BMJ Open

FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL AND SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-007184
Article Type:	Research
Date Submitted by the Author:	13-Nov-2014
Complete List of Authors:	Novak, Dario; University of Zagreb, Dept of General and Applied Kinesiology; Harvard University, Dept. of Social and Behavioral Sciences Suzuki, Etsuji; Okayama University, Department of Epidemiology Kawachi, Ichiro; Harvard University, Department of Social and Behvioral Sciences
Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, Community child health < PAEDIATRICS, PUBLIC HEALTH

FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL AND SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS

Novak[1,2], Dario; Suzuki[3], Etsuji; Kawachi[4], Ichiro

[1]Department of General and Applied Kinesiology, University of Zagreb Faculty of Kinesiology, Zagreb, Croatia

[2] Department of Social and Behvioral Sciences, Postdoctoral Fellow at Harvard University Harvard School of Public Health, Boston, US

[3]Department of Epidemiology, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Okayama, Japan

[4]Department of Social and Behvioral Sciences, Harvard University Harvard School of Public Health, Boston, US

CORRESPONDIG AUTHOR:

Dario Novak

Laniste 1E 15, 10000 Zagreb, Croatia

00385994455699

dario.novak@kif.hr

Key words: health, social capital, students, high school

Word count: 2448

FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL AND SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS

Novak[1,2], Dario; Suzuki[3], Etsuji; Kawachi[4], Ichiro

[1]Department of General and Applied Kinesiology, University of Zagreb Faculty of Kinesiology, Zagreb, Croatia

[2] Department of Social and Behvioral Sciences, Postdoctoral Fellow at Harvard University Harvard School of Public Health, Boston, US

[3]Department of Epidemiology, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Okayama, Japan

[4]Department of Social and Behvioral Sciences, Harvard University Harvard School of Public Health, Boston, US

CORRESPONDIG AUTHOR:

Dario Novak

Laniste 1E 15, 10000 Zagreb, Croatia

00385994455699

dario.novak@kif.hr

Key words: health, social capital, students, high school

Word count: 2448

ABSTRACT

Background: Few studies have distinguished between the impacts of different sources of social capital on self-rated health among high school students. We investigated the associations between self-rated health and social capital in the family, in the neighbourhood, and at school among Croatian high school students.

Methods: Cross-sectional survey of 3427 high school students (1688 males and 1739 females), aged 17-18 years, was carried out in the 2013/14 school year (response rate: 93.8%). We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for poor self-rated health associated with family, neighbourhood and school social capital, while adjusting for gender, self-percieved socioeconomic status, psychological distress, physical activity, and body mass index.

Results: Poor self-rated health was significantly associated with lower family social capital (OR 2.29; 95% CI: 1.33 to 3.94), lower neighbourhood trust (OR 2.00; 95% CI: 1.40 to 2.87) and lower norms of reciprocity at school (OR 1.78; 95% CI: 1.13 to 2.80). When all of the social capital variables were entered simultaneously, poor self-rated health remained significantly associated with lower family social capital (OR 1.91; 95% CI: 1.10 to 3.31), neighbourhood trust (OR 1.77; 95% CI: 1.22 to 2.56) and reciprocity at school (OR 1.71; 95% CI: 1.09 to 2.70). Overall, the associations were primarily observed in girls.

Conclusion: Higher levels of family social capital, neighbourhood trust and school cohesion were independently associated with better health among youth. Intervention and

policies that leverage community social capital might serve as an avenue for health promotion in youth.

Article summary:

Strength and limitation of the study

Strength: This study is one of the fewer studies to date that have focused on social capital and health among children and youth. It has a total of 3427 students responded to the survey. We posited that family, neighbourhood and school social capital may be protective for adolescent's health and that students who report higher social capital in these domains will experience lower levels of poor self-rated health.

Limitation of the study: Due to the cross-sectional design, we cannot exclude the possibility of reverse causation. Second, we used a subjective measure of health and social capital, and therefore there is a possibility of common method bias which may have resulted in bias away from the null. And third, beacuse the students responded the questionnares during the class, there is a possibility of measurement error of school social capital, in particular vertical social capital.

- Family, neighbourhood and school social capital may be protective for adolescent's health
- Students who report higher social capital in these domains will experience lower levels of poor self-rated health
- The effect of social capital seems to be strongly driven by girls not the boys

INTRODUCTION

Social capital has been defined as the "resources embedded in a social structure which are accessed and/or mobilized in purposive actions".[1,2] Some scholars have conceptualised social capital as the social networks themselves, or as both the network structures and the resources channelled through the networks.[3,4] Social capital has garnered increasing attention as a potential influence on the development of youth. In the field of education, research has primarily focused on the role of social capital in children's academic performance;[5,6] however, subsequent research has expanded the range of outcomes to include health behaviors and population health outcomes.[4,7] Social capital theory posits that interpersonal trust, norms of reciprocity, and exchange of social support between members of a networks each constitutes a type of resource, and that access to these resources may facilitate the actions of group members.[4,7,8] Investigation of possible influences of social capital on health may be particularly salient in adolescents because previous work has suggested that contextual influences may the somatic and psychological development of young people throughout the life course.[9,10]

Associations between social capital and health have been extensively investigated in adult samples.[11-13] However, fewer studies to date have focused on social capital and health among children and youth. According to Urie Bronfenbrenner's ecological systems theory of child development, human development is conceptualised as being shaped by the interaction between an individual and his or her environment; and that furthermore there are many different levels of environmental influences that can affect a child's development, starting with people and institutions immediately surrounding the child (i.e. parents and families), to school environments, to residential neighbourhoods,

and eventually the societal culture.[14] In line with this, we hypothesised that family, neighbourhood and school social capital may be protective for adolescent's poor health and that students who reports higher social capital in all three domains will have lower levels of poor self-rated health. However, few studies have simultaneously examined the contribution of different sources of social capital to youth health.

Accordingly in the present study we investigated the influences of different sources of social capital – in the family, in the neighbourhood, and at school – on levels of self-rated health among a sample of high school students in Croatia.

METHODS

Participants

We administered a survey among high school students in Zagreb, a mid-sized urban city in central Croatia with a population of about 1,000,000 people. A random sampling approach was used to select high schools. All of twenty schools that we apporached agreed to take part in the survey, representing 3650 students enrolled in the 2013/14 school year. Of these, 3427 students (1688 males and 1739 females, aged 17–18 years) responded to the survey (93.8%) which was given during class. Finally, the data of 3427 students (1688 males, body height, 182.11±7.06 cm, body weight, 76.21±10.99 kg, body mass index, 22.95±2.85 kg/m^2 and 1739 females, body height, 168.36±6.41 cm, body weight, 59.07±8.39 kg, body mass index, 20.81±2.54 kg/m^2) aged 17–18 years were analyzed. The study was approved by the Institutional Review Board and one of the parents for each subject signed an informed consent form. The students signed an assent form as well.

Self-rated health

Self-rated health was assessed in these young adolescents using the standard single item measure: "How do you perceive your health?". Possible responses were arranged along a 5-item Likert type scale: 1 very poor, 2 poor, 3 fair, 4 good, or 5 excellent. We binarised the outcome, i.e., fair, good and excellent were collpased into one category (good); while poor and very poor were designated as poor self-rated health. Perceived health is an easily administered and widely used outcome measure in social epidemiology studies and it has been shown to be a reliable predictor of mortality and health care use in adults.[15-17] The measure has also been used in adolescents.[18-21]

Social capital indicators

On the survey, we inquired about individual perceptions of social capital in the family, neighbourhood, and high school settings.[3,7,22] Family social capital was assessed by the question: 'Do you feel your family understands and gives attention to you?'.[7,23] Neighbourhood social capital was assessed by using two items; 'Do you feel people trust each other in your neighbourhood (neighbourhood trust)?' 'Do you feel that your neighbors step in to criticize someone's deviant behavior during high school (informal social control)?'.[7] School social capital was assessed by three items; 'Do you feel teachers and students trust each other in your high school (vertical school trust)?' 'Do you feel students trust each other in your high school (horizontal school trust)?' 'Do you feel students collaborate with each another in your high school (reciprocity at school)?' The response options were: 'strongly agree'; 'agree'; 'neither agree or disagree'; 'disagree'; 'strongly disagree'. Then, the 'disagree' and 'strongly disagree' responses

were combined to create a dichotomous variable indicating lower group.[7] The Cronbach alpha of the school social capital scale was 0.71 and since other domains have fewer than three questions we consider not approprate to check Cronbach alphas for these scales.

