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Two theoretical strands of social capital, and total, cardiovascular, cancer and other mortality: A population-based prospective cohort study

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ABSTRACT

The aim is to prospectively investigate both the "cohesion" and "network" perspectives of social capital in relation to total, cardiovascular (CVD), cancer and all other causes mortality. The 2008 public health survey in Scania was a postal questionnaire with three letters of reminder, and it was answered in the Autumn by 28,198 respondents (55% participation) aged 18–80 from a stratified random sample of the population register. This baseline was connected with the national causes of death registry (Dödsorsaksregistret) with a more than five-year follow-up August 27- November 14 (depending on individual response) to December 31, 2013 (946 deaths). The analyses were performed in multiple adjusted survival (Cox-) regression models. Results show that low social participation, common to both theoretical perspectives, had consistently high hazard rate ratios (HRRs) of total, CVD, cancer and other morality, and that HRRs of total and CVD mortality remained statistically significant even after adjustments for all covariates including health behaviors, BMI, unmet healthcare needs and self-rated health, HRR 1.28 (1.08–1.52) and HRR 1.79 (1.28–2.50), respectively. In contrast, low social support, specific to the "network" perspective, showed no significant associations with mortality, except for low emotional and instrumental support and other causes mortality for which HRRs remained significant adjusted for demographics and socioeconomic status (SES). Generalized trust in other people, specific to the "cohesion" perspective, showed statistically significant HRRs for total and other causes mortality until adjustments for health-related behaviours and BMI, although not after complete adjustments, and significant HRRs for CVD and cancer mortality before adjustment for health behaviours. In conclusion, low social participation is consistently associated with all forms of mortality, and particularly total and CVD mortality. Social participation represents a strong core of social capital theory, and items should measure both variety of social contact surfaces and intensity.

1. Introduction

Social capital has been a topic of research and debate in public health for somewhat more than two decades. Social capital was introduced into public health partly inspired by Putnam's "Making Democracy Work" (1993), despite the fact that Putnam in this book suggested public health to be a research area which he anticipated to be among the least associated with and afflicted by social capital. Putnam's political science perspective focuses primarily on the macro (countries, regions, counties, municipalities) level of analysis. Following this perspective, several early social capital studies in public health investigated US state-level ecological associations between for example social capital, income inequality and mortality (Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997), and social capital, income inequality and firearm violent crime (Kennedy, Kawachi, Prothrow-Stith, Lochner,

& Gupta, 1998). Kawachi et al. also suggested four pathways which were hypothesized to causally connect social capital and health: 1) psychological/psychosocial mechanisms, 2) norms and attitudes regarding health-related behaviors such as smoking, exercise, diet and alcohol consumption, 3) access to healthcare and other amenities, and 4) violent crime as cohesion and trust are weakened (Kawachi, Kennedy, & Glass, 1999). Social capital could thus also be regarded as a contextual level extension of the psychosocial theory and a new addition to the debate regarding material and non-material causal mechanisms behind socioeconomic status (SES) differences in health (Berkman and Syme, 1979). This social and contextual approach to SES differences in health was soon challenged by advocates of material models and theories regarding such SES differences (Muntaner et al., 2002; Muntaner, 2004). However, social capital research in public health suffers in its own right from two major weaknesses which will be

introduced consecutively in the following.

First, social capital research suffers from a variety of not always compatible definitions and items used to assess social capital, and the main reason seems to be that strands of social capital theory stem from political science as well as different theoretical traditions in sociology. Putnam's political science ecological, contextual and societal macro perspective entails social capital components such as generalized trust in other people, generalized reciprocity, social participation and social networks that bind entire societies and communities together (Putnam, 1993, 2000, 2007). Theories and hypotheses in sociology are by definition more micro oriented towards the individual and her place in a narrower and closer social network and her access to social support. Political science definitions by Putnam and others of social capital have been named the "cohesion" perspective on social capital (Moore, Child, Wu, & Mandelbaum, 2018). Cohesion approaches to social capital emphasize cognitive aspects of social capital such as trust, sense of social belonging and integration, as well as structural aspects of social capital such as social and civic participation (Moore and Kawachi, 2017). Cognitive social capital entails perceived quality of social relations including generalized trust in other people, trust in institutions, norms and reciprocity. Structural aspects of social capital entail objective quantities of social activities and relations including membership numbers in organizations and civic and social participation (Mitchell and Bossert, 2007). The second "network" approach to social capital is based on the sociological micro and network oriented individual resource perspective (Bourdieu, 1986; Portes, 1998). Social networks are patterns of social ties which exist between actors, i.e, individuals, groups, organizations and institutions (Wasserman and Faust, 1994). The individual or any other actor utilizes the social network as a source of resources to enhance his position within the network in order to be empowered (Bourdieu and Wacquant, 1992). It should be noted that there are different sociologist theories of social networks and their significance. Most sociological theories and network approaches to social capital include civic and social participation but exclude trust and generalized trust in other people (see e.g. Bourdieu, 1986; Portes, 1998). Still, the definitions of social capital by some sociologists such as Coleman are more concerned with the overall functions of the networks and entail both social participation and social network as well as trust and generalized trust in others (Coleman, 1990), and Coleman's functional approach to social networks is thus not considered as central or even relevant to the network approach to social capital. On the other hand, Bourdieu, one of the modern originators of the social capital concept, is considered a main representative of the network approach, and does not include trust and generalized trust in other people in the definition of social capital. Bourdieu's network perspective on social capital has also been interpreted to include less structural social support close to the individual:

> Social capital is the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing *a durable network of more or less institutionalized relationships* of mutual acquaintance and recognition (Bourdieu and Wacquant, 1992, p.119).

