trust their neighbours. They are also more likely to contact their relatives. On the other hand, men report having a larger number of close friends living nearby than women. However, women get more emotional support than men. (113).

Associational involvement is about as common among men and women, although the areas of interest differ, women being slightly keener on local things, especially when they have small children, and men in other activities, such as politics, recreation and sports. One explanation of these differences might be the longer time men spend on leisure activities compared to women, who spend more time on domestic duties. (114, 115). It has been suggested that men have greater access to bonding and linking social capital—indicated as engagement with networks—and women to bridging social capital. Some findings show that men also have higher levels of trust than women (112, 116), but there are conflicting findings as well (111). It has been suggested that men are more trusting in the abstract sense but women more so in specific, concrete situations (109).

Higher levels of income and education are associated with a stronger probability of both interpersonal and generalized trust, group membership and civic engagement. People on low income also tend to participate less and to be less trusting than people with higher income levels. Higher income is also associated with more institutional trust. (116-119). However, it is unclear whether the association is similar between education and institutional trust or quite the reverse (109).

People living with a partner trust more in other people than those living without partners (7). Marriage increases the likelihood of men and women joining various groups.

Town size has been reported to be related to participation. It has been suggested that urban people have less informal social contacts than those in smaller settlements. Contradictory results suggest that in smaller towns both formal and informal participation are reduced. (120, 121).

2.4 Summary

The definition and measurement of social capital depends on the discipline and level of social capital in question. Social capital has been measured in several ways by using proxy variables. Single measures, groups of questions, varied dimensions of social capital and indices have been used in measurement, both at the ecological and at the individual levels. As social capital is a multidimensional concept, deeper understanding of it can be achieved by analysing several dimensions simultaneously, as performed in present study.

It has been suggested that social capital 'is not a homogenous resource that is equally created, sustained and accessed by all members of a particular community. People are embedded in local networks in different degrees and in different ways'. (122). The social needs of individuals are not equal and they may also change during the life cycle. Since we cannot assume that all members of a network have equal interest in and equal access to all the resources needed for collaboration (123), it is natural that the distribution of social capital varies in a given population. However, we should be aware of the possibility of a systematic difference according to socio-demographic factors which may lead to health inequalities. Several studies suggest that socio-demographic factors impact the distribution of social capital in various ways. However, research findings are somewhat inconsistent. (124). In consequence of the suggested benefits of social capital, a national follow-up of the distribution of social capital could be important.

3 Social capital and health

Genes, environment, hormones, behaviour and socio-economic factors are known determinants of health. The association between social factors and health has also been recognized. The relationship between social networks and mortality among Californian adults in Alameda County was reported in 1979. The findings suggested that people who lacked social and community ties were more likely to die during the nine year follow-up period than those with more social contacts. This association was not dependent on self-reported physical health, socio-economic status, health-related behaviour, obesity or utilisation of preventive health services.

The social ties were measured as marital status, contacts with close friends, church membership and associational group membership. The study found that people who lacked social and community ties were more likely to die during the follow-up period than those with more contacts, with two exceptions: Group membership was not a statistically significant predictor of mortality among men and neither was marital status among women, but the other social contacts were likely to lower mortality. This study constructed the Social Network Index, which weighted more the intimate contacts more than church and other group memberships. If this way of measuring social contacts were compared with social capital, this index put more weight on bonding than bridging ties. In their discussion, the authors of this distinguished study suggested that future studies should be done by using more dimensions of social and community ties. (125).

The associations between social capital and health were noticed after the study on social capital and mortality at the community level (6). During the last ten years, the association between social capital and health has come up frequently. The number of articles in epidemiology and public health has increased sharply. The pioneer in this field has been the findings on income inequality, social capital and health study by Ichiro Kawachi and his colleagues (6, 14), who identified the association between community social capital and mortality in 39 US states. Social mistrust, lack of helpfulness and voluntary group membership were positively associated with all-cause mortality. Since then, an increasing amount of literature has linked social capital to various health outcomes and well-being (11, 13, 15, 126). The number of studies at the individual level spread as well, the majority obeying cross-sectional and concentrating to adult populations in developed countries. The number of longitudinal studies is gradually increasing as well.

The potential association between social capital and health has been measured using outcomes such as health-related behaviours (127), self-reported health (16, 116, 128-130), mental health (131, 132) and mortality (17, 133). Some specific diseases, such as cardio-vascular diseases (134) and diabetes (135), have also been studied.

Several psychological, psychosocial and physiological mechanisms have been hypothesised to link social capital and health. Psychological effects include social networks that may promote the individual's self-esteem by social integration and provide support in stressful situations. Psychosocial factors, such as depression or stress, may also affect health through physiological or mediating behavioural choices.

Physiological mechanisms may decrease blood pressure or stress hormones, or increase hormones, such as oxytocin, or strengthen the immune system. Additionally, health behaviour, information flow and norms have been suggested as mediated factors (e.g. (126)).

Then again, criticism of the widespread ideas of positive associations between social capital and health has been proposed recently based on a systematic review of fourteen studies up to October 2012 and evaluating the effect of social capital on all-cause mortality, cardiovascular disease and cancer. The study found only limited evidence for the association. Most of the social capital dimensions had no effect on health indicators, except social participation and civic participation, which were associated with some beneficial effects on all-cause and cardiovascular mortality. This study also recommends more research on pathways to health and finding a consensus on how to measure social capital. Stronger evidence might be possible to find without so much trouble in comparison of the results. (136).

In the following, previous findings concerning the association between social capital and the health outcomes used in this study (health behaviour, self-rated health, mental health and mortality) are reviewed. A systematic search for relevant literature was done in various databases (PubMed, PsychINFO and Web of Science). The key terms in the field of this thesis were used in this search, including for example social capital, social participation, trust, social support, health, self-rated health, mental health, psychological health and mortality.

3.1 Health behaviour

Health behaviours, which are related to socio-demographic factors, have been shown to play an important role in health and mortality inequalities among adults (137). The association between social capital and health behaviour has been examined from the perspectives of sexual risk behaviour (138), the number of cigarettes smoked (139), binge drinking (140), overweight and diabetes (135), and physical activity (141, 142).

Low social participation has been associated with daily smoking, and high levels of social participation and networks with increased likelihood of smoking cessation. Civic participation has been associated with moderate alcohol consumption. High levels of trust were associated with non-smoking but not with use of alcohol. (143, 144).

The positive association between social or civic participation and leisure-time physical activity has been confirmed in several studies (142, 145-147). Among Australian adults, low levels of social participation, networks and support were associated with physical inactivity (148). However, the findings on trust and physical activity have been inconsistent. Multilevel logistic analyses on physical inactivity in an urban adult population in Canada found that generalized trust was not associated with physical activity (146), while in England, Poortinga (2006) found that people with higher levels of generalized trust tended to be more physically active (147). In Sweden, low trust has also been reported to be associated with leisure-time physical inactivity (149).

Social support, trust and civic participation have all been linked with fruit and vegetable consumption. People with lack of social support used less fruit and vegetables than those with high levels of support (144). Swedish data associated active social participation more closely with use of more vegetables than at a less active participation level (150).

It has been also suggested that health behaviours act as mediators between social capital and health, but the evidence is still slender. (126, 127, 144). Against the public hypothesis, some studies did not find evidence of health-related behaviour mediating the association between social capital and self-rated health (151) or survival (133). In the first study, health-related behaviour included alcohol consumption and smoking, and in the second one physical activity and BMI as well.

3.2 Self-rated health

Self-rated health is a valid measure for overall health, reflecting particularly the physical and functional aspects of health (152). It predicts mortality (153). Several studies have suggested a positive association between social capital and self-rated health at both the individual and the collective level in terms of measures of civic participation, social participation and networks, interpersonal trust, reciprocity, and a sense of security in the neighbourhood (39, 55, 85, 154).

Rose suggested that social networks were associated with physical and emotional health (130). However, another study did not find this kind of association between trust and health. Only civic participation was related to health among the elderly (155). Comparing adults in 18 European countries, activity in voluntary associations, trust in people and confidence in the legal system were not associated with self-rated health after economic factors were considered. (156).

Hyypä and Mäki were the first in Finland to examine social capital (friendship, neighbourhood assistance, and leisure participation) and self-rated health. They compared the Finnish- and Swedish- speakers living on the west-coast of Finland. The study showed that Swedish-speakers had more social capital than Finnish-speakers. Friendship, trust and congregational membership were positively related to

self-rated health. (16, 151). Since then, a positive relationship between social capital and health has been reported in certain regions, among language groups and older age groups, and at work places in Finland (51, 157-159).

According to a panel study in Sweden (9), having a close friend had a positive association with self-rated health. Other studies have suggested that inactive social participation was connected to poor self-reported health (85, 160).

Two different reviews on social capital and various indicators of health indicated area, workplace and individual social capital as generally appearing to have positive effects on health outcomes. Strong evidence was found, especially of the association between individual-level social capital (trust, participation) and self-rated health. (11, 161).

3.3 Mental health

Mental illness is among the top causes of years lost due to disability. McCulloch was one of the first to study the associations between social capital and mental health. This study suggested that people at the lowest levels of neighbourhood social capital have increased risk of psychiatric morbidity measured by GHQ-12. (162).

Harpham et al. and Lindström found that low trust is associated with poor mental health measured by SRQ20 and GHQ-12. (84, 85). In Finland, low levels of trust and reciprocity between co-workers, and a shortage of trusting relationships between superior and employee, were associated with an increased likelihood of new onset depression and recorded antidepressant treatment (159).

A cross-sectional survey in Australia found that trust in people, feeling safe in the community and having social reciprocity were associated with a lower risk of mental health distress, measured by Kesslers psychological distress scale, K10. Community participation was not related to mental distress. (163).

According to a systematic review of 14 studies on social capital and mental health at the individual and 7 at the ecological level, the individual results offered evidence for an inverse association between cognitive social capital (feelings of trust and reciprocity) and common mental disorders. No clear evidence for a similar association was found at the ecological level but it was more difficult to compare the results because of differences in methodology, the population investigated and the outcomes of mental disorders. The findings concerning structural social capital were inconsistent. (13).

The study on panel data of British adults found a strong positive association between generalised trust and psychological health over time (132). Psychological health was measured by GHQ-12. Social participation and networks were not related to psychological health when all significant variables were adjusted for. By using the Depression scale from the Center for Epidemiologic Studies for measuring psychological health, and a position generator for social capital in the US sample, a

path analysis model showed that network resources have a direct negative association with psychological distress. (164).

A multilevel study in Japan suggested that cognitive social capital (trust) as well as structural social capital (membership of sport, recreation, hobby and cultural groups) were associated with individual mental health status (165).

A recent review of social capital and mental well-being among older people covered 11 studies in several continents. This review showed that all studies found positive associations between elements of social capital and mental well-being. Two of the studies analysed social capital both at an individual and collective level—levels affecting mental well-being positively. However, since all studies included in this review were cross-sectional, reversed causality should be kept in mind. It may be that older people have reduced social participation because of health problems. Neither was comparing the results arising from different indicators of social capital trouble-free. (19).

3.4 Mortality

Several studies have reported inverse associations between different dimensions of social capital and mortality. A Swedish survey on living conditions found that low levels of cultural participation were related to increased mortality (17). The effect of social support, social participation and locus of control on mortality among an adult population (18+ years) was examined in Norway. After controlling for socio-demographic and biological factors, low social participation and to a lesser extent few close relationships and external locus of control were associated with increased mortality. (10).

A follow-up study examined the association between social ties, social participation and mortality among US male health professionals aged 42–77 at the baseline. After 10 years' follow-up, a higher risk of mortality was found among socially isolated men. (166).

Leisure participation was suggested to predict survival in Finland. Social capital (residential stability, leisure participation and interpersonal trust) was assessed as a predictor of all-cause and cardiovascular mortality among 30–99 year-old Finns during the 24-year follow-up period. Active leisure participation was associated with reduced all-cause mortality. Among women, low interpersonal trust predicted both all-cause and cardiovascular mortality. (167). In line with this, lack of social and religious participation has been shown to be related to increased mortality in the general population of Norway as well as among older people in Dartmouth, U.S., after cardiac surgery (10, 168).