Covariates

We considered levels of physical activity behavior as a potential mediator of the association between social capital and self-rated health, i.e. we hypothesised that higher social capital perceptions are associated with more physical activity, and hence, better self-rated health. As measure of physical activity, we considered students' total physical activity in the last 7 days. Physical activity was assessed using the validated short version of the International Physical Activity Questionnaire (IPAQ) and was expressed as metabolic equivalent-hours per week (MET-hour/week).[24] Socioeconomic status (SES) was entered in our regression models as a potential confounder, i.e. theoretically associated with both self-rated health and social capital.[25] The classification of SES was based on both parents' occupation at the time when research was conducted. Self-perceived SES was categorized into three levels as high SES (i.e., managers and professionals), middle SES (white collar) and low SES (blue collar),[26] and it was dichotomized as high/middle (responses in the range 2-4) and low (responses in the range 5-6). Psychological distress was also assessed as a potential confounder using the 6-item Kessler scale,[27] Each question is scored from 0 (None of the time) to 4 (All of the time). Scores of the 6 questions were then summed (0-24), with lower score indicating low levels of psychological distress. Previous research has shown that dichotomous scoring of responses in the range 13+ versus 0–12 discriminates between respondents with and without significant psychological distress.[27,28]

As additional potential mediators, we considered body mass index (BMI) based on the calculation from self-repoted height and weight (scoring of responses in the range ≥25 kg/m^2 versus <25 kg/m^2 discriminates between respondents with and without high BMI).

Data Analysis

The association of self-rated health with social capital indicators was examined in a sequence of four logistic regression models, in which we calculated odds ratios (ORs) and 95% confidence intervals (CIs) for poor self-rated health according to levels of perceived social capital. As potential confounders, we entered gender, self-perceived SES, and psychological distress. We also included physical activity and BMI as potential mediators of the association between social capital and self-rated health. We investigated the association between self-rated health and family social capital (Model 1), neighbourhood social capital (Model 2), and school social capital (Model 3). Finally, we entered all of these social capital variables simultaneously (Model 4) to assess their independent contributions to self-rated health. The same analyses were stratified also by gender. Interaction term between social capital and gender were not statistically significant so we didn't include it in the final regression model. A p-value of <0.05 (two sided) was considered statistically significant. The Statistical Package for the Social Sciences (version 13.0. SPSS, Inc.) was used for data analyses.

RESULTS

Roughly 20% of the paricipants reported poor health. Girls reported higher prevalence of poor self-rated health (24.4%) compared to boys (14.2%). It is worth to note that the prevalence of psychological distress in girls was twice as high as that in boys (Table 1).

Table 1 about here

The association between social capital and self-rated healh is shown in Table 2. Overall, self-rated health was significantly associated with each domain of social capital. Poor self-rated health was significantly associated with lower family social capital (OR 2.29; 95% CI: 1.33 to 3.94) and lower neighbourhood trust (OR 2.00; 95% CI: 1.40 to 2.87). Regarding school social capital, poor-self health was significantly associated only with perceptions of reciprocity at school (OR 1.78; 95% CI: 1.13 to 2.80). When all social capital variables were entered into the model (Model 4), poor-self health was significantly associated with lower family social capital (OR 1.91; 95% CI: 1.10 to 3.31), neighbourhood trust (OR 1.77; 95% CI: 1.22 to 2.56) and reciprocity at school (OR 1.71; 95% CI: 1.09 to 2.70).

Table 2 about here

Interestingly, the associations of social capital seem to be strongly driven by girls in the sample, but not the boys (Table 3). Poor self-rated health among boys was significantly associated only with lower family social capital (OR 2.52; 95% CI: 1.03 to 6.17). When all types of social capital were entered simultaneously, poor self-rated health

was significantly associated with lower neighbourhood trust (OR 2.08; 95% CI: 1.33 to 3.25) and reciprocity at school (OR 1.73; 95% CI: 1.01 to 2.98) only among girls.

Table 3 about here

DISCUSSION

Previous studies in the US and Europe have suggested that higher levels of informal social control were associated with higher levels of perceived health.[10] Drukker et al. found that higher levels of community informal social control in the Netherlands may directly prevent young people from engaging in deleterious health behaviors as well as indirectly provide them with self-confidence and a sense of protection.[29] Furuta et al. have shown that the association of social capital with self-rated oral health is not uniform; higher trust is associated with better oral health, whereas higher informal control in the community is associated with worse oral health.[7]

To better understand findings of this research, it is very important to briefly explain the Croatian social context and the theoretical approach to young people. The mid 1980s in Croatia was a period of socialism before the collapse of the Soviet bloc. The first decade of the 1990s was more turbulent in Croatia compared to other post-socialist countries. Croatia experienced armed conflicts that lasted for several years. Finally, at the beginning of the 1990s with the state's declaration of independence, and the abolition of the totalitarian regime, the nation became one of many transition countries. Young people in Croatia are one of the population segments most rapidly affected by these processes and changes. The reasons for this are multiple and related to timing of political transition with the transition from childhood to adulthood.[30]

In this study, we have found a statistically significant association between family social capital and self-rated health. For young people, family is important for 'being there' in times of need and family members are often regarded as a crucial source of support[31]. Morgan and Haglund reported that a sense of belonging in family was related to self-rated health and health behaviors in adolescents.[32] In transitional societies, the changes in hierarchical order and value structures accompanying the shift from socialism to free markets meant that families became especially important as a source of social support.[33]

We also found that those living in low trust communities reported worse health compared to youth living in high trust communities. According to surveys, Croatian youth frequently spend their time with friends in the neighbourhood engaged in sport or other activities (i.e., watching TV and videos, listening to the radio).[30]

The indicators based in the school social environment suggested that reciprocity at school (collaboration between pupils) was associated with better health, whereas vertical and horizontal social capital were not significantly associated with health. Spending time with peers at school may engender a sense of belonging,[31] and it may promote better health. The data shows that 78% of Croatian youth frequently talk to their school peers about going out and leisure, music, movies and books.[30] A previous study in Denmark found that school connectedness and sense of belonging may have a strong impact on adolescent psychological health.[34]

Our study has some limitations. First, due to the cross-sectional design, we cannot exclude the possibility of reverse causation, i.e., poor health led to low level of trust and other indicators of social capital. To mitigate this, we adjusted for psychological distress.

Moreover, the differential effect estimates of each type of social capital on health cannot be fully explained by the reverse causation. Second, we used a subjective measure of health and social capital, and therefore there is a possibility of common method bias which may have resulted in bias away from the null. Again, the differential findings for each type of social capital suggest that this is less likely. And third, beacuse the students responded the questionnares during the class, there is a possibility of measurement error of school social capital, in particular vertical social capital.

The present study shows that higher levels of family social capital, neighbourhood trust and reciprocity school (i.e., collaboration relationships between pupils) were associated with better health among youth. Interestingly, the effect of social capital seems to be strongly driven by girls not the boys. There are some researches confirming that, among adolescents, girls tend to report higher levels of social capital, especially school and family belonging than do boys.[35] We can speculate that this was found since adolescent girls have a greater number of friends than do boys, they expect and desire more nurturing behavior from their friends and family members, and experience more empathy, more self-disclosure, and less overt hostility in their friendships than do boys.[36] Additional studies are needed to identify interventions that can increase social capital to engender healthy habits with the ultimate goal of achieving healthier students.

What is already known on this subject?

Associations between social capital and health have been extensively investigated in adult samples showing that human development is shaped by the interaction between an individual and his or her environment. However, fewer studies to date have focused on

social capital and health among children and youth. Few studies have simultaneously examined the contribution of different sources of social capital to youth health.

What this study adds?

Based on Bronfenbrenner's ecological systems theory of child development, we posited that family, neighbourhood and school social capital may be protective for adolescent's health and that students who report higher social capital in these domains will experience lower levels of poor self-rated health.

ACKNOWLEDGMENTS

The authors would like to thank students and teachers for their enthusiastic participation in this study.

Funding

This research was self-funded.

Competing interests

The authors declare no competing interests.

Contributorship statement

DN conceptualized and designed the study, conducted the statistical analyses, and interpreted the data and wrote the article. ES participated in conceptualization of the study, contributed to drafting the article and reviewed the paper. IK reviewed the results and contributed to drafting the article. All authors approved the final manuscript.

REFERENCES

1 Lin N. Social capital: a theory of social structure and action. New York: Cambridge University Press 2001:95-139.

2 Kim D, Subramanian SV, Kawachi I. Bonding versus bridging social capital and their associations with self rated health: a multilevel analysis of 40 US communities. J Epidemiol Community Health 2006; 60:116-122.