The network perspective according to Bourdieu has also sometimes been operationalized to also include aspects of social support (see e.g. Aida et al., 2011; MacArthur, Jacob, Pound, Hickman, & Campbell, 2017; Mohan, Twigg, Barnard, & Jones, 2005; Wen, Cagney, & Christakis, 2005). It should be noted that the inclusion of aspects of social support such as emotional support and instrumental support as aspects of social network has been criticized by Wellman as pseudo- or quasi-network operationalizations because the capture neither the structure or composition of a person's network (Wellman, 1999).

It should also be particularly noted that while the "cohesion" approach to social capital excludes social support, which is partly due to the mainly macro perspective of the "cohesion" approach, and the "network" approach excludes trust and generalized trust in other people, partly due to the micro perspective of the network approach,
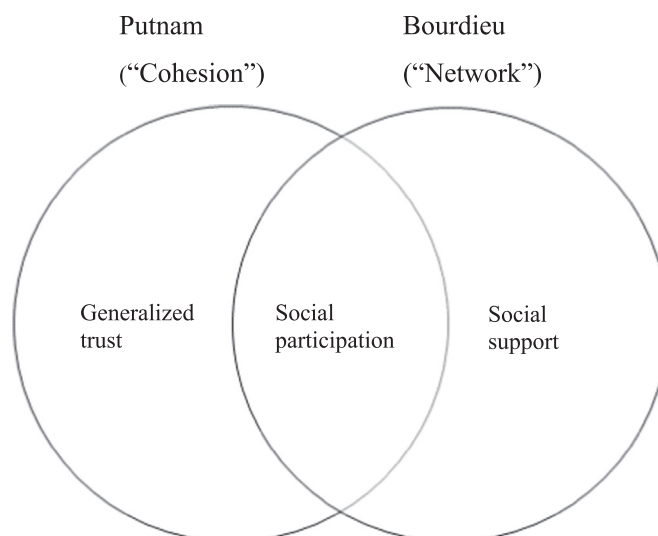

Putnam ("Cohesion") Bourdieu ("Network")

Generalized trust   Social participation   Social support

Fig. 1. Main components of social capital according to main theoretical strands in the political science and sociological literature.

both the "cohesion" and "network" perspectives entail social (and civil) participation, as illustrated in Fig. 1. In this study we will include both the "cohesion" and "network" perspectives by including generalized trust in other people ("cohesion" perspective), social participation ("cohesion" and "network" perspectives) and social support in the forms of emotional and instrumental (practical) support ("network" perspective according to Bourdieu) in the prospective cohort survival analyses of somewhat more than 5-year follow-up of total mortality, cardiovascular mortality, cancer mortality and mortality from all other causes. The analysis of the "cohesion" and "network" perspectives on the same prospective data from a population-based study will make comparison of the two perspectives possible.

Second, social capital and health research suffers from a lack of empirical evidence from longitudinal studies. Most studies are cross-sectional (e.g. Johnson, Rostila, Svensson, & Engström, 2017; Lindström, 2004). Complete panel data studies with three or more observation points over time are scarce (Giordano, Björk, & Lindström, 2012; Lindström and Giordano, 2016) but have made evident support for the bidirectional or even circular nature of the relationship between social capital (trust) and health not discernible in studies with cross-sectional design (Giordano and Lindström, 2016), which is most probably also likely for social capital defined as social participation and health. A number of prospective cohort studies have been conducted including social capital indicators civic participation, social participation, social support and trust analyzed with all cause, cardiovascular and cancer mortality as outcomes (Aida et al., 2011; Ali, Merlo, Rosvall, Lithman, & Lindström, 2006; Blakely et al., 2006; Chaix, Lindström, Rosvall, & Merlo, 2008; Clark et al., 2001; Hyyppä, Maki, Impivaara, & Aromaa, 2007; Islam, Gerdtham, Gullberg, Lindström, & Merlo, 2008; Mohan et al., 2005; Oksanen et al., 2011; Scheffler et al., 2008; Sundquist, Johansson, Yang, & Sundquist, 2006; Van Hooijdonk, Droomers, Deerenberg, Mackenbach, & Kunst, 2008; Veenstra & Patterson, 2012; Wen et al., 2005), and most of these studies were reviewed and meta-analyzed in a review article by Choi et al. (2014). This meta-analysis used a pooled estimate of the measures of effect of social capital on each prospective health outcome per social capital dimension using the most adjusted (including mostly age, sex, SES, cohabitation status, health behaviors, biological factors, mental health, area-level characteristics in the adjustments, if available) measures of effect. All estimates for each social capital dimension were combined to obtain a single measure of health effect/health outcome. These derived effect measures were pooled for each type of risk comparison (e.g. quartiles, binary, continuous) across studies. All effect measures were combined

assuming interchangeability between odds ratio, risk ratio and hazard ratio by random effect models to derive pooled relative risks with 95% confidence intervals. The study concluded that there was limited support for an association between social capital and health, and that lack of consensus on indicators and measurements of social capital hindered the comparability of studies and weakened the evidence base (Choi et al., 2014). To our knowledge no prospective cohort studies analyzing associations between social capital and mortality have been published after the review and meta-analysis by Choi et al.

We have demonstrated that the lack of consensus regarding the definition of social capital has evolved into two strands commonly named the "cohesion" and "network" perspectives, each with its respective robust foundation in political science and sociological theory, respectively, but also with an overlap in the definition of social capital regarding social (and civil) participation (Fig. 1). There is thus a lack of consensus but primarily only between two comparatively clearly defined strands both founded in theory. Second, we have also demonstrated the disparity of results and interpretations of the few empirical studies conducted on prospective cohort data regarding social capital and health.

This study will analyze social support ("network" perspective), social participation ("network" and "cohesion" perspectives) and generalized trust in other people ("cohesion" perspective) in survival (Cox-) regression models with total, CVD, cancer and all other causes mortality as the outcomes in a prospective study with a five-year follow-up, adjusting for relevant confounders and mediators. Statistically significant associations between social capital items and total and cause-specific mortality will be regarded to fulfill the research hypotheses (H1), while the lack of statistically significant results will be regarded to fulfill the null hypotheses (H0). The previous literature indicates that social participation is the one of the social capital items which is most likely to yield statistically significant associations with mortality (Choi et al., 2014).