The association between social capital and all-cause mortality was analysed among people aged 65 or over by a prospective cohort study in Japan the average follow-up time being 4.29 years. The findings were that a friendship network

predicted reduced all-cause mortality. Surprisingly, low general trust was related to lower mortality among women. (169). The findings have not been always very clear. Even though positive associations between high levels of social capital and mortality are rare, both significant and non-significant inverse relationships have been found. And due to the large selection of risk factors for mortality, it is a challenge to include all in one analysis. (159).

3.5 Summary and gaps in the evidence

There is a prevailing perception that there is a positive association between social capital and health, although criticism has also been heard. There is promising evidence about the associations between social capital and self-rated health in the population and among employees (170, 171), cardiovascular diseases (134, 167), mental health (13, 19, 64) and mortality (172). However, both health and social capital are complex phenomena, and there is still inconsistency in the research findings. A recent systematic review of fourteen prospective studies on social capital and health found no association between most social capital dimensions and all-cause mortality, CVD or cancer (136). Additionally, since many studies have covered only limited dimensions of social capital or those potential factors that may confound the association between social capital and health indicators, there is still a need to provide more evidence about the associations between social capital, socio-demographic factors, health and health behaviour.

There is some evidence that low levels of social capital are associated with poor health behaviours. The findings on the potential role of health-related behaviour as a mediating factor between social capital and health have been few and inconsistent. Only limited support for this mediating role of health behaviour has been found so far. (144, 173).

Despite a growing number of studies on these topics, comparability is not straightforward due to variability in operationalization and measurement of social capital. The present study develops a measurement instrument for social capital and uses it systematically in all phases with various health indicators. This will form a coherent whole and lead to better understanding of the associations between the dimensions of social capital and aspects of health. For one, this present study contributes to the discussion on social determinants of health.

4 Aims and framework of the study

The general aim of this study was to examine the associations between social capital, health behaviour and health among the adult Finnish population. In order to perform valid analysis of these associations, an appropriate way of measuring social capital was needed. During the time this research data was collected, no generally accepted ways to measure individual-level social capital existed. The specific aims were:

- 1) to contribute to the measurement of social capital by means of identifying its various dimensions and by developing a suitable way to measure these dimensions through all the sub-studies (Sub-study I)
- 2) to describe the variation in social capital according to the socio-demographic categories of age, gender, living arrangements, education, income and region (Sub-study I)
- 3) to find out how social capital is related to health-related behaviours (Sub-study III)
- 4) to examine the association between social capital and health, indicated by self-rated health and psychological well-being, and all-cause mortality (Sub-studies II and IV)
- 5) to investigate whether social capital is associated with health directly or via health behaviours (Sub-study III and IV)

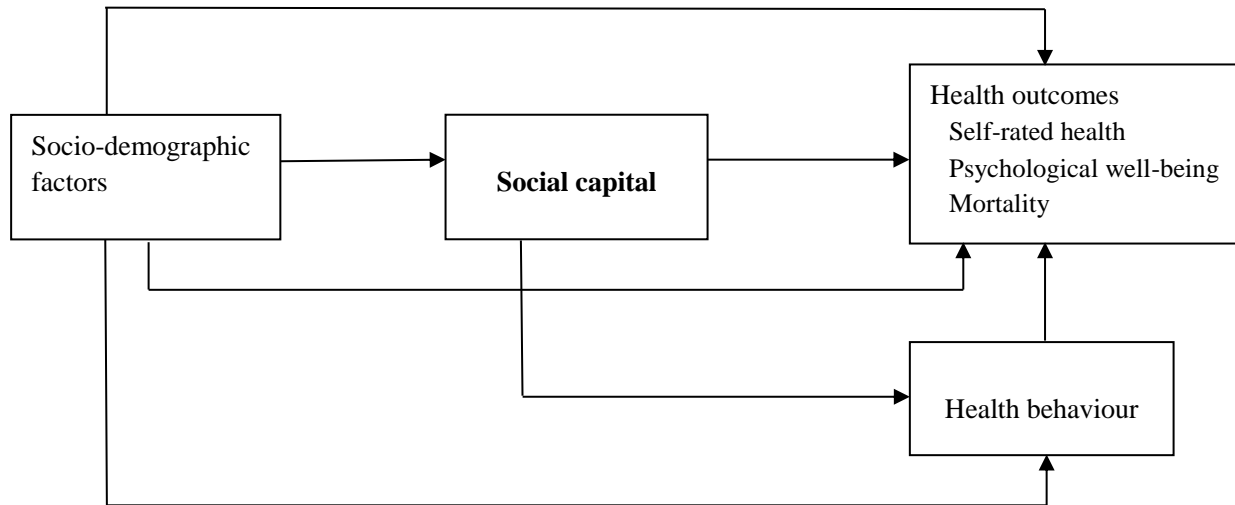
Figure 1 presents empirical framework for this study and the simplified model of assumed associations between social capital, socio-demographic characteristics, health behaviour and health outcomes.

As indicated in the foregoing literature review, socio-demographic factors have been associated with social capital. Both of them are also associated with health behaviour and health outcomes (self-reported health, psychological well-being and mortality). Social capital may influence health either directly or through health behaviour. Socio-demographic factors may thus confound the association between social capital and health behaviour or health while health behaviour is assumed to

act mainly as a mediator between social capital and health. Although not indicated in this figure, some associations may be partly bidirectional: for example, poor health may limit one's ability to participate in social activities.

In this study, social capital is measured at the individual level on the assumption that an individual's investment in group activity reflects social capital seen as a resource related to social networks and group membership. Individual benefits are accessed through social connections in various groups and society. Thus the resources do not reside within the individual but rather in the structure of a person's social networks.

Figure 1. Framework and assumed main associations between social capital, socio-demographic characteristics, health behaviour and health outcomes.



5 Data and methods

5.1 Study population

Data from the nationally representative Health 2000 Health Examination Survey (see www.terveys2000.fi), carried out from autumn 2000 to spring 2001, was used in all four sub-studies. The two-stage cluster sample of 8028 people aged 30 years or over also included people in institutions. People aged 80 years or over were over-sampled by doubling the sampling fraction to make sure that a sufficient number of old examinees were included. The data were collected by means of an interview and self-administered questionnaires and a comprehensive health examination. The response rate was good, varying between 80 and 89 % from section to section. (174, 175). Most people participated in all parts of the study, and 93% of the sample answered at least the most important health questions (174).

We applied the data from an interview and two self-reported questionnaires among Finns aged 30 and over (Sub-studies I–III) and the clinical health examination among those aged 30–79 years (Sub-study IV). The Health 2000 data had also been complemented with register-based information, such as income and education, (Sub-study III), and follow-up of mortality of the respondents, concerning the period 2000–2009 (Sub-study IV).

5.2 Ethical questions and data protection

The data security was of a high standard and all record linkages were performed according to current regulations. The necessary permissions for register linkages and the informed consent of the subjects had been acquired. Linking the register data was carried out in close cooperation between all the organisations involved in the survey, and special attention was given to data protection. The data protection directions and ethical regulations issued by the data protection authorities, the National Public Health Institute and Statistics Finland have been followed in all study phases and with all data sources. Personal identification codes and addresses were deleted before the researchers obtained access to the data. (176).

5.3 Measures

The indicators of social capital are presented at the beginning of this section, followed by the indicators of health behaviours and health. I then go through all the socio-demographic characteristics, and eventually long-standing illness, functional capacity and biological risk factors for mortality. The frequencies of

these indicators by gender appear in Appendix 1. Table 3 shows the design, variables and statistical methods used in sub-studies.

5.3.1 Social capital

Based on a review of existing measures of social capital, a broad selection of suitable questions available in this research data were chosen as the most comprehensive measures of the dimensions and forms of social capital possible (see Appendix 2). These include questions about leisure-time participation and social communication, safety in one's neighbourhood, interpersonal trust and reciprocity, and receiving emotional and practical support when needed. Various combinations of these variables have been suggested as reflecting social capital in previous research literature. The leisure time activities have been used previously as indicators of social participation (3, 6, 17, 133). Questions on general trust and the feeling of safety in one's neighbourhood have been used as indicators of trust (e.g., (55)). Social support has been used as an indicator of cognitive social capital (see, e.g., (172)). These present social support questions, generated by Sarason et al. (177), constitute a valid instrument that has been applied widely.

In this study, these questions were used in developing the social capital measuring instrument. The formation of the dimensions of social capital is described in detail in the statistical methods and results (see Chapters 5.4 and 6.1).

5.3.2 Health behaviour

Five measures of health behaviour were used as outcome variables (Sub-study III) or as possible mediating factors (Sub-study IV):

1) Smoking

Smoking status was measured by a standard question distinguishing non-smokers (never or occasionally) from smokers (daily).

2) Drinking

Weekly consumption of alcohol (grams of pure alcohol per week) was calculated on the basis of reported frequency and quantity of drinking. Based on the Finnish Current Care Guideline for treatment of alcohol abuse, heavy drinking was classified as 140 grams or more for women and 280 grams or more for men per week (178). We dichotomized the use of alcohol as moderate (non-excessive) vs. excessive drinking.

3) Physical activity

Leisure-time physical activity was based on the question 'How much do you exercise and strain yourself physically in your leisure-time?' with four alternative responses: sedentary, light, moderate and competitive sport. Leisure-time physical

activity was classified as ‘sedentary’ or ‘active’. ‘Active’ includes all of the other three alternatives.

4) Consumption of vegetables

Question ‘How often have you eaten vegetables during the last week?’ included four alternative answers: ‘never’, ‘once or twice’, ‘3–5 times’ and ‘6–7 times’. The responses were dichotomized into daily (6–7 times a week) consumption vs. less.

5) Duration of sleep

Hours of sleep per 24 hours was dichotomized as adequate sleep (7–8 hours) and less or more sleep than that.

5.3.3 Health outcomes

Self-rated health and psychological well-being were chosen because both are broad, often-used and approved indicators of the various aspects of health. They were used as outcome variables (Sub-study II) as well as independent variables (Sub-study IV). Together they cover physical, functional and mental aspects of health (152, 179). All-cause mortality was used as an objective outcome variable of health in Sub-study IV.

Self-rated health

Self-rated health was measured by the question: ‘Would you describe your current health status as good, fairly good, average, fairly poor or poor?’ The response was transformed into a dichotomous variable with the two highest categories indicating good health. The reliability and validity of self-rated health measures has been confirmed previously (152, 153).

Psychological well-being

The General Household Questionnaire (GHQ12) contains twelve items on the general level of happiness, depression, anxiety, self-confidence and stress (179). In this study, psychological well-being was measured by the reversed scale of the GHQ12, using 2/3 as the cut-off point, with 0–2 indicating psychological well-being (lack of psychological distress). The total GHQ12 score is a sum of 12 questions and ranges between 0 and 12. The total GHQ12 score was calculated only if at least ten questions had been answered. If one or two items were missing, the missing values were replaced by the average of the other items and the sum was rounded to the next integer. Cronbach’s alpha for GHQ12 was 0.89.

Mortality

This study focused on all-cause mortality. Date of death was obtained from the register of the Social Insurance Institution and linked to the survey data by using personal identity codes. The baseline time varied according to the time of data collection, that is, between September 2000 and March 2001. Mortality was followed to the end of 2009.

5.3.4 Other variables

Socio-demographic characteristics

The socio-demographic characteristics in this study included age, gender, education, living arrangement, income and type of region. Age was categorized into six groups (Sub-studies I–III) or used as a continuous variable (Sub-study IV). The level of education was classified into three categories: basic, secondary and higher education. People without the matriculation examination or vocational training were classified into the basic education group (42%). Those who had passed the matriculation examination or completed vocational school were considered to have secondary education (31%). Higher education (27%) included degrees from higher vocational institutions, polytechnics and universities. (180).