3 Putnam RD. Bowling alone. New York: Simon & Schuster 2000: 296.

4 Kawachi I, Subramanian SV, Kim D. Social capital and health. New York: Springer Science 2010: 215–228.

5 Coleman JS. Social Capital and the Development of Youth. Momentum 1987; 18:6-8.

6 Coleman JS. Foundations of social theory. London: The Belknap Press of Harvard University Press 1990: 300-302.

7 Furuta M, Ekuni D, Takao S, et al. Social capital and self-rated oral health among young people. Community Dent Oral Epidemiol 2012; 40:97–104.

8 Putnam RD. Making democracy work: civic traditions in modern Italy. Princeton: Princeton University Press 1993:167.

9 Kalff AC, Kroes M, Vles JSH, et al. Neighbourhood level and individual level SES effects on child problem behaviour: a multilevel analysis. J Epidemiol Community Health 2001; 55:246–250.

10 Drukker M, Buka, S, Kaplan C. Social capital and young adolescents' perceived health in different sociocultural settings. Soc Sci Med 2005; 61:185-198.

11 Kim D, Subramanian SV, Kawachi I. Social capital and physical health: A

systematic review of the literature. In: Kawachi I, Subramanian SV, Kim D, eds. Social capital and health. New York: Springer 2008: 139–190.

12 Murayama H, Fujiwara Y, Kawachi I. Social capital and health: A review of prospective multilevel studies. J Epidemiol 2012; 22:179–187.

13 Virtanen M, Ervasti M, Oksanen T, et al. Social capital in Schools. In: Kawachi I, Takao S, Subramanian SV, eds. Global Perspectives on Social Capital and Health. New York: Springer 2013: 65–85.

14 Bronfenbrenner U. Ecological models of human development. Oxford: Elsevier 1994: 37-43.

15 Fylkesnes K. Determinants of health care utilization—visits and referrals. Scand J Sociol Med 1993; 21:40–50.

16 Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. J Health Sociol Behav 1997; 38:21–37.

17 Lundberg O, Manderbacka K. Assessing reliability of a measure of self -rated health. Scand J Soc Med 1996; 24:218–224.

18 Johnson PB, Richter L. The relationship between smoking, drinking, and adolescents' self-perceived health and frequency of hospitalization: analyses from the 1997 National Household Survey on Drug Abuse. J Adolesc Health 2002; 30:175–183.

19 Koivusilta L, Arja R, Andres V. Health behaviours and health in adolescence as predictors of educational level in adulthood: a follow-up study from Finland. Soc Sci Med 2003; 57:577–593.

20 Pastor Y, Balaguer I, Pons D, et al. Testing direct and indirect effects of sports

participation on perceived health in Spanish adolescents between 15 and 18 years of age. J Adolesc 2003; 26:717–730.

21 Tobi H, Meijer WM, Tuinstra J, et al. Socio-economic differences in prescription and OTC drug use in Dutch adolescents. Pharm World Sci 2003; 25:203–206.

22 Morrow V. Conceptualising social capital in relation to the well-being of children and young people: a critical review. Sociol Rev 1999; 44:744–65.

23 Duke NN, Skay CL, Pettingell SL, et al. From adolescent connections to social capital: predictors of civic engagement in young adulthood. J Adolesc Health 2009; 44:161–8.

24 Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003; 35: 1381-95.

25 Subramanian SV, Kim DJ, Kawachi I. Social trust and self-rated health in us communities: a multilevel analysis. J Urban Health 2002; 79(Suppl 1):S21–34.

26 Wang Z, Byrne NM, Kenardy JA, et al. Influences of Ethnicity and Socioeconomic Status on the Body Dissatisfaction and Eating Behaviour of Australian Children and Adolescents. Eat Behav 2005; 6:23–33.

27 Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry 2003; 60:184-189.

28 Greif Green J, Gruber MJ, Sampson NA, et al. Improving the K6 short scale to predict serious emotional disturbance in adolescents in the USA. Int J Methods Psychiatr Res 2010; 19:23–35.

29 Drukker, M, Kaplan C, Feron F. Children's health related quality of life,

neighborhood socio-economic deprivation and social capital. A contextual analyses. Soc Sci Med 2003; 57:825-841.

30 Ilisin V, Potocnik D. A sociological portrait of contemporary Croatian youth. Ser Hist Sociol 2 2010; 20:41-56

31 Morrow V. Young people's explanations and experiences of social exclusion: retrieving bourdieu's concept of social capital. Int J Sociol Soc Policy 2001; 21:37–63.

32 Morgan A, Haglund BJ. Social capital does matter for adolescent health: evidence from the English HBSC study. Health Promot Int 2009; 24:363-372.

33 Kennedy BP, Kawachi I, Brainerd E. The role of social capital in the Russian mortality crisis. World Dev 1998; 26:2029-2043.

34 Due P, Lynch J, Holstein B, et al. Socioeconomic health inequalities among a nationally representative sample of Danish adolescents: the role of different types of social relations. J Epidemiol Community Health 2003; 57:692-698.

35 Newman BM, Lohman BJ, Newman PR. Peer group membership and a sense of belonging: their relationship to adolescent behavior problems. Adolesc 2007; 42:241-263.

36 Galambos N. Gender and gender-role development in adolescence. In: Lemer R, Steinberg L, eds. The handbook of adolescent psychology. New York: Wiley 2004: 233-262.

Table 1. Characteristics of the study subjects, Zagreb, Croatia, 2014.

	Total (n=3427)	Males (n=1688)	Females (n=1739)
Family social capital			
High	3242 (94.6)	1598 (94.6)	1644 (94.5)
Low	185 (5.4)	90 (5.4)	95 (5.5)
Neighborhood trust			
High	2323 (67.8)	1222 (72.4)	1101 (63.4)
Low	1104 (32.2)	466 (27.6)	638 (36.6)
Informal social control			
High	2599 (75.8)	1269 (75.2)	1330 (76.5)
Low	828 (24.2)	419 (24.8)	409 (23.5)
Vertical school trust			
High	2377 (69.4)	1203 (71.2)	1174 (67.5)
Low	1050 (30.6)	485 (28.7)	565 (32.5)
Horizontal school trust			
High	2587 (75.5)	1349 (79.9)	1238 (71.2)
Low	840 (24.5)	339 (20.1)	501 (28.8)
Reciprocity at school			
High	2968 (86.6)	1502 (88.9)	1466 (84.3)
Low	459 (13.4)	186 (11.1)	273 (15.7)
Body mass index			
Normal	3001 (87.6)	1367 (80.9)	1634 (93.9)
Overweight/Obese	426 (12.4)	321 (19.1)	105 (6.1)
Self-rated health			
Good	2763 (80.6)	1449 (85.8)	1314 (75.6)
Poor	664 (19.4)	239 (14.2)	425 (24.4)
Self-perceived socioeconomic status			
High/Middle	2064 (60.2)	1008 (59.7)	1056 (60.7)
Low	1363 (39.8)	680 (40.3)	683 (39.3)
Psychological distress			
High	848 (24.7)	274 (16.3)	574 (33.0)
Low	2579 (75.3)	1414 (83.7)	1165 (67.0)
Physical activity			
High/Moderate	2943 (85.9)	1499 (88.8)	1444 (83.1)
Low	484 (14.1)	189 (11.2)	295 (16.9)

Table 2. Odds Ratios for Poor Self-Rated Health among High School Students, Zagreb, Croatia, 2014.

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Family social capital				
High				
Low	2.29 (1.33-3.94) **			1.91 (1.10-3.31) *
Neighborhood trust				
High				
Low		2.00 (1.40-2.87) ***		1.77 (1.22-2.56) **
Informal social control				
High				
Low		1.45 (0.98-2.15)		1.40 (0.94-2.09)
Vertical school trust				
High				
Low			1.31 (0.88-1.95)	1.16 (0.78-1.75)
Horizontal school trust				
High				
Low			1.26 (0.81-1.95)	1.21 (0.78-1.88)
Reciprocity at school				
High				
Low			1.78 (1.13-2.80) **	1.71 (1.09-2.70) *
Gender				
Female				
Male	0.46 (0.30-0.69) ***	0.49 (0.33-0.74) ***	0.49 (0.32-0.74) ***	0.49 (0.32-0.74) ***
Body mass index				
Overweight/Obese				
Normal	0.43 (0.27-0.70) ***	0.42 (0.26-0.68) ***	0.42 (0.26-0.68 ***	0.42 (0.26-0.68) ***
Self-perceived socioeconomic status				
High/Middle				
Low	0.99 (0.68-1.43)	0.95 (0.65-1.37)	0.96 (0.66-1.40)	0.95 (0.65-1.38)
Psychological distress				
High				
Low	0.36 (0.25-0.52) ***	0.36 (0.25-0.52) ***	0.36 (0.25-0.53) ***	0.40 (0.27-0.58) ***
Physical activity				
High/Moderate				
Low	3.20 (2.19-4.67) ***	3.13 (2.14-4.56) ***	3.12 (2.13-4.56) ***	2.79 (1.90-4.10) ***

***p<0.001, **p<0.01, *p<0.05; OR – odds ratio; CI – confidence interval

Model 1: Examine association between family social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighborhood social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

Table 3. Odds Ratios for Poor Self-Rated Health among High School Students, Stratified by Genders, Zagreb, Croatia, 2014.