The aim of this study is to investigate in survival (Cox-) regression models associations between measures of social support, social participation and generalized trust in other people from the two main strands of social capital theory, and total, cardiovascular, cancer and all other causes of death five-year mortality.

2. Methods

2.1. Study population

The public health survey 2008 in Scania, in the southernmost part of Sweden which includes 14% of the Swedish population, is a cross-sectional survey which was conducted from August 27 to October 30, 2008 including a stratified random sample of the registered population in Scania aged 18–80. The sample was weighted to increase sample size in some municipalities and city parts (of the four major cities). The approach to the study population included a postal invitation letter with questionnaire as well as the opportunity to answer the questionnaire online. Three reminders were posted to initial non-respondents. A total 28,198 persons responded which yields an approximately 55% participation rate. The 2008 public health baseline survey was linked to prospective cause specific mortality register data from the cause of death register (Dödsorsaksregistret) at the National Board on Health and Welfare (Socialstyrelsen). This closed cohort was followed from date of registration of the answer to the baseline questionnaire in the autumn of 2008 until December 31, i.e. the average follow-up period until December 31 2013 was 5.3 years, or death. The study, including the connection of the baseline 2008 survey data with prospective register data regarding mortality, was approved by the ethical committee in Lund (No. 2010/343).

2.2. Definitions

2.2.1. Dependent variables

Mortality was followed from August 27-November 14, 2008 (depending on registration date of individual answers) until December 31, 2013 (approximately 5.3 years later), or until death (946 respondents of 28,062 respondents at follow-up), or loss to follow-up (136 respondents of 28,198 not included in this study because they were not possible to trace). The system with ten-digit person number**s** in Sweden was used to connect the baseline study data from the 2008 survey with the Swedish national cause of death register (Dödsorsaksregistret) kept at the Swedish National Board on Health and Welfare (Socialstyrelsen) by a third party (the company Tieto). The ten-digit person numbers were removed before data delivery.

The causes of death were coded according to ICD 10, and in this particular study categorized into three groups: 1) cardiovascular diseases (CVD) including deaths from myocardial infarction, stroke, pulmonary emboli, arrhythmias and diseases of the heart valves (ICD I109-I729), 2) deaths from cancer (C01-C97), and 3) deaths from all other causes (A047-B99, C329-G931 and J01-Y869), including e.g. infections, lung diseases, neurological diseases, gastrointestinal diseases, injuries, accidents and suicides.

2.2.2. Independent variables

Age was stratified into age groups 18–34, 35–44, 45–54, 55–64 and 65–80 years of age in Tables 1 and 2, and was analysed as a continuous variable in Tables 2 (all other variables than age), 3 and 4.

The analyses in Table 1 were stratified by *sex*. Tables 2–4 were collapsed for sex.

Country of birth. All participants born outside Sweden were classified in one group and participants born in Sweden in another.

Socioeconomic status (SES) (by occupation and relation to labor market) included the employed categories non-manual employees in higher positions, non-manual employees in medium level positions, non-manual employees in lower positions, and skilled and unskilled manual workers as well as self-employed/farmers. The categories outside the workforce consist of unemployed, students, early retired (before age 65)/ long-term sick leave, pensioners aged 65 or above, and unclassified.

Leisure-time physical activity was measured with the question "How much have you been exercising physically during leisure time during the past twelve months?" with the four alternative answers 1) regular exercise and training (e.g. running, swimming, tennis, badminton, exercise gymnastics or similar on average at least three times a week at least 30 min per occasion), 2) moderate, regular exercise in leisure time 1–2 times per week at least 30 min per occasion of running, swimming, tennis, badminton or other activity that makes you sweat, 3) moderate leisure time exercise walking, bicycling at least 2 h per week without sweating and 4) sedentary leisure time (walking, bicycling etc. less than 2 h per week).

Tobacco smoking was assessed with the item "Do you smoke?" with the alternatives "Yes, daily", "Yes, but not daily", and "No".

Body mass index (BMI) was assessed as a continuous variable with values between 13.68 and 73.96.

Alcohol consumption was assessed with the item "How often have you consumed alcohol during the past 12 months?" with the alternatives "4 times/week or more", "2–3 times/week", "2–4 times/month", "1 time/month or less", and "Never".

Unmet health care needs were assessed with the question "Have you during the past three months considered yourself to be in need of healthcare by a physician, but not sought care?" with alternatives "No" and "Yes".

Self-rated health was assessed with "How do you consider your general health status?" with alternatives "Very good", "Good", "Neither good nor poor", "Poor" and "Very poor".

Social participation describes participation in activities of formal and

Table 1
Distribution (%) of social support, social participation, generalized trust, age, country of birth, socioeconomic status (SES), leisure-time physical activity, tobacco smoking, BMI, alcohol consumption, unmet healthcare needs and self-rated health. Weighted distributions (%). Men (n = 12,618), women (n = 15,444), and total (n = 28,062). The public health survey in Scania 2008 (follow-up at 31 December, 2013).