Based on self-reported marital status and household composition, living arrangements were classified into four categories: married (57%), cohabiting (11%), living together with people other than a partner (for example siblings or a parent with children, 8%) and living alone (25%) (181). Because of the small number cohabiting in the oldest age group, married and cohabiting were combined in Sub-study IV.

In Sub-studies I–II, income was based on a question about the monthly income of the household. The indicator was formulated by dividing the household income by the number of consumption units, using the OECD scale, in which the first adult of the household receives a value of 1, other adults 0.7 and children 0.5 (182). The respondents were then classified into quintiles according to the household income per consumption unit. In Sub-studies III and IV, income was based on register information which became available during this time. The formulation of this indicator was similar to the previous sub-studies except that income was used as a continuous variable, because of which income per consumption unit was divided by 1000 and rounded to the nearest integer.

Type of region is based on the statistical grouping of municipalities describing the degree of urbanization designed by Statistics Finland. The grouping used here is based on the data of the 2000 Population Census. Region is classified into urban (61%), semi-urban (14%) and rural (25%) municipalities. Type of region was used in first two sub-studies. It was dropped from the next articles as it was not related to self-rated health.

Long-standing illness and functional capacity

Long-standing illness was asked about as ‘Do you have any permanent or chronic illness or any defect, trouble or injury which reduces your working capacity or functional ability?’ and dichotomized (yes/no, Sub-studies II and IV). Functional capacity was also dichotomized (1. able to walk about half a kilometre without resting and 2. either unable or finds it difficult to walk this distance, Sub-study II). The interview, medical health examination and medication registers were used to identify the chronic diseases. Some common chronic diseases (diabetes, cancer, and cardiovascular diseases) were chosen as risk factors and dichotomized in terms of whether the subject had or had not been diagnosed with the particular disease. (Sub-study IV).

Handgrip strength is a good predictor of mortality (183, 184). The handgrip strength of the dominant hand was measured with a handheld dynamometer twice. The maximum strength (Newtons) was used in the analyses as a continuous variable (Sub-study IV).

Biological risk factors

Blood pressure, cholesterol and BMI, based on height and weight, examined by trained staff, were used as biological risk factors for mortality (Sub-study IV). Blood pressure was dichotomized according to the guidelines of the American Heart Association (AHA) as hypertensive (140/90 mm Hg or higher and/or current use of antihypertensive medication) or normal. HDL cholesterol was dichotomized as <1.0 mmol/l and ≥ 1.0 mmol/l, and LDL cholesterol as ≥ 3.0 mmol/l or <3.0 mmol/l. BMI (kg/m^2) was classified into five categories: normal (20–24), underweight (<20), overweight (25–29.9), obese (30–34.9) and severely obese (35+).

Table 3. Design, variables and statistical methods used in sub-studies.

Variables	I	II	III	IV
Outcomes	<p>SOCIAL CAPITAL</p> <ul style="list-style-type: none"> *Social support *Social participation and networks *Trust and reciprocity 	<p>HEALTH</p> <ul style="list-style-type: none"> *Self-rated health *Psychological well-being 	<p>1) HEALTH BEHAVIOUR</p> <ul style="list-style-type: none"> *Smoking *Alcohol use *Leisure-time physical activity *Use of vegetables *Duration of sleep <p>2) HEALTH</p> <ul style="list-style-type: none"> *Self-rated health *Psychological well-being 	<p>ALL-CAUSE MORTALITY</p>
Socio-demographic characteristics	<ul style="list-style-type: none"> Age Gender Living arrangements Education level Income Type of region 	<ul style="list-style-type: none"> Age Gender Living arrangements Education level Income Type of region 	<ul style="list-style-type: none"> Age Gender Living arrangements Education level Income 	<ul style="list-style-type: none"> Age Gender Living arrangements Education level Income

Variables	I	II	III	IV
Other explanatory and mediating variables	-	<p>SOCIAL CAPITAL</p> <ul style="list-style-type: none"> *Social support *Social participation and networks *Trust and reciprocity <p>Functional capacity</p> <p>Long-standing diseases</p>	<p>1) SOCIAL CAPITAL</p> <ul style="list-style-type: none"> *Social support *Social participation and networks *Trust and reciprocity <p>2) 1 and HEALTH BEHAVIOUR</p> <ul style="list-style-type: none"> *Smoking *Alcohol use *Leisure-time physical activity *Use of vegetables *Duration of sleep 	<p>SOCIAL CAPITAL</p> <ul style="list-style-type: none"> *Social support *Social participation and networks *Trust and reciprocity <p>HEALTH BEHAVIOUR</p> <ul style="list-style-type: none"> *Smoking *Alcohol use *Leisure-time physical activity *Use of vegetables *Duration of sleep <p>BIOLOGICAL RISK FACTORS</p> <ul style="list-style-type: none"> *HDL cholesterol *LDL cholesterol *Blood pressure *BMI <p>HEALTH</p> <ul style="list-style-type: none"> *Self-rated health *Psychological well-being *Long-standing illnesses *Diabetes, cancer, CVD *Hand grip strength
Statistical methods	<p>Explanatory factor analysis</p> <p>One-factor model for factor scores</p> <p>Multinomial logistic regression</p>	Logistic regression analysis	Logistic regression analysis	Cox hazards regression

5.4 Statistical methods

Sampling weights

Sampling weights were applied to correct for the oversampling in the 80 years and older age group and to obtain correct population distribution estimates. The oldest women and the youngest men, the least educated, those with low income, and those living alone were least likely to participate in the survey. Post-stratification weights were used to correct the impact of non-response. (175, 185).

Imputation

Non-response rates were higher in self-administered questionnaires than in the interview. Since higher item non-response in some variables meant that much information would have been lost in a (weighted) complete-case analysis, the item non-response was handled by using multiple imputation. (Sub-studies III–IV).

Formulation of the measures of social capital

The data included several indicators used in previous studies of social capital (3, 6, 17, 55, 167). The construction of the measures of social capital was started by exploring the mutual associations of 39 potential social capital indicators by using SAS (version 8.0) procedures (186). Three questions (watching TV; reading newspapers; going out to a restaurant) with very weak loadings were omitted. Exploratory factor analysis (PROC FACTOR) was used for investigating the dimensions of social capital. Unambiguous grouping of the indicators into underlying dimensions was pursued by the three-factor oblique rotation (PROMAX) solution. The existing theories outlined the choices of the number of factors and the rotation method. After this phase, one-factor-models were applied to each indicator group. This produced factor scores which were grouped into tertiles, the lowest tertiles of each dimension of social capital including people with low levels of this particular dimension of social capital. Correspondingly, the upper tertile included those with high levels of social capital with regard to the dimension in question. These dimensions of social capital were used in the following analyses as the response variables (Sub-study I) or as explanatory variables (Sub-studies II–IV).

Statistical analysis in Sub-studies I–IV

In Sub-study I, the distribution of social capital was examined by gender, age group, living arrangements, education, income and type of region. The adjusted prevalences were obtained by using multinomial logistic regression analysis adjusting for all the socio-demographic variables simultaneously. The statistical

significance of the interactions between gender and each socio-demographic variable was tested by using SUDAAN (187).

Logistic regression analysis was applied in order to examine good self-rated health and psychological well-being through three dimensions of social capital and other covariates (age, gender, education, income, living arrangements, type of region, long-standing illness and functional capacity). Age- and gender-adjusted associations between the health outcome variable (self-rated health or psychological well-being) and each determinant were first examined separately. All the dimensions of social capital were then added simultaneously to the model followed by socio-demographic factors, functional capacity and long-standing illness in order to assess their possible effect on the association between social capital and health. Interactions between dimensions of social capital and socio-demographic factors (age, gender, education, income, and living arrangements) and functional capacity and long-standing illness were also analysed to find out whether the associations between social capital and health were similar in different subgroups of the population. The data were analysed using SUDAAN, which takes into account the complex sampling design, that is, stratification, clustering and sampling weights (185, 187). (Sub-study II).

The associations between three dimensions of social capital and each health behaviour (non-smoking status, non-excessive drinking, leisure-time physical activity, daily use of vegetables and adequate duration of sleep) were assessed by using logistic regression analyses (Sub-study III).

Cox proportional hazards regression analysis was used to estimate the effect of social capital on all-cause mortality during the nine-year follow-up time. Socio-demographic characteristics and several risk factors were adjusted for. Separate analyses were conducted for women and men aged 30–79 years (Sub-study IV).

6 Results

6.1 Dimensions of social capital

Factor analysis with oblique rotation of 36 items distinguished three dimensions of social capital: 1) social support (the belief that emotional support and practical help would be provided when needed), 2) social participation and networks (social activities and meeting friends), and 3) trust and reciprocity (trust in people, the feeling of reciprocity, feeling safe in the neighbourhood) (Table 4). The correlations between three factors were quite weak: 0.28 between support and participation, 0.11 between support and trust and 0.04 between participation and trust.

In order to construct factor score variables for the dimensions of social capital, three one-factor solutions were produced, based on three mutually exclusive indicator sets identified by means of their loadings in rotated three-factor models (Table 4). The reliability coefficients of the factor scores from one-factor models were 0.90 (social support), 0.75 (social participation and networks) and 0.82 (trust and reciprocity). The abbreviated names (social support, social participation, and trust, or simply support, participation and trust) will be used starting from Table 5a.

Table 4. Rotated three-factor and one-factor structures (correlations)

Variable	Rotated three-factor solution			One-factor solution		
	Factor 1 Social support	Factor 2 Social participation and networks	Factor 3 Trust and reciprocity	Factor 1 Social support	Factor 2 Social participation and networks	Factor 3 Trust and reciprocity
Club and society activities	0.09	0.50	-0.01		0.49	
Cultural activities (theatre, movies, etc.)	0.35	0.40	-0.02		0.51	
Studying	0.25	0.33	-0.11		0.42	
Congregational activities	- 0.02	0.47	0.04		0.38	
Physical activity (exercise, fishing, gardening, etc.)	0.19	0.46	0.06		0.50	
Handicrafts, singing, etc.	0.11	0.53	-0.05		0.51	
Visiting family, friends or neighbours	0.18	0.61	0.12		0.58	
Having family, friends or neighbours visiting you	0.11	0.53	-0.05		0.45	
Phone conversations	0.26	0.46	0.00		0.51	
Health promotion / discussion groups (11 questions)	0.19	0.34	-0.24		0.37	
Feeling safe in the neighbourhood	-0.06	-0.02	0.56			0.47

Variable	Rotated three-factor solution			One-factor solution		
	Factor 1 Social support	Factor 2 Social participation and networks	Factor 3 Trust and reciprocity	Factor 1 Social support	Factor 2 Social participation and networks	Factor 3 Trust and reciprocity
Feeling safe walking out alone late	-0.18	-0.12	0.49			0.36
People on whose help you can count when you feel exhausted	0.81	0.21	0.05	0.84		
People you think really cares about you no matter what	0.83	0.18	0.09	0.85		
People who can really make you feel better when you feel down	0.80	0.21	0.06	0.84		
People from whom you get practical help from when needed	0.81	0.20	0.09	0.82		
Cynical mistrust (based on eight items)	0.43	0.29	0.42			0.55
Being surprised by the behaviour of people you thought you knew well	0.18	0.06	0.75			0.81
Is it happening that people whom you counted on disappointed you	0.23	0.08	0.76			0.82

6.2 Socio-demographic variation in social capital

Social capital was examined by three dimensions 1) social support, 2) social participation and networks and 3) trust and reciprocity. Based on factor scores, all respondents were classified into low, medium and high levels under each dimension (see Chapter 5.4). The socio-demographic variation in social capital was analysed by age, gender, education, living arrangement, income and type of region. These same socio-demographic characteristics except region, which was either statistically insignificant or inconsistent, were used in all of these sub-studies as well. Tables 5a (men) and 5b (women) show the adjusted variations by each dimension of social capital.

Table 5a. Socio-demographic variation of social capital. Prevalence (%) of low and high levels of social support, social participation and trust adjusted by age group, living arrangements, education, income and type of region. Men 30+ years.