	Males (n=1688)				Females (n=1739)			
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Family social capital								
High								
Low	2.52 (1.03-6.17) *			2.10 (0.83-5.29)	2.05 (1.03-4.08) *			1.75 (0.87-3.53)
Neighborhood trust								
High								
Low		1.41 (0.72-2.75)		1.18 (0.58-2.36)		2.32 (1.50-3.59) ***		2.08 (1.33-3.25) ***
Informal social control								
High								
Low		1.32 (0.65-2.65)		1.18 (0.57-2.42)		1.52 (0.94-2.45)		1.52 (0.94-2.46)
Vertical school trust								
High								
Low			1.11 (0.54-2.31)	1.04 (0.49-2.19)			1.41 (0.88-2.27)	1.24 (0.76-2.01)
Horizontal school trust								
High								
Low			1.57 (0.71-3.45)	1.55 (0.70-3.44)			1.19 (0.70-2.00)	1.14 (0.68-1.92)
Reciprocity at school								
High								
Low			1.87 (0.81-4.31)	1.71 (0.73-4.01)			1.76 (1.02-3.03) *	1.73 (1.01-2.98) *
Body mass index								
Overweight/Obese								
Normal	0.68 (0.32-1.45)	0.67 (0.32-1.41)	0.69 (0.33-1.47)	0.70 (0.33-1.48)	0.30 (0.16-0.54) ***	0.28 (0.15-0.52) ***	0.28 (0.15-0.51) ***	0.28 (0.15-0.51) ***
Self-perceived SES								
High/Middle								
Low	1.23 (0.64-2.36)	1.21 (0.63-2.33)	1.27 (0.66-2.45)	1.28 (0.66-2.48)	0.87 (0.55-1.37)	0.81 (0.51-1.29)	0.83 (0.53-1.31)	0.81 (0.51-1.29)
Psychological distress								
High								
Low	0.23 (0.12-0.46) ***	0.21 (0.11-0.41) ***	0.23 (0.12-0.45) ***	0.26 (0.13-0.52) ***	0.44 (0.29-0.68) ***	0.46 (0.30-0.71) ***	0.45 (0.29-0.70) ***	0.49 (0.31-0.76) ***
Physical activity								
High/Moderate								
Low	3.44 (2.66-6.45) ***	3.42 (2.62-6.43) ***	3.42 (2.68-6.49) ***	3.43 (2.61-6.39) ***	2.89 (1.56-4.40) ***	2.84 (1.52-4.32) ***	2.86 (1.54-4.35) ***	2.86 (1.53-4.34) ***

***p<0.001, **p<0.01, *p<0.05; OR – odds ratio; CI – confidence interval

Model 1: Examine association between family social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighborhood social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **[Within the title page 1 and method section of the abstract page 2 and 3]**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **[See results section of abstract page 2 and 3]**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **[Pages 4 and 5]**
Objectives	3	State specific objectives, including any prespecified hypotheses **[Page 5]**
Methods		
Study design	4	Present key elements of study design early in the paper **[Methods pages 5-8]**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **[Methods page 5]**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up **[N/A]** *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls **[N/A]** *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **[Methods page 5]**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed **[N/A]** *Case-control study*—For matched studies, give matching criteria and the number of controls per case **[N/A]**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **[Pages 6-8]**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **[Pages 6-8]**
Bias	9	Describe any efforts to address potential sources of bias **[Page 5]**
Study size	10	Explain how the study size was arrived at **[Page 5]**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **[Pages 6-8]**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **[Page 5]**
		(*b*) Describe any methods used to examine subgroups and interactions **[Page 5]**
		(*c*) Explain how missing data were addressed **[N/A]**
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed **[N/A]** *Case-control study*—If applicable, explain how matching of cases and controls was addressed **[N/A]** *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy **[N/A]**
		(*e*) Describe any sensitivity analyses **[N/A]**

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **[Table 1]**
		(b) Give reasons for non-participation at each stage **[N/A]**
		(c) Consider use of a flow diagram **[N/A]**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **[Pages 7 and 8; Table 1]**
		(b) Indicate number of participants with missing data for each variable of interest **[Table 1]**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount) **[N/A]**
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time **[N/A]**
		Case-control study—Report numbers in each exposure category, or summary measures of exposure **[N/A]**
		Cross-sectional study—Report numbers of outcome events or summary measures **[N/A]**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **[Pages 7 and 8; Tables 2 and 3]**
		(*b*) Report category boundaries when continuous variables were categorized **[N/A]**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **[N/A]**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **[Tables 2 and 3]**
Discussion		
Key results	18	Summarise key results with reference to study objectives **[Pages 9 and 10]**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **[Pages 11 and 12]**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **[Pages 10-13]**
Generalisability	21	Discuss the generalisability (external validity) of the study results **[Page 12]**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **[N/A]**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

ARE FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL ASSOCIATED WITH HIGHER SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS? A POPULATION-BASED STUDY

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-007184.R1
Article Type:	Research
Date Submitted by the Author:	23-Feb-2015
Complete List of Authors:	Novak, Dario; University of Zagreb, Dept of General and Applied Kinesiology; Harvard University, Dept. of Social and Behavioral Sciences Suzuki, Etsuji; Okayama University, Department of Epidemiology Kawachi, Ichiro; Harvard University, Department of Social and Behvioral Sciences
Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, Community child health < PAEDIATRICS, PUBLIC HEALTH

ARE FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL ASSOCIATED WITH HIGHER SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS? A POPULATION-BASED STUDY

Dario Novak,[1,2] Etsuji Suzuki,[3] Ichiro Kawachi [4]

[1]Department of General and Applied Kinesiology, University of Zagreb Faculty of Kinesiology, Zagreb, Croatia

[2] Department of Social and Behvioral Sciences, Postdoctoral Fellow at Harvard University Harvard School of Public Health, Boston, Massachusetts, US

[3]Department of Epidemiology, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Okayama, Japan

[4]Department of Social and Behvioral Sciences, Harvard School of Public Health, Boston, Massachusetts, US

CORRESPONDIG AUTHOR:

Dario Novak

Laniste 1E 15, 10000 Zagreb, Croatia

00385994455699

dario.novak@kif.hr

Key words: health, social capital, students, high school

ABSTRACT

Objectives: We investigated the associations between self-rated health and social capital in the family, in the neighbourhood, and at school among Croatian high school students. We hypothesised that family, neighbourhood and school social capital may be protective for adolescent's poor health and that students who report lower levels of social capital in all three domains will have poorer self-rated health.

Design: Cross-sectional survey among high school students was carried out in the 2013/14 school year

Setting: High schools in Croatia.

Participants: Subjects were 3427 high school students (1688 males and 1739 females), aged 17-18 years (response rate: 93.8%).

Main outcome measures: We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for poor self-rated health associated with family, neighbourhood and school social capital, while adjusting for gender, self-perceived socioeconomic status, psychological distress, physical activity, and body mass index. We used the generalised estimating equation method in order to correct standard errors for clustering.

Results: Poor self-rated health was significantly associated with lower family social capital (OR 2.29; 95% CI: 1.33 to 3.94), lower neighbourhood trust (OR 2.00; 95% CI: 1.40 to 2.87) and lower norms of reciprocity at school (OR 1.78; 95% CI: 1.13 to 2.80). When all of the social capital variables were entered simultaneously, poor self-rated health remained significantly associated with lower family social capital (OR 1.91; 95% CI: 1.10 to 3.31), neighbourhood trust (OR 1.77; 95% CI: 1.22 to 2.56) and reciprocity at

school (OR 1.71; 95% CI: 1.09 to 2.70). Overall, the associations were primarily observed in girls.