	Men (n = 12,618)	Women (n = 15,444)	Total (n = 28,062)
Emotional support			
High	62.1	68.8	65.5
Low	37.9	31.2	34.5
(Missing)	(286)	(356)	(642)
Instrumental support			
High	71.3	75.5	73.4
Low	28.7	24.5	26.6
(Missing)	(292)	(337)	(629)
Social participation			
High	57.6	60.0	58.8
Low	42.4	40.0	41.2
(Missing)	(340)	(382)	(722)
Generalized trust			
High	63.9	61.8	62.9
Low	36.1	38.2	37.1
(Missing)	(532)	(698)	(1230)
Age			
18–34	27.7	30.5	29.1
35–44	18.3	19.0	18.7
45–54	17.2	16.4	16.8
55–64	18.4	16.3	17.3
65–80	18.4	17.8	18.1
(Missing)	(0)	(0)	(0)
Country of birth			
Sweden	81.0	80.3	80.7
Other country	19.0	19.7	19.3
(Missing)	(0)	(0)	(0)
Socioeconomic status			
Higher non-manual	9.4	7.5	8.4
Medium non-manual	11.5	14.9	13.2
Lower non-manual	5.1	10.0	7.6
Skilled manual	11.5	8.9	10.2
Unskilled manual	12.7	12.0	12.4
Self-employed/farmer	8.0	3.9	6.0
Early retired	3.6	4.6	4.1
Unemployed	4.0	4.2	4.1
Student	6.9	9.3	8.1
Old age pensioner	20.2	19.0	19.6
Long term sick leave	6.3	4.2	5.2
Unclassified	0.9	1.4	1.2
(Missing)	(207)	(242)	(449)
Leisure-time physical activity			
Regular exercise	19.6	17.1	18.3
Moderate regular	24.0	21.9	22.9
Moderate	40.8	47.8	44.3
Sedentary lifestyle	15.6	13.1	14.4
(Missing)	(312)	(429)	(741)
Tobacco smoking			
No	80.6	79.9	80.3
Yes, but not daily	5.4	4.6	5.0
Daily	14.0	15.4	14.7
(Missing)	(165)	(183)	(348)
Body Mass Index			
-24.99	42.6	58.6	50.6
25.00–29.99	42.7	27.7	35.2
30.00-	14.7	13.7	14.2
(Missing)	(323)	(603)	(926)
Alcohol past year			
Never	9.5	4.6	7.0
Once per month or less	25.1	18.6	21.8
2–4 times/month	36.5	33.4	34.9
2–3 times/week	18.9	27.3	23.1
4 times/week or more	9.9	16.0	13.0
(Missing)	(215)	(224)	(439)
Unmet healthcare needs			
No	82.5	79.6	81.0
Yes	17.5	20.4	19.0

Table 1 (*continued*)

	Men (n = 12,618)	Women (n = 15,444)	Total (n = 28,062)
(Missing)	(471)	(566)	(1037)
Self-rated health			
Very good	24.4	21.7	23.1
Good	48.3	48.3	48.3
Neither good nor poor	20.9	23.4	22.2
Poor	5.0	5.5	5.3
Very poor	1.3	1.1	1.2
(Missing)	(247)	(396)	(643)

informal groups of society (study circle/course at workplace, other study circle/course, union meeting, meeting of other organizations, theatre/cinema, arts exhibition, church, sports event, letter to the editor of newspaper/journal, demonstration, night club/entertainment, big gathering of relatives, private party). It was indexed, and if three or less alternatives were indicated, social participation was classified as low.

Emotional support was assessed with the question "Do you know one or some persons who could give you proper personal support to cope with the stress and problems of life?" with the alternatives "Yes, completely certain", "Yes, probably", "Not certain" and "No". The variable was dichotomized with the first versus the three latter alternatives.

Instrumental support was assessed with the question "Can you get help from one or some persons if you are ill or have practical problems (borrowing smaller items, with reparation, formulating a letter, get advice or information)?", which contains the same alternatives as emotional support and was dichotomized accordingly.

Generalized trust in other people was assessed with the item "Generally, you can trust other people" with the alternative answers: "Do not agree at all", "Do not agree", "Agree", and "Completely agree". These alternatives were dichotomized with the two first options depicting low trust and the two latter high.

2.3. Statistics

Distribution (%) of variables in the public health questionnaire in Scania 2008 were calculated, stratified by sex (Table 1). Ocular tests of proportionality for the four social capital items emotional support, instrumental support, social participation and generalized trust were conducted, by plotting Kaplan-Meier graphs. Hazard rate ratios (HRRs) with 95% confidence intervals (95% CIs) for all variables in the study were calculated for total mortality in survival (Cox-) regression models, not stratified by sex due to similar associations (Table 2). Hazard rate ratios (HRRs) with 95% confidence intervals (95% CIs) for the four social capital items emotional support, instrumental support, social participation and generalized trust in other people were calculated for total mortality, cardiovascular mortality, cancer mortality and all other causes mortality in multiple adjusted survival (Cox-) regression models, adjusting for covariates including sex (Table 3). Hazard rate ratios with 95% confidence intervals (HRR, 95%) were calculated for total mortality according to numbers of social participation sub-items (0–13) answered by the respondents (Table 4). Statistical calculations were conducted by the SPSS software, version 23.0.

3. Results

Table 1 shows that 37.9% of the men and 31.2% of the women reported low emotional support. The distribution of low instrumental support was 28.7% among men and 24.5% among women. Low social participation was observed for 42.4% of the men and 40.0% of the women. Low generalized trust in other people was reported by 36.1% of the men and 38.2% of the women. The distributions (%) of the other baseline variables in the analyses are also given in Table 1.

Table 2
Bivariate hazard rate ratios and 95% confidence intervals (HRR, 95% CI) of total five-year mortality according to sociodemographic factors, SES, health behaviours, unmet healthcare needs and self-rated health, all associations except age and total mortality were adjusted for age. Men and women collapsed. The public health survey in Scania 2008 (total 28,062 respondents and 946 deaths on December 31, 2013).