	MEN					
	SOCIAL SUPPORT		SOCIAL PARTICIPATION		TRUST	
	Low levels	High levels	Low levels	High levels	Low levels	High levels
Age group						
30–39	29	30	35	27	22	41
40–49	41	26	42	24	28	39
50–59	48	24	44	22	35	35
60–69	52	24	45	27	33	38
70–79	48	28	43	20	29	43
80–	59	26	57	21	22	49
P	<0.0001		<0.0011		<0.0027	
Living arrangements						
Married	38	30	39	27	24	43
Cohabiting	42	24	49	19	33	33
Living with others	57	18	46	22	39	33
Living alone	55	17	45	19	42	29
P	<0.0001		0.0038		<0.0001	

Education						
Higher	31	34	24	38	24	45
Secondary	40	27	41	22	28	38
Basic	52	19	54	17	33	35
P	<0.0001		<0.0001		<0.0029	
Income quintiles						
5 highest	38	30	37	26	23	42
4	40	29	39	25	28	40
3	45	22	42	23	31	36
2	44	26	42	23	30	38
1 lowest	49	21	51	23	36	36
P	0.027		0.038		0.0010	
Type of region						
Urban	43	26	45	22	31	37
Semi urban	40	28	38	28	27	40
Rural	43	24	37	27	26	42
P	0.633		0.015		0.184	

The bold figures indicate the highest prevalence in each category

p=statistical significance of the difference in the distribution of the outcome variable between the categories

Table 5b. Socio-demographic variation in social capital. Prevalence (%) of low and high levels of social support, social participation and trust adjusted by age group, living arrangements, education, income and type of region. Women 30+ years.

	WOMEN					
	SOCIAL SUPPORT		SOCIAL PARTICIPATION		TRUST	
	Low levels	High levels	Low levels	High levels	Low levels	High levels
Age group						
30–39	20	47	20	46	34	29
40–49	23	41	22	40	41	27
50–59	33	37	23	43	42	24
60–69	39	35	22	49	35	31
70–79	47	23	28	37	30	37
80–	51	17	49	24	31	38
p	<0.0001		<0.0001		0.0016	

Living arrangements						
Married	25	44	23	43	34	31
Cohabiting	26	39	30	36	40	28
Living with others	43	29	28	39	38	26
Living alone	42	25	21	46	42	23
P	<0.0001		0.009		0.0031	
Education						
Higher	25	45	17	52	32	31
Secondary	31	37	21	44	40	27
Basic	37	32	31	33	40	27
P	<0.0001		<0.0001		0.006	
Income quintiles						
5 highest	28	41	23	44	32	33
4	27	41	21	45	37	28
3	31	37	23	42	37	29
2	34	35	25	40	40	26
1 lowest	37	35	27	41	40	26
P	0.002		0.443		0.057	
Type of region						
Urban	31	39	26	40	40	26
Semi urban	31	37	22	45	30	38
Rural	33	36	19	47	34	31
P	0.496		0.0002		<0.0001	

The bold figures indicate the highest prevalence in each category

p=statistical significance of the difference in the distribution of the outcome variable between the categories

6.2.1 Age and gender

At the age of 30–69, high levels of social support were more prevalent among women than men. The level of social support tended to decrease with age. This decrease was steeper and more systematic among women than men (interaction between gender and age group: $p < 0.0001$).

In the high-level group, social participation decreased with age non-linearly among both genders. However, people in their sixties participated as actively as those in

their thirties. Women were more active in social participation than men: a greater proportion of women belong to the high level tertile of social participation than men.

Trust was at the highest level among those aged 80 and over, and nearly as high among men aged 30–39. The 50–59 age group reported the lowest level of trust. Interpersonal trust was more prevalent among men than women in all age groups.

6.2.2 Living arrangements

Married people received more social support than people in other living arrangements. Both men and women got less support when they were living without a partner, even if they shared their household with other people.

Married men and women, and women living alone, were the most active in social participation compared to the other living arrangements.

The prevalence of high trust was the greatest among married men and women and lowest among those living alone. Forty-three percent of married men and less than one-third of married women belonged to the group with the highest level of trust and reciprocity. Among both genders, the proportion of low levels of trust is greater among those living alone compared to the other living arrangements. The differences between the groups were more distinct among men than among women (interaction between gender and living arrangements: $p=0.03$).

6.2.3 Education

High education was associated with high levels of social support and active social participation. The direction of the association between educational level and social participation was similar among men and women. People with high education showed a high level of trust, a conclusion which can be drawn from the fact that among both genders high levels of trust are more common and low levels of trust less common in the higher educational levels than the other educational levels.

6.2.4 Income

People living in high-income households received more social support than those living in low-income households. The proportional level of social support is higher among women than men.

Women's social participation was not bonded to income but among men social participation increased with income.

High income was associated with high levels of trust, particularly among men. On the whole, men trusted and felt reciprocity relatively more than women.

6.2.5 Type of region

Type of region was not associated with social support. Both men and women living in urban regions were less active in social participation than those in other types of region. The differences between semi-urban and rural regions were rather small. The highest interpersonal trust was among the semi-urban women, while women in urban areas had the lowest. The differences in trust between the regional types were not significant among men.

6.2.6 Summary of the socio-demographic variation of social capital

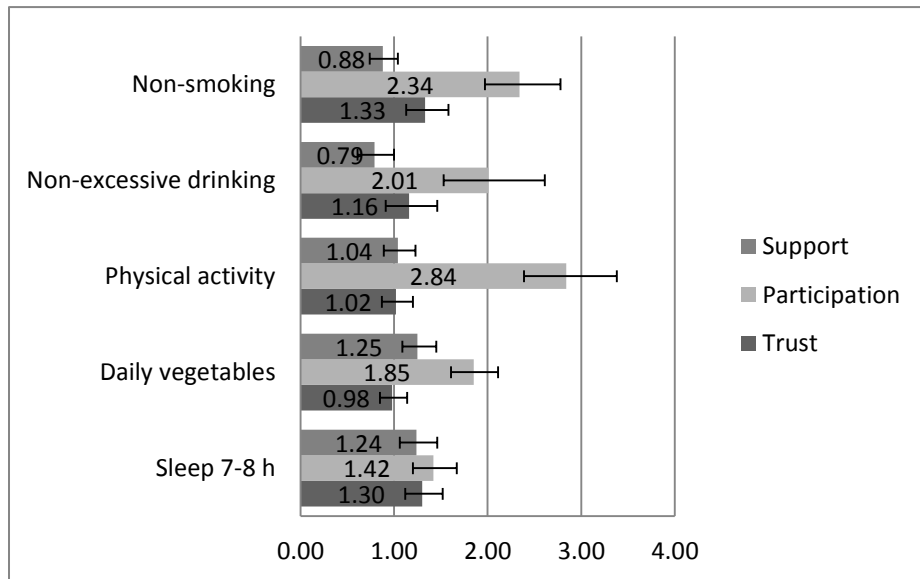
- The levels of social support and social participation decrease with age. High levels of trust are most common later in life.
- Social support and social participation are at a higher level among women than among men. However, older men get more social support than women at the same age. High levels of trust are more prevalent among men than among women.
- Married people have more social capital than the others, except that women living alone are the most active in social participation.
- Education is strongly and positively associated with the level of social capital.
- Income and social capital correlate among men, but do not among women, with the exception of a positive association between income and social support.
- Type of region is not associated with social support. Inhabitants of urban regions participate less than those in other types of region. Urban women have the lowest level of trust.

6.3 Social capital and health behaviours

Social participation was the only dimension of social capital that was associated with all health behaviours regardless of age, gender, education, living arrangements and income (Figure 2). Active social participation was related to non-smoking (OR=2.34, 95% CI 1.97–2.78), moderate alcohol consumption (OR=2.01, 95% CI 1.53–2.61), leisure-time physical activity (OR=2.84, 95% CI 2.39–3.38), daily use of vegetables (OR=1.85, 95% CI 1.61–2.11) and adequate sleep (OR=1.42, 95% CI 1.20–1.67). Moderate social activity was also related to healthy behaviour patterns, although less strongly than high levels of social participation.

Social support was positively associated with consumption of vegetables and 7–8 hours of sleep daily. High levels of trust were associated with non-smoking and 7–8 hours of sleep.

Figure 2. Associations between high levels of social capital and healthy behaviour patterns¹ (OR with 95% CI).



¹ All the dimensions of social capital, socio-demographic factors (age, gender, education, living arrangements and income) have been simultaneously adjusted for. Social participation comprises a large question battery with one question on exercise and outdoor activities. This question was excluded from the analysis of the association between physical activity and social participation.

6.4 Social capital and health

This section describes the results on social capital and three different health outcomes, which include self-rated health, psychological well-being and all-cause mortality. The second sub-study included the first two health outcomes, while mortality was examined in the Sub-study IV. These outcomes represent both subjective and objective health indicators.

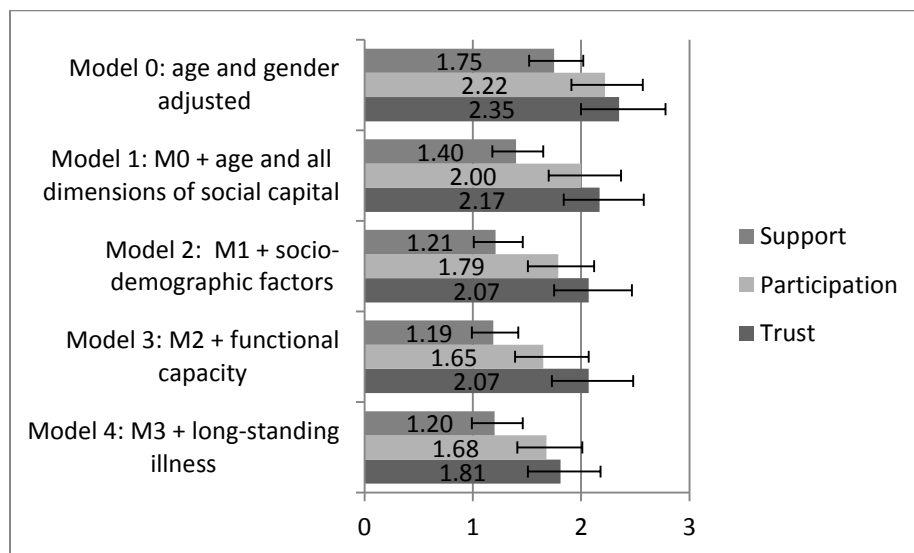
6.4.1 Self-rated health

Social participation was positively associated with self-rated health, as was trust. The likelihood for good self-rated health increased with the levels of participation and trust. The association between social support and self-rated health was mostly explained by the other two dimensions of social capital and socio-demographic factors (Figure 3), whereas active participation and high levels of trust remained

related to good self-rated health after adjusting for the other dimensions of social capital, socio-demographic factors, functional capacity and chronic diseases (OR=1.68, 95% CI 1.41–2.01 and OR=1.81, 95% CI 1.51–2.18 respectively). Young age, high education, high income, and the absence of both long-standing illness and functional limitations were also associated with good self-rated health. However, having long-standing illnesses did not significantly decrease the association between social capital and self-rated health. Living arrangements were strongly associated with self-rated health in the age-adjusted model, but this association disappeared after adjusting for the other socio-demographic variables and social capital. No interactions were found between social capital by socio-demographic factors or long-standing illness. Active social participation was more strongly related to self-rated health among those with functional limitations than among those without them.

How far health behaviours explain about this association was also tested (results not shown here). Each dimension of social capital was associated with self-related health independently. However, physical activity attenuated the association between social participation and self-rated health.

Figure 3. Odds ratios for good and quite good self-rated health according to high levels of social capital (support, participation, trust), adjusted for socio-demographic factors, physical functional capacity and long-standing illness and analysed by logistic regression (95% CI).