Conclusions: Lower levels of family social capital, neighbourhood trust and school cohesion were independently associated with poorer self-rated health among youth. Intervention and policies that leverage community social capital might serve as an avenue for health promotion in youth.

Article summary:

Strengths and limitations of this study

- This study is one of the fewer studies to date that have focused on social capital and health among children and youth.
- We used a random sampling approach to select 20 high schools in Zagreb, all of which agreed to take part in the survey. A total of 3427 students (93.8%) responded to the survey which was given during class.
- To clarify which source of social capital is likely to affect adolescents' health, we assessed three different sources of social capital – in the family, in the neighbourhood, and at school – among high school students.
- We used the generalised estimating equation method in order to correct standard errors for clustering.
- Due to the cross-sectional design, we cannot exclude the possibility of reverse causation. Since we used a subjective measure of health and social capital, there is a possibility of common method bias.

INTRODUCTION

Social capital has been defined as the "resources embedded in a social structure which are accessed and/or mobilised in purposive actions".[1,2] Some scholars have conceptualised social capital as the social networks themselves, or as both the network structures and the resources channeled through the networks.[3,4] Social capital has garnered increasing attention as a potential influence on the development of youth. In the field of education, research has primarily focused on the role of social capital in children's academic performance;[5,6] however, subsequent research has expanded the range of outcomes to include health behaviors and population health outcomes.[4,7] Social capital theory posits that interpersonal trust, norms of reciprocity, and exchange of social support between members of a networks each constitutes a type of resource, and that access to these resources may facilitate the actions of group members.[4,7,8] Investigation of possible influences of social capital on health may be particularly salient in adolescents because previous work has suggested that contextual influences may have effects on the somatic and psychological development of young people throughout the life course.[9,10]

Associations between social capital and health have been extensively investigated in adult samples.[11-13] Social capital has been found in previous studies to be related to both physical activity and body mass index (BMI).[14-16] That being said, both physical activity and BMI are predictors of self-rated health. However, fewer studies to date have focused on social capital and health among children and youth. According to Urie Bronfenbrenner's ecological systems theory of child development, human development is conceptualised as being shaped by the interaction between an individual and his or her environment; and that furthermore there are many different levels of environmental

influences that can affect a child's development, starting with people and institutions immediately surrounding the child (i.e. parents and families), to school environments, to residential neighbourhoods, and eventually the societal culture.[17] In line with this, we hypothesised that family, neighbourhood and school social capital may be protective for adolescent's poor health and that students who report lower levels of social capital in all three domains will have poorer self-rated health. However, few studies have simultaneously examined the contribution of different sources of social capital to youth health.

Accordingly in the present study we investigated the influences of different sources of social capital – in the family, in the neighbourhood, and at school – on levels of self-rated health among a sample of high school students in Croatia.

METHODS

Participants

We administered a survey among high school students in Zagreb, a mid-sized urban city in central Croatia with a population of about 1,000,000 people. A random sampling approach was used to select high schools. All of 20 schools that we approached agreed to take part in the survey, representing 3650 students enrolled in the 2013/14 school year. Of these, 3427 students (1688 males and 1739 females, aged 17–18 years) responded to the survey (93.8%) which was given during class. Finally, the data of 3427 students aged 17–18 years were analysed. The study was approved by the Institutional Review Board and one of the parents for each subject signed an informed consent form. The students signed an assent form as well.

Self-rated health

Self-rated health was assessed in these young adolescents using the standard single item measure: "How do you perceive your health?". Possible responses were arranged along a 5-item Likert type scale: 1 very poor, 2 poor, 3 fair, 4 good, or 5 excellent. We binarised the outcome, i.e., fair, good and excellent were collapsed into one category (good); while poor and very poor were designated as poor self-rated health. Perceived health is an easily administered and widely used outcome measure in social epidemiology studies and it has been shown to be a reliable predictor of mortality and health care use in adults.[18-20] The measure has also been used in adolescents.[21-24]

Social capital indicators

On the survey, we inquired about individual perceptions of social capital in the family, neighbourhood, and high school settings.[3,7,25] Family social capital was assessed by the question: 'Do you feel your family understands and gives attention to you?'.[7,26] Neighbourhood social capital was assessed by using two items; 'Do you feel people trust each other in your neighbourhood (neighbourhood trust)?' 'Do you feel that your neighbours step in to criticize someone's deviant behavior during high school (informal social control)?'.[7] School social capital was assessed by three items; 'Do you feel teachers and students trust each other in your high school (vertical school trust)?' 'Do you feel students trust each other in your high school (horizontal school trust)?' 'Do you feel students collaborate with each other in your high school (reciprocity at school)?' The response options were: 'strongly agree'; 'agree'; 'neither agree or disagree'; 'disagree'; 'strongly disagree'. Then, for each response, we created a dichotomous variable (high: 'strongly agree', 'agree' and 'neither agree or disagree'; low: 'disagree' and 'strongly

disagree').[7] The Cronbach alpha of the school social capital scale was 0.71 and since other domains have fewer than three questions we consider not appropriate to check Cronbach alphas for these scales.

Covariates

Social capital has been found in previous studies to be related to both physical activity and BMI.[14-16] At the same time, both physical activity and BMI are predictors of self-rated health. Therefore, physical activity and BMI are not considered to be confounders of the relation between social capital and self-rated health. Rather, we considered levels of physical activity behavior and BMI as a potential mediators of the association between social capital and self-rated health. As measure of physical activity, we considered students' total physical activity in the last 7 days. Physical activity was assessed using the validated short version of the International Physical Activity Questionnaire (IPAQ) and was expressed as metabolic equivalent-hours per week (MET-hour/week).[27] As additional potential mediators, we considered BMI based on the calculation from self-reported height and weight (scoring of responses in the range ≥25 kg/m^2 versus <25 kg/m^2 discriminates between respondents with and without high BMI). Socioeconomic status (SES) was entered in our regression models as a potential confounder, i.e. theoretically associated with both self-rated health and social capital.[28] The classification of SES was based on both parents' occupation at the time when research was conducted. Self-perceived SES was categorised into three levels as high SES (i.e., managers and professionals), middle SES (white collar) and low SES (blue collar),[29] and it was dichotomised as high/middle (responses in the range 2-4) and low (responses in the range 5-6). Psychological distress was also assessed as a potential

confounder using the 6-item Kessler scale by the questions: 'About how often during the past 30 days did you feel nervous?', 'During the past 30 days, about how often did you feel hopeless?', 'During the past 30 days, about how often did you feel restless or fidgety?', 'How often did you feel so depressed that nothing could cheer you up?', 'During the past 30 days, about how often did you feel that everything was an effort?' and 'During the past 30 days, about how often did you feel worthless?'[30] Each question is scored from 0 (None of the time) to 4 (All of the time). Scores of the 6 questions were then summed (0-24), with lower score indicating low levels of psychological distress. Previous research has shown that dichotomous scoring of responses in the range 13+ versus 0–12 discriminates between respondents with and without significant psychological distress.[30,31]

Data Analysis

The association of self-rated health with social capital indicators was examined in a sequence of four logistic regression models, in which we calculated odds ratios (ORs) and 95% confidence intervals (CIs) for poor self-rated health according to levels of perceived social capital. We used the generalised estimating equation method in order to correct standard errors for clustering. We also have performed a chi-squared test to check the statistical significance of the gender difference in proportion of boys vs. girls reporting poor self-rated health. As potential confounders, we entered gender, self-perceived SES, and psychological distress. We also included physical activity and BMI as potential mediators of the association between social capital and self-rated health. We investigated the association between self-rated health and family social capital (Model 1), neighbourhood social capital (Model 2), and school social capital (Model 3). Finally, we

entered all of these social capital variables simultaneously (Model 4) to assess their independent contributions to self-rated health. The same analyses were stratified also by gender. Interaction term between social capital and gender were not statistically significant so we didn't include it in the final regression model. A p-value of <0.05 (two sided) was considered statistically significant. The Statistical Package for the Social Sciences (version 13.0. SPSS, Inc.) was used for data analyses.

RESULTS

Males are taller and heavier than females and also having higher BMI (body height 182.11±7.06 cm, body weight, 76.21±10.99 kg, body mass index, 22.95±2.85 kg/m^2 vs body height, 168.36±6.41 cm, body weight, 59.07±8.39 kg, body mass index, 20.81±2.54 kg/m^2). Roughly 20% of the participants reported poor health. Girls reported higher prevalence of poor self-rated health (24.4%) compared to boys (14.2%). It is worth to note that the prevalence of psychological distress in girls was twice as high as that in boys (Table 1).