	Total mortality (n = 946) (HRR, 95%CI) (events)
Age	
18–34	1.00
35–44	5.79 (2.54–13.23)
45–54	10.41 (4.73–22.94)
55–64	33.06(15.50–70.51)
65–80	115.67 (54.75–244.34)
	(946 events)
Country of birth	
Sweden	1.00
Other	1.107 (1.10–1.114)
	(946)
SES	
Higher non-manual	1.00
Medium non-manual	1.33 (0.71–2.51)
Lower non-manual	1.52 (0.76–3.04)
Skilled manual	1.05 (0.51–2.15)
Unskilled manual	1.99 (1.07–3.71)
Self-employed	0.88 (0.39–1.98)
Early retired	5.56 (3.22–9.88)
Unemployed	3.51 (1.69–7.28)
Student	2.88 (0.93–8.93)
Old age pensioner	2.26 (1.28–3.99)
Long term sick leave	1.95 (0.75–5.10)
Unclassified	11.73 (6.07–22.69)
	(946)
Leisure-time physical activity	
Regular exercise	1.00
Moderate regular	0.98 (0.74–1.30)
Moderate	1.18 (0.94–1.48)
Sedentary	3.45 (2.71–4.37)
	(888)
Tobacco smoking	
No	1.00
Not daily	1.54 (1.03–2.29)
Daily	2.22 (1.88–2.62)
	(905)
BMI	
-24.99	1.00
25.00–29.99	0.95 (0.82–1.10)
30.00-	1.12 (0.94–1.35)
	(885)
Alcohol past year	
Never	1.00
Once per month or less	0.66 (0.52–0.83)
2–4 times/month	0.73 (0.58–0.91)
2–3 times/week	1.02 (0.82–1.27)
4 times/ week or more	1.15 (0.92–1.44)
	(903)
Unmet healthcare needs	
No	1.00
Yes	1.43 (1.20–1.70)
	(840)
Self-rated health	
Very good	1.00
Good	1.44 (1.09–1.91)
Neither good nor poor	2.98 (2.26–3.92)
Poor	6.74 (4.99–9.12)
Very poor	12.66 (8.69–18.46)
	(898)

Table 2 reports a steep increase in total mortality with increasing age. There was no significant association between country of birth and total mortality. Unskilled manual workers, early retired, unemployed, old age pensioners and unclassified had significantly higher HRRs of total mortality than the higher non-manual employee reference group.

The group with sedentary lifestyle had a significantly higher HRR than the reference group with regular exercise. Both non-daily and daily tobacco smokers had significantly higher HRRs than the non-smoker reference group. The daily smokers had a higher effect measure than the non-daily smokers. The groups with overweight (BMI 25.00–29.99) and obesity (BMI 30.00-) did not have significantly higher HRRs compared to the BMI below 25.00 reference group. Only the middle groups with alcohol consumption 2–4 times/month and 2–3 times week differed with significantly lower HRRs of total mortality from the never alcohol consumption in the past year reference group. The group with unmet health care needs at some occasion during the past three months in 2008 had a significantly higher HRR 1.43 (1.20–1.70) of total mortality compared to the no unmet healthcare needs reference group with reference HRR 1.00. Poorer self-rated health had significantly higher HRRs of five-year total mortality, especially the group with poorest self-rated health with HRR 12.66 (8.69–18.46). All bivariate calculations in Table 2 except age were adjusted for age as a continuous variable.

Table 3 shows that low social support in the forms of low emotional and low instrumental support was not prospectively associated with increased total, CVD and cancer mortality. The only exception was total mortality for which the HRR was significantly higher for low instrumental support compared to high after adjustment for sex and age, HRR 1.28 (1.11–1.47). Both low emotional support and low instrumental support were associated with significantly higher mortality from all other causes before adjustment for health behaviors and BMI in the multiple adjusted models. In contrast, low social participation was significantly associated with total, CVD, cancer and all other causes mortality with particularly high HRRs for low social participation in relation to CVD mortality. For total and CVD mortality the HRR:s remained significantly higher throughout the multiple adjustments. For total mortality the HRR for low social participation in the sex- and age-adjusted model was 1.84 (1.59–2.14), and in the fully multiple adjusted final model the HRR for low social participation was 1.28 (1.08–1.52). For CVD mortality the HRR of low social participation in the sex- and age-adjusted model was 2.68 (1.98–3.61), and in the fully multiple adjusted final model the HRR was 1.79 (1.28–2.50). In the sex- and age-adjusted model for cancer mortality, HRR 1.46 (1.17–1.83) was observed for low social participation which was reduced to HRR 1.29 (1.01–1.65) in the model adjusted for all variables except self-rated health. When self-rated health was included in the fully multiple adjusted model, the HRR of cancer mortality for low social participation was reduced to a statistically not significant HRR 1.17 (0.91–1.51). In the sex- and age-adjusted model for all other causes mortality, an HRR 1.85 (1.40–2.44) was observed for low social participation which was reduced to HRR 1.75 (1.33–2.32) in the model adjusted for SES. When health behaviours and BMI were included in the multiple adjusted model the HRR for low social participation was reduced to a statistically not significant HRR 1.34 (0.99–1.81), which was further reduced to also statistically not significant HRR 1.09 (0.80–1.48) in the fully multiple adjusted model also including lack of access to healthcare and self-rated health. Finally, low generalized trust in other people was significantly associated with higher HRRs of total mortality before adjustment for unmet healthcare needs (adjustment including health-related behaviours and BMI), HRR 1.20 (1.04–1.40), higher HRRs of CVD and cancer mortality before adjustments for health-related behaviours and BMI (adjustment including SES), HRR 1.30 (1.01–1.69) and 1.27 (1.02–1.58), respectively, and higher HRR of all other causes mortality before adjustment for unmet healthcare needs (adjustment including health-related behaviours and BMI), HRR 1.33 (1.01–1.74), which was reduced to a statistically not significant HRR 1.26 (0.95–1.67) after adjustment for unmet healthcare needs and further reduced to HRR 1.15 (0.87–1.54) after final adjustment for self-rated health.

Table 4 shows that HRRs decrease to significantly lower levels already when those who answered 1 of 13 items were compared to those who answered 0 items (none of the activities during the past year). The HRRs mostly declined with rising number of items (activities)

Table 3

Hazard rate ratios and 95% confidence intervals (HRR, 95% CI) of total, cardiovascular, cancer and all other causes five-year mortality according to low social (emotional and instrumental) support, low social participation and low generalized trust in other people, adjusted stepwise for demographic factors, SES, health behaviours and BMI, unmet healthcare needs and self-rated health. The public health survey in Scania 2008 (total 28,062 respondents and 946 deaths on December 31, 2013).