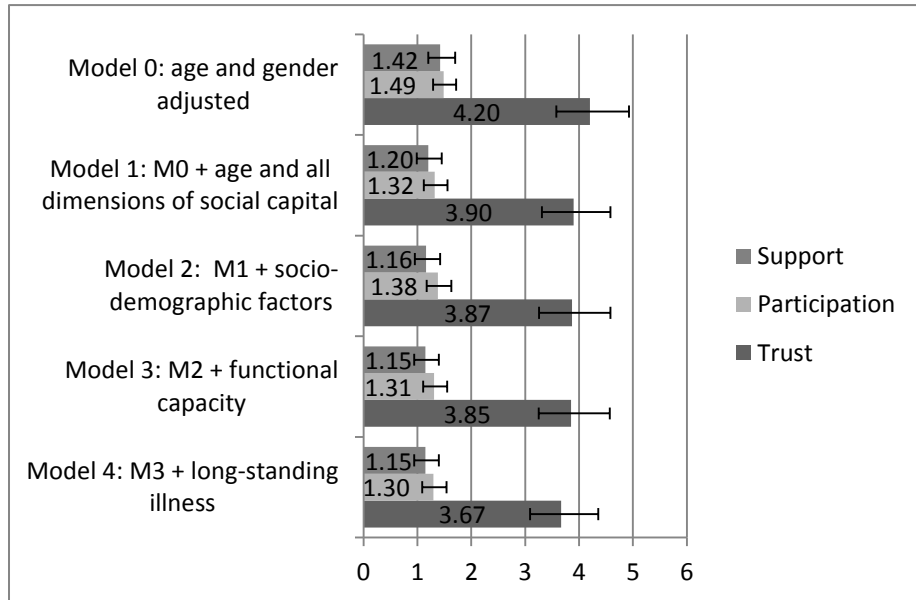
6.4.2 Psychological well-being

All dimensions of social capital were associated with psychological well-being. However, social support lost its significance when the other two dimensions of social capital were included in the model (Figure 4). The strongest association was shown by high levels of trust (OR=3.67, 95% CI 3.09–4.36). Active social participation was also associated with psychological well-being (OR=1.30, 95% CI 1.09–1.54). When age- and gender-adjusted socio-demographic factors were in the model one at a time, younger age, male gender, high income, living with a partner and absence of both functional limitations and long-standing illness increased the odds for psychological well-being. When social capital was added to the model, living arrangements lost its significance. No major changes occurred after all possible variables were included in the model.

Three interactions were found between social capital and socio-demographic factors: active social participation was strongly associated with better psychological well-being among people living alone and, correspondently, those living alone and without social networks experienced more psychological distress. The association between active participation, a high level of trust and psychological well-being was stronger the lower the education. Functional capacity and long-standing illness did not have any interaction with social capital.

Social support was not associated with psychological well-being. Active social participation was associated with psychological well-being, but physical activity attenuated this association moderately. High levels of trust were related to psychological well-being.

Figure 4. Odds ratios for psychological well-being according to high levels of three dimensions of social capital (support, participation, trust), adjusted for socio-demographic factors, physical functional capacity and long-standing illness and analysed by logistic regression (95% CI).



6.4.3 Mortality

During the follow-up period, 582 of the participants aged 30–79 years at baseline (340 men and 242 women) died. Age-adjusted Hazard ratios showed that low levels of social participation and networks were associated with a higher risk of mortality among both men (HR=2.38, 95% CI 1.72–3.45) and women (HR=2.00, 95% CI 1.43–2.83). Among men, low level of social support was related to a higher mortality risk (age-adjusted HR=1.71, 95% CI 1.25–2.38) as well as moderate social support (age-adjusted HR=1.57, 95% CI 1.07–2.24). No relation between trust and mortality was found. These results are not shown here.

Most hypothesized risk factors were associated with mortality among men and to a lesser extent among women. However, the level of education and alcohol and vegetable consumption and most of the biological risk factors were not associated with mortality among women.

The associations between three dimensions of social capital and all-cause mortality for men (Figure 5) and for women (Figure 6) are shown separately.

Different groups of covariates (health behaviour, biological risk factors and health) were cumulatively added to the model one group after the other adjusted for age including social capital and socio-demographic factors.

Figure 5. Hazard ratios (with 95% CI) for all-cause mortality according to three dimensions of social capital with contribution of socio-demographic factors, health behaviour, biological risk factors and health, adjusted for age. Men aged 30–79 years.

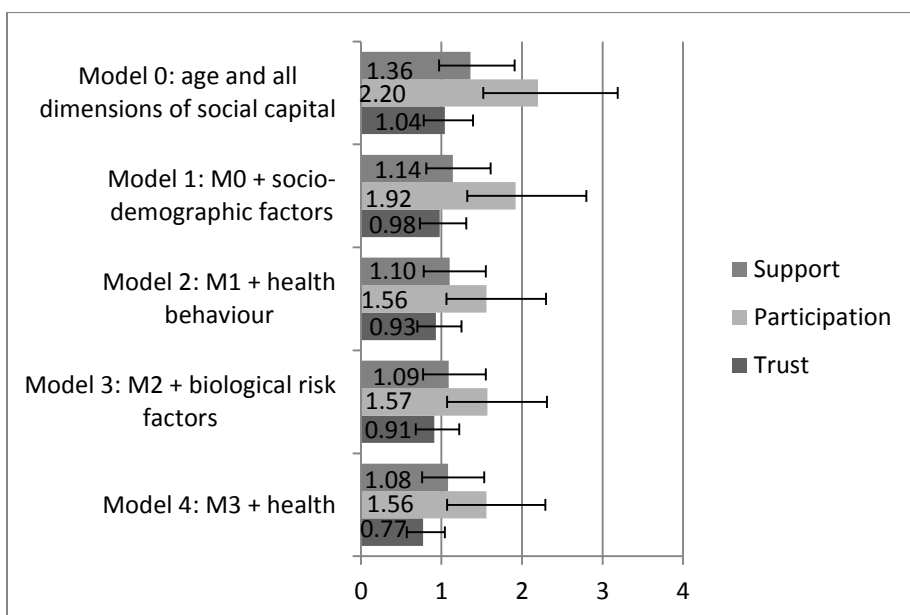
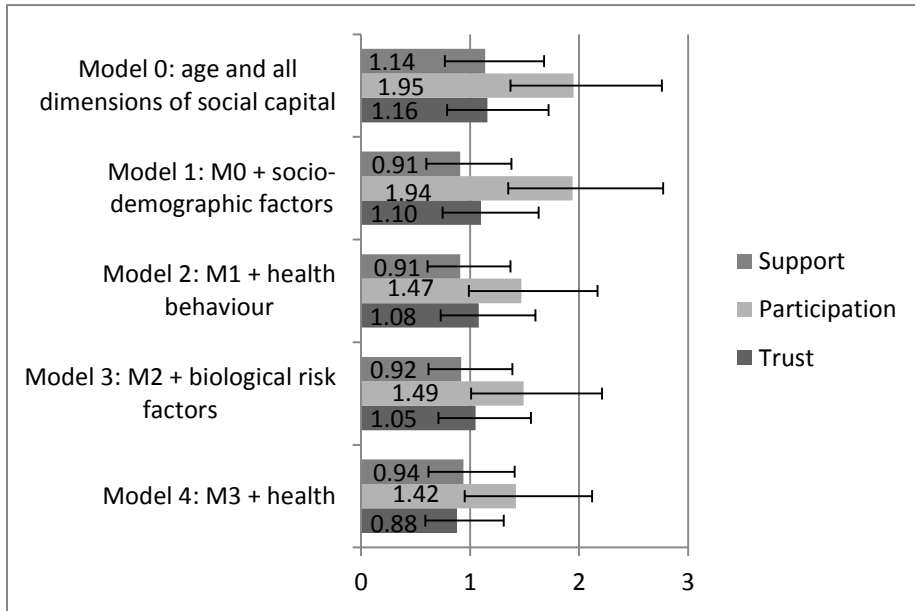


Figure 6. Hazard ratios (with 95% CI) for all-cause mortality according to three dimensions of social capital with contribution of socio-demographic factors, health behaviour, biological risk factors and health, adjusted for age. Women aged 30–79 years.



Compared to the socially most active group of both men and women, low levels of participation doubled the risk of mortality. Socio-demographic (Model 1) and biological risk factors (Model 3) did not change this association. Besides participation, physical activity, non-smoking, good self-rated health and hand grip strength were also associated with a lower risk of mortality. Still, when all other factors were added to the model simultaneously (Model 5), the association between low levels of social participation and higher mortality was clear with men (HR 1.56, 95% CI 1.07–2.29) and suggestive among women (HR 1.42, 95% CI 0.95–2.12).

6.5 Summary of the associations between social capital and health

The associations between all three dimensions of social capital with health and health behaviours are summarised in Table 6. Structural social capital (social participation) was associated more strongly with health than cognitive social capital (social support and trust). Participation was associated with all health indicators, since the highest levels of participation increase health and decrease mortality,

while trust was related to half of the health indicators, and social support only to sleep and use of vegetables.

Social capital was unequally distributed by age, gender, education, income and living arrangements. Young age, high education, marriage and higher income were associated with all three dimensions of social capital. However despite SES, chronic diseases and deficiencies, people with higher levels of social capital feel healthier physically and psychologically. Those with social networks and participating actively engage in healthier behaviours, while low levels of social participation were associated with higher mortality. Both high levels of social capital and healthier behaviour patterns were associated with self-rated health. Leisure-time physical activity mediated the association between social capital and self-rated health and psychological well-being only partly.

Table 6. Associations between dimensions of social capital and health behaviours and health. Odds ratios (OR) or hazard ratios (HR) with 95% CI.

Health behaviours and health	Dimensions of social capital		
	Support	Participation	Trust
Smoking ¹	0.88 (0.74-1.04)	2.34 (1.79-2.78)	1.33 (1.13-1.58)
Non-excessive drinking ¹	0.79 (0.61-1.00)	2.01 (1.53-2.61)	1.16 (0.91-1.46)
Physical activity ¹	1.04 (0.89-1.23)	2.84 (2.39-3.38)	1.02 (0.87-1.20)
Daily vegetables ¹	1.25 (1.09-1.45)	1.85 (1.61-2.11)	0.98 (0.85-1.14)
Sleep 7-8 hours ¹	1.24 (1.06-1.46)	1.42 (1.20-1.67)	1.30 (1.12-1.52)
Self-rated health ²	1.20 (0.99-1.46)	1.68 (1.41-2.01)	1.81 (1.51-2.18)
Psychological well-being ²	1.15 (0.94-1.40)	1.30 (1.09-1.54)	3.67 (3.09-4.36)
All-cause mortality ³	Men: 1.08 (0.76-1.53) Women: 0.94 (0.62-1.41)	Men: 1.56 (1.07-2.29) Women: 1.42 (0.95-2.12)	Men: 0.77 (0.57-1.04) Women: 0.88 (0.59-1.31)

¹ The associations between high levels of social capital and healthy behaviour patterns when socio-demographic factors have been controlled for (OR).

² The associations between high levels of social capital and good health when socio-demographic factors, long-standing illnesses, and functional capacity have been controlled for (OR).

³ Mortality: The association between low levels of social support, social participation and trust, and higher risk of mortality. Socio-demographic factors (age, gender, education, income, living arrangements), behavioural factors (smoking and drinking habits, physical activity, consumption of vegetables, duration of sleep), biological risk factors (HDL and LDL cholesterol levels, blood pressure, body mass index (BMI)), health (self-rated health, long-standing illness, diabetes, cancer, cardiovascular diseases, hand-grip strength) were controlled for (HR).

Statistically significant associations in bold.

7 Discussion

The aims of this study were to contribute to the measurement of social capital by means of identifying its various dimensions and by developing a suitable way to measure them through all the sub-studies, describe the variation in social capital according to socio-demographic categories (age, gender, living arrangements, education, income, and region), find out how social capital is related to health-related behaviours, examine the association between social capital and health indicated by self-rated health and psychological well-being and all-cause mortality, and to examine whether social capital is associated with health directly or via health behaviours. The main findings are discussed in the following sections followed by the methodological considerations of this study.