Table 1 Characteristics of the study subjects, Zagreb, Croatia, 2014

	Total (N=3427) N (%)	Males (N=1688) N (%)	Females (N=1739) N (%)	p-value*
Family social capital				
High	3242 (94.6)	1598 (94.6)	1644 (94.5)	
Low	185 (5.4)	90 (5.4)	95 (5.5)	0.808
Neighborhood trust				
High	2323 (67.8)	1222 (72.4)	1101 (63.4)	
Low	1104 (32.2)	466 (27.6)	638 (36.6)	<0.001
Informal social control				
High	2599 (75.8)	1269 (75.2)	1330 (76.5)	
Low	828 (24.2)	419 (24.8)	409 (23.5)	0.342
Vertical school trust				
High	2377 (69.4)	1203 (71.2)	1174 (67.5)	
Low	1050 (30.6)	485 (28.7)	565 (32.5)	0.014
Horizontal school trust				
High	2587 (75.5)	1349 (79.9)	1238 (71.2)	
Low	840 (24.5)	339 (20.1)	501 (28.8)	<0.001
Reciprocity at school				
High	2968 (86.6)	1502 (88.9)	1466 (84.3)	
Low	459 (13.4)	186 (11.1)	273 (15.7)	<0.001
Body mass index				
Normal	3001 (87.6)	1367 (80.9)	1634 (93.9)	
Overweight/Obese	426 (12.4)	321 (19.1)	105 (6.1)	<0.001
Self-rated health				
Good	2763 (80.6)	1449 (85.8)	1314 (75.6)	
Poor	664 (19.4)	239 (14.2)	425 (24.4)	<0.001
Self-perceived socioeconomic status				
High/Middle	2064 (60.2)	1008 (59.7)	1056 (60.7)	
Low	1363 (39.8)	680 (40.3)	683 (39.3)	0.706
Psychological distress				
High	848 (24.7)	274 (16.3)	574 (33.0)	
Low	2579 (75.3)	1414 (83.7)	1165 (67.0)	<0.001
Physical activity				
High/Moderate	2943 (85.9)	1499 (88.8)	1444 (83.1)	
Low	484 (14.1)	189 (11.2)	295 (16.9)	<0.001

* Univariable, chi-squared test

The association between social capital and self-rated health is shown in Table 2. Overall, self-rated health was significantly associated with each domain of social capital. Poor self-rated health was significantly associated with lower family social capital (OR 2.44; 95% CI: 1.98 to 2.89) and lower neighbourhood trust (OR 1.90; 95% CI: 1.59 to 2.22). Regarding school social capital, poor-self health was significantly associated only with perceptions of reciprocity at school (OR 1.63; 95% CI: 1.17 to 2.10). When all social capital variables were entered into the model (Model 4), poor-self health was significantly associated with lower family social capital (OR 1.90; 95% CI: 1.03 to 2.42), neighbourhood trust (OR 1.55; 95% CI: 1.20 to 1.90) and reciprocity at school (OR 1.50; 95% CI: 1.04 to 1.97).

Table 2 Odds ratios for poor self-rated health among high school students, Zagreb, Croatia, 2014

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Family social capital				
High				
Low	2.44 (1.98 to 2.89) ***			1.90 (1.03 to 2.42) **
Neighborhood trust				
High				
Low		1.90 (1.59 to 2.22) ***		1.55 (1.20 to 1.90) ***
Informal social control				
High				
Low		0.98 (0.62 to 1.34)		0.88 (0.51 to 1.24)
Vertical school trust				
High				
Low			0.81 (0.51 to 1.11)	0.48 (0.17 to 0.78)
Horizontal school trust				
High				
Low			0.52 (0.13 to 0.92)	0.44 (0.04 to 0.83)
Reciprocity at school				
High				
Low			1.63 (1.17 to 2.10) **	1.50 (1.04 to 1.97) *
Gender				
Male				
Female	2.25 (1.79 to 2.71) ***	2.06 (1.60 to 2.52) ***	2.07 (1.60 to 2.55) ***	2.08 (1.59 to 2.56) **
Body mass index				
Normal				
Overweight/Obese	2.22 (1.66 to 2.79) **	2.28 (1.69 to 2.87) **	2.30 (1.70 to 2.91) **	2.32 (1.73 to 2.92) **
Self-perceived socioeconomic status				
High/Middle				
Low	0.13 (-0.32 to 0.60)	0.21 (-0.25 to 0.68)	0.15 (-0.30 to 0.62)	0.19 (-0.26 to 0.64)
Psychological distress				
High				
Low	0.34 (0.23 to 0.50) ***	0.34 (0.23 to 0.50) ***	0.34 (0.22 to 0.51) ***	0.38 (0.25 to 0.56) ***
Physical activity				
High/Moderate				
Low	3.17 (2.6 to 4.64) ***	3.10 (2.11 to 4.53) ***	3.09 (2.10 to 4.53) ***	2.76 (1.87 to 4.08) ***

***p<0.001, **p<0.01, *p<0.05; OR – odds ratio; CI – confidence interval

Model 1: Examine association between family social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighborhood social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

Interestingly, the associations of social capital seem to be strongly driven by girls in the sample, but not the boys (Table 3). Poor self-rated health among boys was significantly associated only with lower family social capital (OR 2.82; 95% CI: 2.12 to 3.52). When all types of social capital were entered simultaneously, poor self-rated health was significantly associated with lower neighbourhood trust (OR 1.99; 95% CI: 1.55 to 2.43) and reciprocity at school (OR 1.57; 95% CI: 1.07 to 2.07) only among girls.

Table 3 Odds ratios for poor self-rated health among high school students, stratified by genders, Zagreb, Croatia, 2014

	Males (n=1688)				Females (n=1739)			
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Family social capital								
High								
Low	2.82 (2.12 to 3.52) **			2.23 (1.56 to 2.91)	2.04 (1.45 to 2.63) **			1.57 (0.90 to 2.25)
Neighborhood trust								
High								
Low		1.03 (0.52 to 1.54)		0.49 (-0.02 to 1.00)		2.29 (1.90 to 2.69) ***		1.99 (1.55 to 2.43) ***
Informal social control								
High								
Low		0.95 (0.49 to 1.41)		0.57 (0.09 to 1.04)		1.07 (0.59 to 1.56)		1.06 (0.57 to 1.56)
Vertical school trust								
High								
Low			0.36 (-0.13 to 0.86)	0.16 (-0.33 to 0.65)			1.02 (0.63 to 1.41)	0.64 (0.24 to 1.04)
Horizontal school trust								
High								
Low			1.30 (0.66 to 1.94)	1.25 (0.60 to 1.90)			0.24 (-0.19 to 0.68)	0.16 (-0.27 to 0.60)
Reciprocity at school								
High								
Low			1.70 (0.96 to 2.45)	1.42 (0.62 to 2.21)			1.63 (1.12 to 2.14) *	1.57 (1.07 to 2.07) *
Body mass index								
Normal								
Overweight/Obese	0.90 (-0.01 to 1.82)	0.91 (-0.02 to 1.84)	0.82 (0.17 to 1.82)	0.85 (-0.12 to 1.82)	3.23 (2.66 to 3.80) ***	3.32 (2.76 to 3.89) ***	3.41 (2.83 to 3.99) ***	3.43 (2.88 to 3.98) ***
Self-perceived SES								
High/Middle								
Low	0.62 (0.01 to 1.22)	0.62 (0.02 to 1.22)	0.76 (0.15 to 1.37)	0.76 (0.18 to 1.33)	0.52 (0.08 to 1.13)	0.66 (0.04 to 1.29)	0.60 (-0.01 to 1.21)	0.63 (0.02 to 1.24)
Psychological distress								
High								
Low	0.21 (0.10 to 0.44) ***	0.19 (0.09 to 0.39) ***	0.21 (0.10 to 0.43) ***	0.24 (0.11 to 0.50) ***	0.42 (0.27 to 0.66) ***	0.44 (0.28 to 0.69) ***	0.43 (0.27 to 0.68) ***	0.47 (0.29 to 0.74) ***
Physical activity								
High/Moderate								
Low	3.41 (2.63 to 6.42) ***	3.39 (2.59 to 6.40) ***	3.39 (2.65 to 6.46) ***	3.40 (2.58 to 6.36) ***	2.86 (1.53 to 4.37) ***	2.81 (1.49 to 4.29) ***	2.83 (1.51 to 4.32) ***	2.83 (1.50 to 4.31) ***