Total mortality (n = 946)	Emotional support (HRR, 95%CI) (events)	Instrumental support (HRR, 95% CI) (events)	Social participation (HRR, 95%CI) (events)	Generalized trust (HRR, 95% CI) (events)
Sex-adjusted	1.12 (0.97–1.28) (880)	**1.28 (1.11–1.47)** (881)	**3.33 (2.88–3.85)** (862)	**1.28 (1.12–1.48)** (821)
+age	0.99 (0.87–1.14) (880)	1.05 (0.91–1.21) (881)	**1.84 (1.59–2.14)** (862)	**1.38 (1.20–1.59)** (821)
+country of birth	0.99 (0.86–1.14) (880)	1.05 (0.91–1.21) (881)	**1.85 (1.59–2.14)** (862)	**1.38 (1.20–1.58)** (821)
+SES	0.99 (0.86–1.13) (879)	1.04 (0.90–1.20) (880)	**1.78 (1.54–2.07)** (861)	**1.34 (1.16–1.54)** (820)
+health behaviors and BMI	0.90 (0.78–1.04) (789)	0.93 (0.80–1.08) (791)	**1.48 (1.26–1.74)** (778)	**1.20 (1.04–1.40)** (746)
+unmet healthcare needs	0.89 (0.76–1.03) (736)	0.92 (0.78–1.08) (739)	**1.45 (1.23–1.71)** (729)	1.14 (0.97–1.33) (705)
+self-rated health	*0.80 (0.68–0.93)* (719)	*0.83 (0.70–0.97)* (722)	**1.28 (1.08–1.52)** (712)	1.04 (0.88–1.21) (688)
CVD mortality (n = 294)				
Sex-adjusted	0.98 (0.76–1.26) (272)	1.28 (0.99–1.65) (271)	**5.35 (3.98–7.20)** (267)	1.23 (0.95–1.60) (244)
+age	0.87 (0.68–1.12) (272)	1.03 (0.80–1.33) (271)	**2.68 (1.98–3.61)** (267)	**1.34 (1.03–1.73)** (244)
+country of birth	0.87 (0.68–1.11) (272)	1.03 (0.80–1.33) (271)	**2.69 (1.99–3.63)** (267)	**1.33 (1.03–1.73)** (244)
+SES	0.87 (0.68–1.12) (271)	1.03 (0.80–1.33) (270)	**2.62 (1.94–3.54)** (266)	**1.30 (1.01–1.69)** (243)
+health behaviors and BMI	*0.71 (0.54–0.94)* (240)	0.89 (0.68–1.18) (238)	**2.08 (1.51–2.87)** (233)	1.12 (0.85–1.48) (216)
+unmet healthcare needs	*0.72 (0.54–0.96)* (217)	0.88 (0.65–1.18) (216)	**2.00 (1.44–2.78)** (212)	1.06 (0.80–1.42) (203)
+self-rated health	*0.68 (0.50–0.90)* (215)	0.83 (0.61–1.11) (214)	**1.79 (1.28–2.50)** (210)	0.97 (0.72–1.30) (201)
Cancer mortality (n = 377)				
Sex-adjusted	0.94 (0.75–1.18) (355)	1.04 (0.82–1.32) (358)	**2.46 (1.98–3.06)** (348)	1.21 (0.97–1.51) (334)
+age	0.84 (0.68–1.06) (355)	0.87 (0.69–1.10) (358)	**1.46 (1.17–1.83)** (348)	**1.30 (1.04–1.62)** (334)
+country of birth	0.85 (0.68–1.06) (355)	0.88 (0.69–1.11) (358)	**1.47 (1.17–1.84)** (348)	**1.30 (1.04–1.62)** (334)
+SES	0.84 (0.67–1.05) (355)	0.87 (0.68–1.10) (358)	**1.42 (1.13–1.78)** (348)	**1.27 (1.02–1.58)** (334)
+health behaviors	0.83 (0.66–1.05) (323)	0.84 (0.65–1.07) (326)	**1.29 (1.01–1.65)** (322)	1.19 (0.94–1.50) (311)
+unmet healthcare needs	0.82 (0.65–1.05) (307)	0.80 (0.62–1.04) (310)	**1.29 (1.01–1.65)** (309)	1.11 (0.88–1.41) (298)
+self-rated health	*0.74 (0.58–0.95)* (298)	*0.72 (0.55–0.93)* (301)	1.17 (0.91–1.51) (300)	1.02 (0.80–1.29) (289)
All other mortality (n = 275)				
Crude	**1.60 (1.25–2.05)** (253)	**1.66 (1.28–2.14)** (252)	**3.30 (2.51–4.53)** (247)	**1.44 (1.11–1.85)** (243)
+age	**1.42 (1.11–1.82)** (253)	**1.36 (1.05–1.76)** (252)	**1.85 (1.40–2.44)** (247)	**1.55 (1.20–2.00)** (243)
+country of birth	**1.41 (1.10–1.80)** (253)	**1.36 (1.05–1.75)** (252)	**1.84 (1.39–2.43)** (247)	**1.54 (1.19–1.98)** (243)
+SES	**1.39 (1.09–1.78)** (253)	**1.33 (1.03–1.72)** (252)	**1.75 (1.33–2.32)** (247)	**1.49 (1.16–1.93)** (243)
+health behaviors	1.25 (0.96–1.63) (226)	1.12 (0.85–1.48) (227)	1.34 (0.99–1.81) (221)	**1.33 (1.01–1.74)** (219)
+unmet healthcare needs	1.20 (0.91–1.58) (212)	1.14 (0.86–1.52) (213)	1.29 (0.95–1.76) (208)	1.26 (0.95–1.67) (204)
+self-rated health	1.05 (0.80–1.40) (206)	1.00 (0.75–1.34) (207)	1.09 (0.80–1.48) (202)	1.15 (0.87–1.54) (198)

answered. The groups 10, 11, 12 and 13 item (activities) answers were not applicable due to few such answers at baseline and extremely few or no events (deaths). The hazard rate ratios remained generally unaltered between the age- and sex-adjusted model and the model adjusted for age, sex, country of birth and SES.