7.1 Summary of the main findings

The main findings are:

- 1) Three dimensions of social capital were identified: social support, social participation and networks, trust and reciprocity.
- 2) Social capital varied according to socio-demographic category. It was also concentrated in population groups advantaged in other respects.
- 3) High levels of social capital were associated with better health but the associations varied according to dimension.
- 4) The strongest predictor of good health was social participation, which was positively associated with healthy behaviour patterns and all health indicators, all-cause mortality of men, and suggestively for women as well.
- 5) High levels of trust were also associated with good self-rated health and psychological well-being and partially with healthy behaviour.
- 6) Social support was associated only with use of vegetables and duration of sleep.

With the exception of the composition of the dimensions of social capital, the main results of this study (Sub-studies I–IV) have been summed up in a simplified model (Figure 7). Since this Figure includes the association between social capital, health behaviours and health outcomes that are statistically significant after adjustment for all factors in the models analysed and follow the whole pathway up to health, social support was excluded as it was not associated with health after participation and trust were adjusted for. However, it is still discussed in the text.

The results show that, high levels of education, high income and marriage are associated with higher levels of social support, social participation and trust (A). These socio-demographic characteristics establish better access to social capital. The associations of age vary. High levels of social capital are mainly related to being young, with the exception that 60–69 year olds are socially as active as the youngest age group, and high trust in old age is evident. The association between socio-demographic characteristics and cognitive and structural social capital varies between genders. Men possess higher levels of trust than women, while women are more active in social participation.

Both cognitive and structural social capital are associated with health in that the more trust and social participation, the better the self-rated health and psychological well-being (B). Cognitive social capital is directly associated with health (B), whereas structural social capital is associated with self-rated health and psychological well-being via healthy behaviour patterns (C, D). High levels of structural social capital, mediated by leisure-time physical activity, are related to lower mortality (E). Good subjective health also predicts lower mortality (F). Cognitive social capital (trust) is associated with adequate sleep and non-smoking, while structural social capital (participation) is associated with healthier behaviour patterns on the whole.

The role of the dimensions of social capital varies. Active social participation and networks are especially associated with physical and psychological well-being, healthier behaviours and lower mortality. There is an evident gradient regardless of the socio-demographic background.

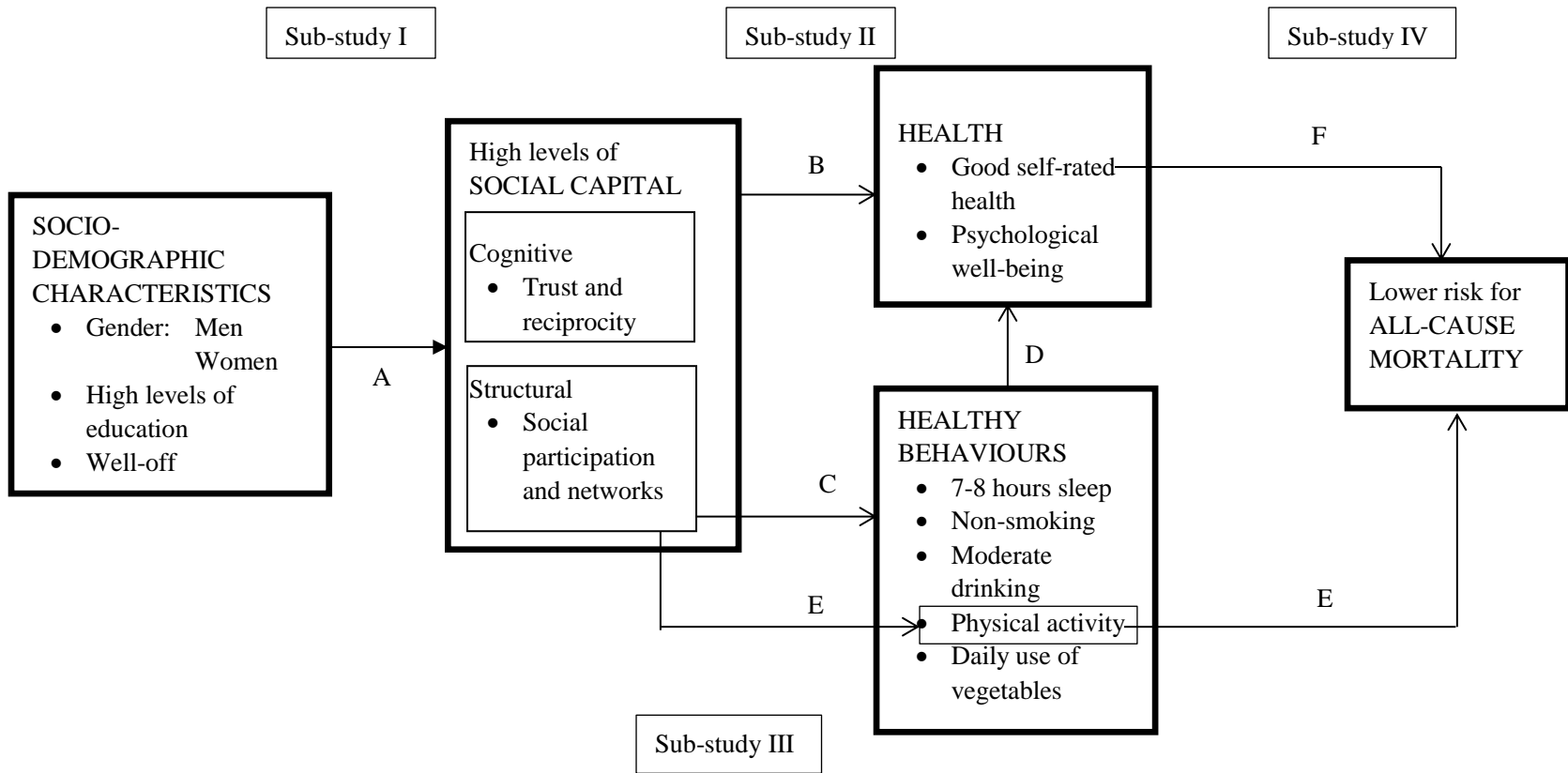


Figure 7. Main results of the associations between the dimensions of social capital, health behaviours and health.

7.2 Dimensions of social capital

It is widely agreed that social capital is a multidimensional concept. However, varied dimensions have been suggested (see Table 2, for example). The analyses of this study distinguished three dimensions: 1) social support, 2) social participation and networks, and 3) trust and reciprocity. Participation and trust are generally accepted dimensions of social capital (3, 11), while there is disagreement over social support (20, 95, 96). Earlier, social support was often used as one dimension but have lately merely been excluded the analyses of social capital.

Social support, used only in the individual level analyses, includes emotional (empathy, caring), instrumental (time, money) and informal (advice, information) elements. Social support makes an individual feel loved and esteemed, and as a part of a network. It is an exchangeable element in social networks. However, the linkages within social networks may but do not necessarily provide social support. (188, 189). Social support was included in this study as one dimension of social capital for two reasons: firstly, this has been a common convention in earlier research; secondly, it was premised on the notion that social support is a result of having social relationships. Based on the results of this study, social support was not associated with any of the health outcomes after controlling for the other dimensions of social capital. Furthermore, since background information indicates that most respondents receive social support from their spouses, social support describes more a feature of a more intimate social relationship. Among close friends and family one is accepted as one is. If social capital is understood as broader networks which provide their members with new information and opportunities, social support should be excluded from the notion of social capital.

Participation has often been used as one dimension of social capital. Civic participation and memberships of organised groups are common indicators at the collective level. In individual-level analyses social participation is also commonly used as an indicator of social capital.

Trust is a focal dimension of social capital, although it is challenging to measure. The most often used indicator is generalized trust. However, the conceptual definition and description is not simple because of the complexity in distinguishing between the pre-conditions and consequences. It can be seen as a predisposing factor, necessary for developing social capital (52), as part of social capital (1, 34) or resulting from social capital (190, 191). As a consequence, it can be thought of as a proxy. Furthermore, some scholars indicate that the questions used in questionnaires are difficult to answer, since they can be interpreted in several different ways. (192, 193)

Although some incoherence still remains, it seems that social networks, participation, trust and reciprocity are often considered as the core dimensions of

social capital (39). On the whole, according to present knowledge, this study seemed to capture the essential dimensions of social capital.

7.3 Distribution of social capital

Earlier results on the distribution of social capital between genders have been inconsistent. In Sweden, large disparities were found in the odds for access to social capital by gender and educational level. In accordance with Putnam (3), men had better stocks of bonding and linking social capital while women were found to have higher odds for bridging social networks than men (116). In contrast, some other studies showed that women were more involved with bonding networks than men because their networks that are related more to children, school and neighbourhood. The discordance may have to do with social roles and expectations as well as the measures used.

In this study, gender differences were found at the levels of social capital. The differences in social participation in particular were apparent, showing more active social participation among women than men. Living arrangements and income also influence the level of social participation among men, men without partners or with lower income level in particular being inactive in social participation. This finding was not seen among women, who were quite active independent of partnership. By contrast, women living alone seem to have large networks and they participate socially at least as actively as married women and men—if not more. It seems that women are socially more active than men on average. If they are married, they encourage their husbands to lead a more lively social life. This is an important result which should be considered in discussions about social exclusion. For example, single or divorced men may be prone to a less healthy and a lonelier life than women in a similar phase of life. However, cohabiting and single parenthood reduce the social participation of women compared to married women or those living alone.

Well-educated people tend to possess higher levels of social capital than the less educated, and people with high income, men in particular, who have more social capital than those with a smaller income. Similar results have been suggested earlier in the individual-level studies. The associations between higher income and higher levels of community involvement have also been suggested earlier. (3, 49, 110) Based on Bourdieu, other scholars have assumed that high levels of human and economic capital facilitate access to social capital. People with more material resources have greater potential to use their social capital. (29, 43, 53, 194).

Consistent with Bourdieu's theory, the results of this study suggest that social capital accrues, like other capitals, mostly to the advantaged groups. Higher education, better livelihood and marriage are associated with active social participation and high levels of trust. These socio-demographic characteristics facilitate the access and probably mobilization of social capital, leading to health

benefits as well. At the same time, deficiency of social capital leads to poor health, which means that unequal distribution of social capital among groups and individuals leads to unequal distribution of health benefits as well. It has been argued that the roots of social capital are in childhood, but social capital is formed later when people invest in social relationships. Social capital increases rather than decreases with use (195).

In addition to the individual level, it has been argued that there is an unequal distribution of social capital in the community so that privileged groups—for example by education—possess higher levels of social capital than the others. Poor areas often lack bridging social capital although they might have bonding social capital. However, bridging social capital is essential for finding new resources and getting out of the circle of exclusion (3, 89). Social capital is also polarised between countries. Higher levels of social capital have been distinguished in welfare states (21, 34).

7.4 Social capital, health and health behaviour

To get a comprehensive picture of social capital and health, three dimensions of social capital and health were used in the present study. Several factors influencing health status, such as health behaviour, chronic diseases, functional capacity and socio-demographic factors were examined as well. Throughout the sub-studies, the association between three dimensions of social capital and all health outcomes was quite consistent in that the more social capital, the healthier behaviour patterns and the better health.

Health

Social participation was the only dimension of social capital that was associated with all health outcomes, both subjective and objective, after adjustment for all other factors. Active social participation predicted good health and healthier behaviour patterns. High levels of trust were associated with good self-rated health, psychological well-being, non-smoking and adequate sleep but not the other three health behaviours or mortality. High levels of social support were associated only with daily vegetable usage and adequate sleep, which means that structural social capital (participation) had stronger association with health than cognitive social capital (support and trust). Some novel details arose, which are discussed further.

Several earlier findings have suggested a positive association between social capital and physical and psychological health, even though the measures of social capital have differed slightly from another (11, 126, 196). The results concerning physical health seem more consistent than those concerning mental health. A systematic review (13) concluded that there is evidence of an inverse association between cognitive social capital and mental disorders. The contribution of structural

social capital to mental health is parallel. In the present study, the contribution of structural social capital was statistically significant as well.

Social participation proved to be a very powerful determinant of all our health-related indicators. Consistent with these results, previous research has recognized it as a cornerstone in the generation of social capital (3) at the community level and with a strong association with health at the individual level (133). Social participation has also been claimed to have a positive effect on psychological well-being through increasing social ties and community integration (197).