***p<0.001, **p<0.01, *p<0.05; OR – odds ratio; CI – confidence interval, SES – socioeconomic status

Model 1: Examine association between family social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighborhood social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

DISCUSSION

Previous studies in the US and Europe have suggested that higher levels of informal social control were associated with higher levels of perceived health.[10] Drukker et al. found that higher levels of community informal social control in the Netherlands may directly prevent young people from engaging in deleterious health behaviors as well

as indirectly provide them with self-confidence and a sense of protection.[32] Furuta et al. have shown that the association of social capital with self-rated oral health is not uniform; higher trust is associated with better oral health, whereas higher informal control in the community is associated with worse oral health.[7]

To better understand findings of this research, it is very important to briefly explain the Croatian social context and the theoretical approach to young people. The mid 1980s in Croatia was a period of socialism before the collapse of the Soviet bloc. The first decade of the 1990s was more turbulent in Croatia compared to other post-socialist countries. Croatia experienced armed conflicts that lasted for several years. Finally, at the beginning of the 1990s with the state's declaration of independence, and the abolition of the totalitarian regime, the nation became one of many transition countries. Young people in Croatia are one of the population segments most rapidly affected by these processes and changes. The reasons for this are multiple and related to timing of political transition with the transition from childhood to adulthood.[33]

In this study, we have found a statistically significant association between lower levels of family social capital and poorer self-rated health. For young people, family should be important for 'being there' in times of need and family members are often regarded as a crucial source of support[34]. Morgan and Haglund reported that a sense of belonging in family was related to self-rated health and health behaviors in adolescents.[35] In transitional societies, the changes in hierarchical order and value structures accompanying the shift from socialism to free markets meant that families became especially important as a source of social support.[36]

We also found that those living in low trust communities reported worse health

compared to youth living in high trust communities. According to surveys, Croatian youth frequently spend their time with friends in the neighbourhood engaged in sport or other activities (i.e., watching TV and videos, listening to the radio).[33]

The indicators based in the school social environment suggested that lower reciprocity at school (collaboration between pupils) was associated with poorer self-rated health, whereas vertical and horizontal social capital were not significantly associated with self-rated health. Spending time with peers at school may engender a sense of belonging,[34] and it may promote better health. The data shows that 78% of Croatian youth frequently talk to their school peers about going out and leisure, music, movies and books.[33] A previous study in Denmark found that school connectedness and sense of belonging may have a strong impact on adolescent psychological health.[37]

Our study has some limitations. First, due to the cross-sectional design, we cannot exclude the possibility of reverse causation, i.e., poor health led to low level of trust and other indicators of social capital. To mitigate this, we adjusted for psychological distress. Moreover, the differential effect estimates of each type of social capital on health cannot be fully explained by the reverse causation. Second, we used a subjective measure of health and social capital, and therefore there is a possibility of common method bias which may have resulted in bias away from the null. Again, the differential findings for each type of social capital suggest that this is less likely. Third, because the students responded the questionnaires during the class, there is a possibility of measurement error of school social capital, in particular vertical social capital. Fourth, the social capital variables in our study are anaylsed at the individual level. Therefore, we are referring to the students' individual perceptions of social capital. And fifth, all types of social capital

were assessed in primary sample. Future studies are warranted to assess all three domains (family, neighbourhood and school social capital) by approaching different sample subjects who are not participating in primary sample.

The present study shows that higher levels of family social capital, neighbourhood trust and reciprocity school (i.e., collaboration relationships between pupils) were associated with better health among youth. Interestingly, the effect of social capital seems to be strongly driven by girls not the boys. There are some researches confirming that, among adolescents, girls tend to report higher levels of social capital, especially school and family belonging than do boys.[38] We can speculate that this was found since adolescent girls have a greater number of friends than do boys, they expect and desire more nurturing behavior from their friends and family members, and experience more empathy, more self-disclosure, and less overt hostility in their friendships than do boys.[39] Additional studies are needed to identify interventions that can increase social capital to engender healthy habits with the ultimate goal of achieving healthier students. More studies exploring social capital and health in different countries should be conducted since social capital in general and in particular levels of informal social control may depend on different cultural norms and values.[40,41]

What is already known on this subject?

Associations between social capital and health have been extensively investigated in adult samples showing that human development is shaped by the interaction between an individual and his or her environment. However, fewer studies to date have focused on social capital and health among children and youth. Few studies have simultaneously examined the contribution of different sources of social capital to youth health.

What this study adds?

Based on Bronfenbrenner's ecological systems theory of child development, we posited that family, neighbourhood and school social capital may be protective for adolescent's poor health and that students who report lower levels of social capital in all three domains will have poorer self-rated health.

ACKNOWLEDGMENTS

The authors would like to thank students and teachers for their enthusiastic participation in this study.

Funding

This research was self-funded.

Competing interests

The authors declare no competing interests.

Contributorship statement

DN conceptualised and designed the study, conducted the statistical analyses, and interpreted the data and wrote the article. ES participated in conceptualisation of the study, contributed to drafting the article and reviewed the paper. IK reviewed the results and contributed to drafting the article. All authors approved the final manuscript.

REFERENCES

1 Lin N. Social capital: a theory of social structure and action. New York: Cambridge University Press 2001:95-139.

2 Kim D, Subramanian SV, Kawachi I. Bonding versus bridging social capital and

their associations with self rated health: a multilevel analysis of 40 US communities. J Epidemiol Community Health 2006; 60:116-122.

3 Putnam RD. Bowling alone. New York: Simon & Schuster 2000: 296.

4 Kawachi I, Subramanian SV, Kim D. Social capital and health. New York: Springer Science 2010: 215–228.

5 Coleman JS. Social Capital and the Development of Youth. Momentum 1987; 18:6-8.

6 Coleman JS. Foundations of social theory. London: The Belknap Press of Harvard University Press 1990: 300-302.

7 Furuta M, Ekuni D, Takao S, et al. Social capital and self-rated oral health among young people. Community Dent Oral Epidemiol 2012; 40:97–104.

8 Putnam RD. Making democracy work: civic traditions in modern Italy. Princeton: Princeton University Press 1993:167.

9 Kalff AC, Kroes M, Vles JSH, et al. Neighbourhood level and individual level SES effects on child problem behaviour: a multilevel analysis. J Epidemiol Community Health 2001; 55:246–250.

10 Drukker M, Buka, S, Kaplan C. Social capital and young adolescents' perceived health in different sociocultural settings. Soc Sci Med 2005; 61:185-198.

11 Kim D, Subramanian SV, Kawachi I. Social capital and physical health: A systematic review of the literature. In: Kawachi I, Subramanian SV, Kim D, eds. Social capital and health. New York: Springer 2008: 139–190.

12 Murayama H, Fujiwara Y, Kawachi I. Social capital and health: A review of prospective multilevel studies. J Epidemiol 2012; 22:179–187.

13 Virtanen M, Ervasti M, Oksanen T, et al. Social capital in Schools. In: Kawachi I, Takao S, Subramanian SV, eds. Global Perspectives on Social Capital and Health. New York: Springer 2013: 65–85.

14 Lindstrom M, Hanson BS, Ostergren PO. Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in sharping health related behavior. Soc Sci Med 2001; 52:441-451.

15 Lindstrom M, Moghaddassi M, Merlo J. Social capital and leisure-time physical activity: A population-based multilevel analysis of individual- and neighbourhood level data in Malmo. J Epidemiol Community Health 2003; 57:23-28.

16 Ali SM, Lindstrom M. Psychosocial work conditions and leisure time physical activity: A population base study. Scand J Public Healt 2006; 34:209-216.

17 Bronfenbrenner U. Ecological models of human development. Oxford: Elsevier 1994: 37-43.

18 Fylkesnes K. Determinants of health care utilization—visits and referrals. Scand J Sociol Med 1993; 21:40–50.

19 Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. J Health Sociol Behav 1997; 38:21–37.

20 Lundberg O, Manderbacka K. Assessing reliability of a measure of self -rated health. Scand J Soc Med 1996; 24:218–224.

21 Johnson PB, Richter L. The relationship between smoking, drinking, and adolescents' self-perceived health and frequency of hospitalization: analyses from the 1997 National Household Survey on Drug Abuse. J Adolesc Health 2002; 30:175–183.

22 Koivusilta L, Arja R, Andres V. Health behaviours and health in adolescence as predictors of educational level in adulthood: a follow-up study from Finland. Soc Sci Med 2003; 57:577–593.