4. Discussion

This study has empirically investigated the two main theoretical "cohesion" and "network" perspectives in social capital and mortality research in a study with a prospective cohort design. The results indicate that low social participation, the aspect of social capital common to both the "cohesion" and "network" perspectives, was significantly

Table 4

Hazard rate ratios and 95% confidence intervals (HRR, 95% CI) of total mortality according to number of social participation items (0–13) answered by respondents. Men and women. The public health survey in Scania 2008 (total 28,062 respondents and 946 deaths on December 31, 2013).

Number of social participation sub-items answered	HRR (95% CI)[a]	HRR (95% CI)[b]
0 ("None")	1.00	1.00
1	0.70 (0.57–0.87)	0.70 (0.57–0.88)
2	0.58 (0.47–0.73)	0.59 (0.47–0.73)
3	0.41 (0.32–0.52)	0.42 (0.33–0.53)
4	0.39 (0.30–0.50)	0.40 (0.31–0.51)
5	0.32 (0.24–0.43)	0.33 (0.25–0.44)
6	0.38 (0.27–0.52)	0.39 (0.29–0.54)
7	0.29 (0.19–0.45)	0.31 (0.20–0.47)
8	0.16 (0.007–0.36)	0.17 (0.08–0.38)
9	0.20 (0.06–0.64)	0.22 (0.07–0.69)
10	Not applicable	Not applicable
11	Not applicable	Not applicable
12	Not applicable	Not applicable
13	Not applicable (862 events)	Not applicable (861 events)

[a] Adjusted for age and sex.
[b] Adjusted for age, sex, country of birth and socioeconomic status.

associated with total, CVD, cancer and all other causes mortality. In fact, low social participation at baseline remained significantly associated with CVD mortality and total mortality, even after multiple adjustments in the survival (Cox-) models for demographics, SES, health behaviours, BMI, unmet healthcare needs and self-rated health. In contrast, the results show almost no support for associations between lack of social support ("network" perspective according to common interpretations of Bourdieu) and increased mortality, with the exception of a significant association between low emotional support and low instrumental support, and higher mortality in all other causes before adjustment for health-related behaviors. Finally, generalized trust, specific to the "cohesion" perspective, shows significant associations with total, CVD, cancer and other causes mortality, although only after adjustments for health-related behaviours and BMI for total and all other causes mortality and adjustments for SES for CVD and cancer mortality, but not after complete multiple adjustments. In sum, social participation, the aspect of social capital common to both the "cohesion" and "network" strands, was consistently associated with all four groups of mortality, and in the case of CVD mortality and total mortality these statistically significant associations persisted throughout the multiple adjustments including self-rated health at baseline.

Social participation, which is a social capital component and feature common to both the "cohesion" and "network" perspectives, showed the most consistent and statistically significant associations with all main groups of mortality in this study. In the case of social participation and CVD mortality the statistically significant associations persisted even after final adjustments for self-rated health (which includes both physical and mental health) at baseline. Since both the health behavior and access to healthcare pathways outlined by Kawachi et al. (1999) did not attenuate the statistically significant effect measures (hazard rate ratios) for the association between social participation and CVD mortality, only the psychosocial and violent crime pathways of the four hypothesized pathways remain to explain the strong prospective association. Violent crime is not plausible as a mediator between social participation and CVD mortality, at least not for Sweden a couple of years ago, which leaves the psychosocial pathway as a plausible mechanism. Still, this is a conclusion by exclusion. The debate regarding the "cohesion" and "network" perspectives seems less relevant when it comes to our results, because the social participation component of social capital is central to both. Public health studies should thus include items on both variety and intensity of social participation as central indicators of social capital. It may be that generalized trust promotes health to a higher extent at the social and contextual level rather than the individual level. Social (emotional and instrumental) support is so close to the individual that even risky health-related behaviours such as tobacco smoking may even be promoted, e.g. having a smoking spouse will not be supportive for smoking cessation (Lindström, 2000).

Even Choi et al. (2014) concluded that social participation was the social capital component significantly associated with mortality in their review and meta-analysis, although effect measures were moderate after multiple adjustments including final adjustments for baseline mental health and/or self-rated health, a finding which still supports the results of this study. However, attenuation of effect measures and statistical significance of associations between social capital indicators and mortality after adjustments for variables indicating pathways such as health-related behaviours and access to healthcare should be regarded as results that primarily suggest the importance of these pathways rather than the lack of importance of social capital. In the present study, social participation remained significantly associated with CVD mortality after adjustments including health behaviors, unmet healthcare needs and even baseline self-rated health. But how much multiple adjustment may be performed before the association between social capital and mortality may be dismissed? The relevance of this question is illustrated by the fact that the statistically significant SES differences in total mortality in the present study between higher non-manual employees and unskilled manual workers become attenuated and not statistically significant when only self-rated health is added to the survival models which just include the demographic variables age, from 1.99 (1.07–3.71) after adjustment for age to 1.73 (0.93–3.23) after adjustment for age and self-rated health. The same results are observed when all variables in the full multiple models in this study are included (not shown in tables). Do these results lead to the conclusion that there are no SES differences in mortality between higher non-manual employees and unskilled manual workers in the southernmost part of Sweden? The commonly accepted view is that SES differences do exist, which begs the question why associations between social capital indicators and mortality should be judged differently? The debate regarding such methodological issues will continue, and Choi et al. (2014) themselves suggested among other methodologies further studies including mediation analysis.