The results of this study show that active social participation and networks were strongly associated with good self-rated health and psychological well-being. However, as most surveys have been cross-sectional or have not considered the effect of chronic illnesses, it has been suggested that it is not possible to know whether social participation precedes health or whether those in good health are more capable of participating.

Good health is important for being able to engage in social activities. Illnesses and reduced functional capacity may decrease social capital. So far, since research has not reported results that might clarify the role of health from this perspective, it has been unclear whether good health is purely an outcome or is also a source of social capital. The results of this study suggest that high levels of social capital, social participation in particular, tend to improve health. Chronic illness attenuated the association between social capital and self-rated health only slightly; that is, people with high levels of social capital (social participation and trust) felt healthier than those with low levels, regardless of their objective health status.

Social capital is unequally divided among different population groups, and social capital may not uniformly benefit the health of every member of society. In this study, interactions between dimensions of social capital and socio-demographic and functional capacity and long-standing illness were analysed to find out whether the associations between social capital and health were similar among different sub-groups of the population.

An interaction was discovered between social participation and functional capacity ($p < 0.05$). A high level of participation was related to good self-rated health irrespective of the level of functional capacity, but the association was stronger among those with functional limitations (OR 3.98) than among those without them (OR 1.89). Statistically significant interactions ($p < 0.05$) were also found between social participation and living arrangements, social participation and education, and trust and education. Active social participation had a particularly strong connection with psychological well-being among those living alone, as opposed to social inactivity. The health of those with low education benefits especially from high trust and reciprocity and active social participation.

Based on these results, it might be that participation gives the feeling of empowerment and more control over one's life. Many chronic illnesses certainly restrict normal life somehow, but being part of social circles gives a feeling of managing one's own life. The mechanism between participation and health is still unrecognized, although hypotheses have been suggested about companionship and hormonal or stress buffering mechanisms that enhance the sense of better health.

The results of this study also add to our understanding of marriage as a determinant of health. In several earlier studies, marriage has been claimed to have protective effects for health and survival (198, 199). Our study suggests that social capital partly explains this association.

The role of social participation and trust appeared to be strong. These two dimensions of social capital determined health regardless of the other known determinants of health such as education and income, while social support lost its statistical significance.

Although the measurement of trust has encountered challenges, it has been considered to be an important dimension of social capital. In this study, high levels of trust were associated with good self-rated health, particularly psychological well-being. Recent research based on longitudinal data suggests that trust is the most important dimension of social capital predicting good self-rated health (200). In this study, trust was also associated with not smoking and adequate sleep. However, it was not related to mortality, not even before the other factors were considered.

Other studies have reported that individual cognitive social capital—including trust—is more strongly associated with self-rated health than structural social capital (129, 201). Our results confirm this, although the latter association was nearly as strong. Similar findings about the importance of generalised trust as an independent determinant of health have also been reported elsewhere. (200).

There are conflicting views about the relationship between social participation and trust. Putnam assumes that active participation precedes trust but there are also countervailing arguments about trust as a prerequisite to participation (202). It is possible that both of these views are correct, which leads to problems in the interpretation of causality. However, this and some other studies show that these two dimensions of social capital are not strongly correlated, and both dimensions are associated with self-rated health (200, 203).

The contribution of social support to health has been reported earlier (204-206) and it has been consistently found to predict health (207, 208). However, according to the present study, active social participation and trust seemed to be more important determinants of health.

Social support refers to people's social ties and is provided through social networks to which individuals belong (209). However, some social networks may be supportive while some others are not. Being a member of a network does not guarantee social support. One explanation of this finding may be that as people decide themselves on what kind of group and how frequently they participate

(investment decisions), the self-activation makes them feel empowerment and healthier (beneficial returns) than the support they get from others usually in situations they do not handle as well and independently. (10).

As already mentioned, using social support as one dimension of social capital is a controversial issue. There is a considerable discrepancy between the views about the role of support. Even though it has been used as a measure of social capital at the individual level, it is probably more common to exclude it from social capital. This study followed views that include social support as one dimension of social capital (95). In one sense, this choice made these results interesting, as social support turned out not to be associated with health indicators after controlling for other factors, while the more conventional dimensions of social capital—social participation and networks and trust and reciprocity—were related to health.

Social support has been suggested as buffering the negative effects of stressors on health by diminishing psychological distress (210). The importance of social support for well-being has been shown in numerous studies (211). These studies have usually not included social capital. However, it has been suggested that the association between social networks and health is mediated through social support (132, 212). Our results do not endorse this. Although social support was related to health, this association did not remain when participation and trust were included.

A link often suggested between resources embedded in social networks and health has been that involvement in social networks provides various forms of social support that may influence health by buffering stress (212). Even though in this study social support has been used as a dimension of social capital equal to social networks, it does not seem to be related to health after the other factors have been taken into account. According to these results, however, it seems that social participation per se is associated with health.

Health behaviours

In this study (Sub study III), three dimensions of social capital, representing both structural and cognitive social capital, and five health-related behaviours were analysed. It was found that 7–8 hours of sleep daily was associated with high levels of every dimension of social capital. However, not all dimensions had similar associations with the other four health behaviours. Compared to socially inactive persons, people active in social participation were more likely to be non-smokers, drink alcohol moderately, be more active physically during their leisure time and to eat vegetables. People with high levels of support were more likely to eat vegetables than those with low levels. Compared to people with low levels of trust, those with high levels of trust were more likely to be non-smokers.

Several studies have found higher mortality rates, a greater risk of coronary heart disease, increased prevalence of hypertension and poorer self-reported health with long or short sleep duration (213-216). Although some determinants of varied

duration of sleep have been suggested, the research on the association between social capital and the sleep duration is still embryonic. Apart from this study, the association between social capital and sleep duration has been examined in the Netherlands, where neighbourhood social capital was not associated with sleep duration (173). However, high levels of individual social capital in this study were associated with adequate sleep. Based on these two results it seems that individual social resources are more important for adequate sleep than those in the neighbourhood social structure. The quality of sleep has also been claimed to relate to engagement in social activities. Good sleep has been found to promote health and prevent severe health problems (217, 218).

Physical activity has consistently been reported as beneficial to health. In the Netherlands, compared to people living in neighbourhoods with a low stock of social capital, those living in neighbourhoods with high levels of social capital had a 118% greater chance of being physically active (173). In this study, a corresponding association was found at the individual level. However, our results indicate that active social participation is associated with healthier behaviour patterns in addition to the impact of a partner or family members or social support as suggested earlier (212, 219). Swedish and Japanese population-based studies reported an association between low trust and physical inactivity (141, 220). In contrast, in this present study trust and social support were not associated with leisure-time physical activity when all three dimensions of social capital and socio-demographic factors were adjusted for. One explanation for the disparate results might be that the measures of both social capital and physical activity are different. For example, the Japanese study measured neighbourhood trust. The Swedish study investigated generalized trust like this study but there seemed to be a difference in the dichotomization of physical activity in the sense that some of those categorized as sedentary in Finland were among the active in Sweden, as well as in the Japanese study.

Corresponding with the results of this study, multilevel statistical analyses have shown that social participation and leisure time physical activity are associated with each other. The causality remains unclear because of the cross-sectional settings. (127).

However, Lindström has earlier discussed his findings of similar association claiming that the effects of social participation on the extent of leisure-time physical activity might be mediated by encouragement or peer pressure to participate in such activities (149).

It has been unclear whether the use of fruit and vegetables is dependent on socio-economic status directly or is mediated through social networks (126). The results from a cross-sectional study in Sweden found the association between active social participation and sufficient vegetable consumption (150). This present study offers corresponding results based on vegetable consumption, and adds that high levels of social support are also associated with it regardless of socio-demographic status.

In this study, non-smoking was associated with high levels of social participation and trust after adjustment for socio-demographic factors. Similar associations have been found among the Swedish adult population between daily smoking and inactive social participation and low levels of generalized trust (12), and in the Netherlands between non-smoking and high neighbourhood social capital (173). This study also analysed the association between smoking and social support. Moderate levels of support were significantly negatively associated with non-smoking. Investigating the smoking habits of adolescents has shown that young people growing up in smoking families often have a greater tendency to be smokers themselves than those coming from a non-smoking environment. It might be that many smoking adults get social support from family and friends who smoke themselves and are more prepared to accept smoking than to demand smoking cessation. It might even be possible that social capital can promote smoking or other unhealthy behaviour patterns if the group norm is that everybody smokes. (221, 222).

Non-excessive alcohol consumption was not associated either with social support or trust, but it was twice prevalent among those with active social participation compared to those who were inactive. High social participation with low levels of generalised trust has been linked to excessive drinking (12). It is possible that if social trust is at a low level, this results in a weaker identification with the society and tendency not to follow the norms. Similar connections have been reported in other studies among adults and adolescents (223, 224). Participation with social contacts seems to predispose to frequent drinking, but drinking tends to remain moderate in a trustful atmosphere and may become excessive in an environment without trust. In Taiwan, frequent drinking is more common among those participating actively in social events (224). Cultural differences may be relevant here, since in Taiwan society tolerates or even encourages considerable alcohol consumption at social events. People renew personal bonds over a drink. The survey question on alcohol consumption differs as well. The European measures are classified according to the frequency and amount of alcohol whereas the Taiwanese measure is based only on frequency, not amount.

Research on pathways between social capital and health has been scant (225). Some hypotheses have been suggested about better information channels (health and health services), biological or psychological mechanisms, or the influence of peers on health behaviour. Social networks and support might buffer against stress (126, 212). The present study does not confirm the role of social support. However, social participation seems to encourage to healthier behaviour patterns and at least leisure-time physical activity attenuates the association between social capital and health to some extent. These findings are in accordance with those from the Netherlands (173). It is also possible that social participation increases the information useful for health as well as levels of beneficial hormones, such as oxytocin (126). The role of

hormones has remained outside the scope of studies in this field although there are early signs of interest in this (226).

7.5 Methodological considerations

7.5.1 Strengths of the study

The participation rate in the Health 2000 Survey was exceptionally high. The strength of this study was representative nationwide data with small non-response. The response rate varied between 89% in personal interviews and 79% in the third supplementary questionnaire. Nonetheless, sampling weights were constructed to return the observed data to correspond to the distribution of the target population. The weights were calibrated according to design weight based on adjusted inclusion probability, health centre district indicator, university hospital district indicator, age, gender and language. Weights were used in statistical analyses for adjusting variability and non-response errors. (185).

As the non-response grew towards the end of the data collection, there was a bigger item non-response in the third self-administered questionnaire which included all the questions related to trust. The missing information was therefore imputed. These weighting and imputation schemes improved the quality of the study data.

The data set used in this study was a rich source of suitable variables for examination of both social capital and health and health related behaviours with good reliability and validity. However, while the indicators of social participation measure frequencies, they do not capture the quality of those social contacts. Some of the participation questions do not explicitly reveal whether you do something alone or with others. In addition, the most often used question of trust (“Would you say that most people can be trusted, or that you can't be too careful in dealing with people?”) (227) was not included in this survey. In this study, several questions about trust were used instead. Cynical distrust was used as a whole because of several suitable items. This may have led to the situation in which dimensions of trust and social participation correlated very weakly. However, in cognitive tests in Finland, the operationalization of trust has been found to be very difficult in any case. The respondents were asked several questions used previously to measure trust and also describe what they thought when they answered these questions. Since the respondents understood the questions in various ways, and trust is used as an indicator of social capital internationally, the validity of the questions should be verified. (192) After this, the usefulness of trust as a part of social capital has been questioned (228).

The selection of the variables describing social capital was intentionally not very narrow. A diverse selection of variables widely recognized in research was included

in factor analyses. The results led to recognized dimensions of social capital as well. Still, there are controversial views about the role of social support, as mentioned in Chapter 2.2. In this study, social support did not appear to be related to health after adjusting for the other two dimensions of social capital. In addition, it can be considered a feature of a personal relationship based on the fact that the respondents in this study reported getting most social support from their spouses.