The results are probably generalizable to the rest of Sweden and the other Scandinavian countries (Denmark and Norway) for cultural, political and social reasons. Further generalizability is disputable, although insights into the beneficial effects of social and civil participation were reported already by De Tocqueville (2003) in the USA in the 1830s. Social participation was the strongest predictor of mortality in a recent review (Choi et al., 2014).

In the age adjusted analyses the HRRs of social participation were reduced and the HRRs of generalized trust in other people somewhat increased which is due to the fact that high social participation is more prevalent in younger age groups and generalized trust in older age groups (Lindström, 2004).

High or moderate leisure-time physical activity and moderate alcohol consumption were found to be significantly associated with lower mortality, and tobacco smoking with significantly higher mortality, and these findings fully correspond with reviews and meta-analyses of lifestyle factors and total mortality (Ford, Zhao, Tsai, & Li, 2011; Colpani et al., 2018).

4.1. Strengths and limitations

The fact that this is a large population-based study of the southernmost part of Sweden which represents approximately 14% of the total population of Sweden is a major strength. The prospective cohort study design is also a major strength of this study which means that the temporality criterion regarding causality is fulfilled.

It may be questioned whether the 5-year follow-up period would

affect mortality in CVD and cancer. Choi et al. (2014) include prospective studies with between 2 and 35-years follow-up regarding social capital and health. The links between social capital and health include psychosocial stress, norms regarding health-related behaviours, access to healthcare and other amenities, and violent crime (Kawachi et al., 1999). Psychosocial stress and access to healthcare may affect CVD and cancer within the 5-year time frame, while psychosocial stress, access to healthcare and violent crime would affect mortality from all other causes within the 5-year follow-up. Furthermore, health-related behaviours are comparatively constant for most adult people (e.g. smokers versus non-smokers).

The respondent study population is acceptably representative of the stratified sample from the total register population. When the respondents in the 2008 public health survey were compared with the sample from the general register population in Scania some under-representation of the young (22.0% of respondents compared to 29.0% in the sample), men (45.1% compared to 50.0%) and those with low formal education (25.2% compared to 29.3%) was found. All associations in the bivariate Table 2 are also in the directions known from the literature (Lindström, Fridh, & Rosvall, 2014). The risk of selection bias is thus comparatively small. As demonstrated in Table 2, mortality in the 18–34 age stratum is almost 100 times lower than in the 65–80 age stratum. Seven persons aged 18–34, 29 aged 35–44, 54 aged 45–54, 180 aged 55–64 and 677 aged 65–80 died during the 5-year follow-up. The effects of social capital items appear to be similar across age strata. We thus included the younger age groups in this study. Estimates of incidence show that mortality in the 18–44 stratum was 86.1/100,000 among men in the study compared to 81.6/100,000 in Sweden in 2012, and it was 45.7/100,000 for women in the study compared to 46.1/100,000 in Sweden. In the 45–64 age stratum male mortality was 573.9/100,000 in the study compared to 464,0/100,000 in Sweden, and for women 304,2/100,000 in the study compared to 303.1/100,000 in Sweden. Finally, in the age stratum 65–80 mortality was 3054.7/100,000 for men in the study compared to 3060/100,000 in Sweden, and for women 1769.7/100,000 in the study compared to 2155/100,000 in Sweden (Heimersson, 2013).

The validity of the emotional support, instrumental support and social participation items is regarded as high, and the dichotomization three activities or less versus four or more for social participation has been used since the 1970s in Sweden (Hanson, Östergren, Elmståhl, Isacsson, & Ranstam, 1997). The generalized trust in other people item has been used internationally for decades (Putnam, 1993, 2000). The lack of items measuring intensity of social participation and different aspects of social participation is a weakness of the study, and our recommendation is that a variety of aspects of social participation and contact surfaces with different social and civic activities in society should be measured as well as the intensity of such activities in order to depict the most central aspect of social capital common to both the "cohesion" and "network" perspectives. The SES measure used was defined by occupation and relation to the labour market. It is highly correlated with education and income, but although highly correlated all three SES measures represent different aspects of SES. Income is not included in the 2008 public health survey in Scania. Education was not included in the analyses because it has a substantially higher number of internally missing than SES by occupation. Furthermore, education is dependent on birth cohort due to the rapid increase in the proportion of the population with higher education during many decades. The addition of education to the multiple adjusted models do not affect the effect measures (HRR:s), it only increases the numbers of internally missing (not shown in tables). There thus seems to be no reason to suspect residual confounding due to the omission of the education variable. The validity and reliability of the physical activity item has been regarded as acceptable based on comparison with golden standards which assessed with four-day heart rate monitoring as well as whole-body calorimetry and double-labelled water (Wareham et al., 2003). The validity and reliability of the questionnaire item regarding tobacco smoking are regarded as high (Wells, English, Posner, Wagenknecht, & Perez-Stable, 1998). Swedish register data regarding mortality and cause-specific mortality have a high validity. The other baseline survey items are mostly internationally used and internationally regarded as valid. The three specific mortality groups are also very broad, which means that some degree of misclassification *within* these broad mortality groups may be unimportant in this study.

5. Conclusions

In conclusion, low social participation, common to both the "cohesion" and "network" perspectives, is consistently associated with all forms of mortality, and particularly with CVD mortality and total mortality throughout the multiple analyses. Social participation represents a strong core of social capital theory, and items should measure both variety of social contact surfaces and intensity. In contrast, low social support, specific to the "network" perspective (according to Bourdieu), shows only significant association with other cause mortality after adjustments for demographics and SES for emotional and instrumental support. Generalized trust, specific to the "cohesion" perspective, shows significant associations with total, CVD, cancer and other causes mortality, although not after complete multiple adjustments.

Conflicts of interest

None.

Ethical statement

The study, including the connection of the baseline 2008 survey data with prospective register data regarding mortality, has been approved by the ethical committee in Lund (No. 2010/343). All analyses are conducted aggregated for the whole or substantial parts of the population, which makes identification of individual characteristics impossible.

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