7.5.2 Limitations of the study

One limitation in this study was its cross-sectional design, except for the analysis of mortality. Given this restriction, it is not possible to draw straightforward conclusions about the causal directions. The possibility of reverse causality must be borne in mind in interpreting the associations between social capital and other factors. For example, poor health may lead to lower levels of social participation or vice versa. People have to be well enough to be able to participate or even get out of their homes. However, the Sub-study II discovered that despite poor health, long-standing illnesses and limitations in functional capacity, those active in social participation reported their health was better compared to their inactive peers. But of course you have to be well enough to even be active. One recent Japanese study suggests that participation in the community salon (community centres where older residents could congregate and engage in a variety of social activities) is associated with a significant improvement in self-rated health over time (229). Some other causal associations were not as clear, but other studies have suggested a causal direction from social capital to health (173, 200). Additionally, cross-sectional data render it impossible in the strict sense to examine mediating factors between social capital and health. In the main, it is only possible to evaluate whether any factor attenuates the association between them. Nowadays multi-level studies are also preferred although—or because—most of the studies are not that.

Another limitation was that it was not possible to distinguish bonding and bridging social capital. This distinction would have been valuable. The dimension of trust was not the best possible as we did not have the most generally used question on general trust. Trust included several questions one being cynical mistrust. There is a potential method bias, for example, as applied the association between trust and mental health. While they are not objectively diagnosed, both these measures are based on several questions and therefore not ‘directly’ self-reported as, for example, self-rated health.

7.6 Relevance of social capital in health research

As the literature review shows, there is a surplus of definitions of social capital. This hampers the operationalization of the definition. In addition to this, measurement of social capital is challenging because it is still difficult to measure the capital itself.

Instead, we have to use proxies. Access and the actual use of social capital are estimated by the approximate existence of this capital based on social networks, participation and trust. This often confuses researchers into thinking that social capital is nothing new but the already well-known social relationships.

Social capital has been criticized for being “old wine in new bottles” (225, 230). The criticism springs from individual features, that is, social support and networks that have been examined for decades and are known to be related to health and well-being. But the benefits come from social structure that individuals participate in. Two different studies showed that social capital does not automatically lead to better health (39, 231). They suggest that the beneficial health effects of social capital mainly apply to trusting, socially active individuals. The benefits materialize only if individuals are able to access and mobilise social capital. People do not profit directly from the available supportive social networks. The challenge of the research on social capital is the lack of ‘revealing’ measures. So far, only proxies are available.

The supporters of the macro level social capital have claimed that social capital cannot be possessed by individuals. However, several multilevel studies on social capital have demonstrated that a minor part of the total variation in individual health is attributable to community or state contexts (232-234). One recent multilevel study examining different levels of social capital simultaneously reported that individual social capital influences individual health more than any other form (200, 235). Furthermore, it is not clear that the contextual-level results reflect genuine contextual effects, as they are most often based on aggregated individual-level measures (230, 232). The starting-point for individual-level social capital is in the idea that society is an aggregate of individuals. The individual is the one to decide on the investment in social relationships. Through them and membership of groups, individuals get access to networks, information, trust and reciprocity. As a result of their membership of social networks, individuals are able to accrue resources. Health benefits are seen as a consequence of individual membership in various groups in society.

Either way, social capital has found its place among the social determinants of health and it also seems that social capital is linked to health inequalities. The concept of social capital may still have much to offer us. The enthusiastic debate on social capital hopefully promotes scientific research to solve issues that would lead the operationalization and measurement forward. At the very least, social determinants of health have received an enthusiastic reception among scholars all over the world which may lead to new sights and findings.

8 Conclusions and implications of the results

Social capital is unequally divided among different population groups. While advantageous educational, economic and partnership circumstances are linked to its accumulation, social capital treats those who get access to it equally, that is, regardless of the socio-demographic background or chronic diseases or limitations in functional capacity, those who have more social capital feel healthier and live longer than those with low levels.

Better access to social capital is associated with good self-rated health, psychological well-being, healthier behaviour patterns and low mortality. Based on this study, and other recent longitudinal studies suggesting that social participation promotes well-being (18), health could be promoted by increasing social capital. Especially the increase of social participation would enhance health in different subgroups of population.

Social participation and trust should be recognized in epidemiological research as determinants of health. In addition to health behaviour, social capital should be recognised in public health work. They both are important in health promotion.

It has already been demonstrated that people facing unemployment have a strong disincentive to participate in social groups, partly on account of the distrust they tend to develop towards society (236). In Finland, it was found that during the employment experiment project on the long-term unemployed in the municipality of Paltamo, institutional trust increased among the experimental group (237). Reducing unemployment, increasing rehabilitation and encouraging social participation are relevant tools in preventing exclusion.

The social abilities, needs and prospects of people vary. The social abilities may be influenced in day care and at school. In addition, single men are in greater danger of exclusion than women, who participate socially more actively than men. The health centres could give health information in groups more. Accessible and affordable leisure-time activities should be increased as well as community activity.

The fundamental preconditions for the creation and maintenance of social capital are communication and social exchange. This is a challenge in areas with low levels of social capital, especially its bridging form. The lack of social capital quickly leads to a cycle of maintaining the same circumstances without any progress. Diversity in the form of some people with high levels of social capital also contributes to those with lower levels. (3, 29). Previous discussion has also stressed the importance of local public meeting places for increasing social capital (48, 55). However, this is not enough. One should also develop means of inducing those people with least social capital to participate in social activities. For example, the long-term

unemployed might lose their interest in participating because of their many problems.

Follow-up of changes in the level and distribution of social capital among population groups would be a good tool in tackling health inequalities. By way of follow-up, it would be possible to allocate the support for those most in need.

For example, health centres could arrange more peer groups, and retirement homes could use more resources in leisure activities or cultural performances instead of keeping the elderly in a lying position or sitting without anything to do. Workshops and more urban living spaces for all ages would be possible choices as well.

Various trials have been conducted. However, if interventions are implemented, the painstaking evaluation should be done as well. In the end, participation is an individual choice but the availability of these activities, help to access them if needed and spurring people to join could help the most inactive group with health problems.

Future research

There is already accumulating evidence of the associations between social capital and health. Despite some inconsistency, it can be said that high levels of social capital are associated with good health. However, the picture of the totality of these associations and the pathways are still incomplete, and open questions remain. Research on this topic with good measures of social capital and longitudinal data is thus still needed. There is space for research on mechanisms applying between social capital and health, which are still matters of guesswork. Knowledge of formation of social capital, the variation in social capital during the various phases of life or during social and cultural changes is still needed, as well as more information on causality. In analysing longitudinal data, the study should utilise both baseline and follow-up information sufficiently. Not all the available information has always been utilised enough, while all the aspects measured may change during the follow-up period.

Based on recent reviews of the research, the measurement of social capital should advance to include necessary dimensions and to exclude the dispensable. Participation seems to have an important role nowadays (see, for example, (172)) but the roles of social support and even trust have been questioned (96, 228). On the other hand, there might be new phenomena in the dimensions of social capital, such as informal social control. But it will take time to reach a consensus on the operationalization of social capital. There seems to be demand for a similar task force like the now defunct Budapest meeting in May 2003, see (<http://unstats.un.org/unsd/methods/citygroup/sienna.htm> (95)).

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Appendix 1

Distribution of measures used in this study by gender (%) and number of missing values from gross sample of the Health 2000 Survey.

	Men (%)	Women (%)	Total (N)	Missing (N)
Age group			8028	0
30–39	24	21	1775	
40–49	25	21	1851	
50–59	22	18	1628	
60–69	14	14	1118	
70–79	9	12	838	
80–	6	14	818	
Support			6268	1760
High	26	37	1994	
Medium	31	30	1922	
Low	43	33	2352	
Participation			6098	1930
High	24	41	2033	
Medium	34	33	2033	
Low	42	26	2032	
Trust			5586	2442
High	39	29	1862	
Medium	32	34	1862	
Low	29	37	1862	
Education			7358	670
Higher	23	30	1979	
Secondary	37	26	2278	
Basic	40	44	3101	
Income			6636	1392
5 highest	23	16	1271	
4	22	21	1443	
3	19	22	1372	
2	18	17	1150	
1 lowest	18	24	1400	

	Men (%)	Women (%)	Total (N)	Missing (N)
Living arrangements			7252	776
Married	62	52	4092	
Cohabiting	12	10	771	
Living with others	6	9	558	
Living alone	20	29	1831	
Smoking			7357	671
Never/Occasionally	71	84	5753	
Daily	29	16	1604	
Drinking			6761	1267
Non-excessive	88	95	6197	
Excessive	12	5	564	
Physical activity			5481	2547
Active	64	65	3532	
Sedentary	36	35	1949	
Vegetables			7047	981
Daily	51	62	4039	
Less	49	38	3008	
Sleep			5986	2042
7–8 hours	73	71	4300	
More or less	27	29	1686	
Self-rated health			7364	664
Good	60	60	4413	
Poor	40	40	2951	
Psychological well-being			6545	1483
Good	77	73	4916	
Poor	23	27	1629	
Long-standing illnesses			7382	646
No	49	43	3390	
Yes	51	57	3992	
BMI			6703	1325
20–24.9	31	36	2274	
less than 20	2	5	246	
25–29.9	46	35	2682	
30–34.9	17	17	1143	
35–	4	7	358	

	Men (%)	Women (%)	Total (N)	Missing (N)
Blood pressure			7071	957
Normal	44	47	3240	
Hypertensive	56	53	3831	
Cardiovascular diseases			8082	0
No	85	84	6805	
Yes	15	16	1223	
Diabetes			8082	0
No	92	93	7432	
Yes	8	7	596	
Cancer			8082	0
No	95	92	7502	
Yes	5	8	526	

Appendix 2

Variables of social capital and their categories used in this study.

Variable and question number ¹	Scale
1.club or society activities (including posts of trust in society), Q1_Q2001	5 categories from 1=“less than once a year or never” to 5=“every day or during most days”
2. theatre, movies, concerts, art exhibitions, sporting competitions, etc., Q1_Q2002	as above
3. studying, Q1_Q2003	as above
4.church or other religious activities, Q1_Q2004	as above
5. exercise, hunting, fishing, gardening or other outdoor activity, Q1_Q2005	as above
6. handicrafts, playing music, singing, photography, painting, collecting (e.g., stamps), Q1_Q2008	as above
7. visiting family/friends/ neighbours, Q1_Q2010	as above
8. family / friends / neighbours visiting you, Q1_Q2012	as above
9. talking on the phone, Q1_Q2014	as above
10–20. joining regularly in (health promotion) discussion group activities, Q1_Q61	Summation of 11 items, three categories: 0=no joined any group, 1= joined at least one group but not during the past 12 months, 2=joined at least one group during the past 12 months
21.feeling unsafe when walking in the neighbourhood, Q1_Q62	from 1=feel very often unsafe to 5= feeling never unsafe
22. feeling safe to be alone outdoors in the evenings after 10 pm, Q1_Q64	From 1=afraid (every now and then, or often, or doesn't go out because is afraid) to 2= not afraid (can't tell or never)
23. having someone to count on when feeling exhausted, Q1_Q68	0=no one, 1=one person, 3= two persons or more
24. having someone who really cares no matter what, Q1_Q68	as above
25.having someone who really make you feel better when you feel down, Q1_Q68	as above

Variable and question number ¹	Scale
26. having someone to get practical help from when needed, Q1_Q68	as above
27. being surprised by the behaviour of the people you thought you knew well, Q3_Q1703	from 1=always happened to 7= never happened
28. being disappointed by people whom you counted on, Q3_Q1704	as above
29–36. cynical mistrust, Q1_Q81	Contains eight items, variables totalled, reversed scale 8=most distrust - - 32=least mistrust

¹ The questionnaires can be found on the website

<http://www.terveys2000.fi/forms.html> in English.

The questionnaire (I=interview, Q1=basic questionnaire 1, and Q3=complementary questionnaire 3) and question numbers (_Question no) are mentioned in this table.

Original publications I-IV