23 Pastor Y, Balaguer I, Pons D, et al. Testing direct and indirect effects of sports participation on perceived health in Spanish adolescents between 15 and 18 years of age. J Adolesc 2003; 26:717–730.

24 Tobi H, Meijer WM, Tuinstra J, et al. Socio-economic differences in prescription and OTC drug use in Dutch adolescents. Pharm World Sci 2003; 25:203–206.

25 Morrow V. Conceptualising social capital in relation to the well-being of children and young people: a critical review. Sociol Rev 1999; 44:744–65.

26 Duke NN, Skay CL, Pettingell SL, et al. From adolescent connections to social capital: predictors of civic engagement in young adulthood. J Adolesc Health 2009; 44:161–8.

27 Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003; 35: 1381-95.

28 Subramanian SV, Kim DJ, Kawachi I. Social trust and self-rated health in us communities: a multilevel analysis. J Urban Health 2002; 79(Suppl 1):S21–34.

29 Wang Z, Byrne NM, Kenardy JA, et al. Influences of Ethnicity and Socioeconomic Status on the Body Dissatisfaction and Eating Behaviour of Australian Children and Adolescents. Eat Behav 2005; 6:23–33.

30 Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry 2003; 60:184-189.

31 Greif Green J, Gruber MJ, Sampson NA, et al. Improving the K6 short scale to predict serious emotional disturbance in adolescents in the USA. Int J Methods Psychiatr Res 2010; 19:23–35.

32 Drukker, M, Kaplan C, Feron F. Children's health related quality of life, neighborhood socio-economic deprivation and social capital. A contextual analyses. Soc Sci Med 2003; 57:825-841.

33 Ilisin V, Potocnik D. A sociological portrait of contemporary Croatian youth. Ser Hist Sociol 2 2010; 20:41-56.

34 Morrow V. Young people's explanations and experiences of social exclusion: retrieving bourdieu's concept of social capital. Int J Sociol Soc Policy 2001; 21:37–63.

35 Morgan A, Haglund BJ. Social capital does matter for adolescent health: evidence from the English HBSC study. Health Promot Int 2009; 24:363-372.

36 Kennedy BP, Kawachi I, Brainerd E. The role of social capital in the Russian mortality crisis. World Dev 1998; 26:2029-2043.

37 Due P, Lynch J, Holstein B, et al. Socioeconomic health inequalities among a nationally representative sample of Danish adolescents: the role of different types of social relations. J Epidemiol Community Health 2003; 57:692-698.

38 Newman BM, Lohman BJ, Newman PR. Peer group membership and a sense of belonging: their relationship to adolescent behavior problems. Adolesc 2007; 42:241-263.

39 Galambos N. Gender and gender-role development in adolescence. In: Lemer R, Steinberg L, eds. The handbook of adolescent psychology. New York: Wiley

2004: 233-262.

40 Binbay T, Drukker K, Alptekin H, et al. Evidence that the wider social environment moderates the association between familial liability and psychosis spectrum outcome. Psychol Med 2012; 42:2499-2510.

41 Drukker M, Driessen G, Krabbendam L, et al. The wider social environment and mental health service use. Acta Psychiat Scand 2004; 110:119–129.

20-Feb-2015

Dear Editor:

We are pleased to resubmit for publication the revised version of Manuscript ID bmjopen-2014-007184 entitled "FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL AND SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS". We appreciate the constructive criticisms of the Editor and the reviewers. We have addressed each of their concerns as outlined below.

The most substantial revision concerns the data clustering. Following the reviewer's advice, we have included the school level in the analyses and we have re-analyzed the data by accounting for the clustered nature of the samples. In addition, we have rewritten parts of the paper to provide more clarity (see specifics outlined below).

RESPONSES TO EDITOR'S COMMENTS:

1/ Please amend the title to include the research question and study design

> *Research question and study design has been included in the title now. We would suggest the following title: "Are family, neighbourhood, and school social capital associated with higher self-rated health among Croatian high school students? A population-based study".*

2/ Abstract: "with better health among youth"; better health or better self-rated health?

> *In order to provide more clarity and better text flow there should stay "poorer self-rated health". Done.*

RESPONSES TO THE COMMENTS FROM REVIEWER 1 (DR. MARJAN DRUKKER):

Major Concerns

1. High schools were randomly sampled. If I understand correctly, all students of those high schools were asked to participate. However, because of the sampling of the high schools it is a multistage sample anyway. Because of this sampling method clustering is introduced in the data. Therefore, the school level should have been taken into account in the analyses: multilevel analysis.

> *Thank you for the comment. A total of n=20 schools were sampled. Rather than performing multi-level analysis (with an effective sample size of 20 at level 2), we have chosen to conduct GEE in order to correct the standard errors for clustering. We mention this in the revised abstract, too.*

2. Perceived social capital at the school level is included in the questionnaire, while multiple students per school were asked to participate. This school level social capital is more similar in students attending the same school than in students attending different schools. This is another reason to include the school level in the analyses. In addition, one might hypothesize that (horizontal) social capital is different in each class; therewith introducing clustering at the class-level, too.

Unfortunately, we do not have information about which classrooms the students attended within each school. Therefore, we could not perform a 3-level multi-level model.

3. On top of that, there is the neighbourhood level. Neighbourhood social capital is also included in the study. I assume that students attending the same school also live in a limited number of neighbourhoods. This introduces clustering per neighbourhood. In addition, depending on the distance between the high schools, students living in one neighbourhood can attend different schools. If so, data do not have a normal multilevel structure, but a cross-level structure. In SPSS, it is possible to perform multilevel analysis. I do not know whether the addition of a cross-level is also possible. For example, Stata and MLWin can analyse cross-level data. When in the analysis of multilevel data clustering is ignored, standard errors and significances are not correct.

Thank you for pointing this out. Unfortunately, we do not have information about which neighborhoods the respondents lived in. Therefore, we are unable to perform cross-classified multi-level analysis. We have clarified in the revised text that when we talk about "school social capital" and "neighborhood social capital", we are referring to the students' individual PERCEPTIONS of social capital in these settings. Therefore, the social capital variables in our study are analyzed at the individual level. We have mentioned this as a limitation in the Discussion section.

4. In addition, the authors stratify by gender in the analysis (page 9). Presenting results for strata of an interacting variable and drawing conclusions that there are differences between the strata is only warranted when interaction is tested and is statistically significant (and testing is only allowed when there is a hypothesis for interaction that has been explained in the introduction). Directly after announcing the stratification by gender the authors state that the interaction term was not statistically significant. So, they should not have stratified and the conclusion that "social capital seems to be strongly driven by girls, but not boys" is not supported by their results.

Thank you for this comment. We agree that the sex-stratified analyses need to be interpreted with caution because the (sex) x (social capital) interaction term was not statistically significant. Nonetheless, given the large number of previous studies which have found gender interactions in the relation between social capital and health, we felt that it is theoretically interesting to present the gender-stratified results. For readers who remain skeptical about interpreting gender-stratified results, we have also provided the results for the combined sample.

5. The authors should add the method of analysis to the methods section of the abstract.

Done.

6. All types of social capital were assessed in primary sample. It would have been better to assess neighbourhood social capital using other residents of the neighbourhood, not participating in the primary study. Previous studies addressing neighbourhood social capital have used this method, but it is also possible at the school level (when not all children of a class are selected for the primary study) and perhaps even at the family level. The issue of reversed causality is addressed in the discussion. However, it remains a limitation and I would advise to specifically mention the possibility to assess social capital in a different sample subjects (in future research).

We completely agree. Would be better to assess all three domains (family, neighbourhood and school social capital) by approaching different sample subjects who are not participating in primary sample. This is specifically mentioned in the limitation section.

7. Page 6, line 45. At this point the height and weight of the respondents is of no interest. Because of the hypothesized mediation of the BMI it is possible to provide height and weight figures in the results instead.

Done.

8. The assessment of psychological distress is not clear to me. Of course referring to another paper for more information is good, but the authors cannot expect all readers to search for all references. So, the present paper needs a little bit more information.

The assessment of psychological distress is now explicitly stated and explained in the covariates section.

9. Page 8, covariates. If the authors consider physical activity and BMI to be a mediator they should explain this in the introduction.

We have inserted a brief explanation of our conceptual framework in the Introduction and Methods, i.e. social capital has been found in previous studies to be related to both physical activity and BMI (Lindstrom, Hanson, & Ostergren, 2001; Lindstrom, Moghaddassi, & Merlo, 2003; Ali & Lindstrom, 2006). At the same time, both physical activity and BMI are predictors of self-rated health. Therefore, physical activity and BMI are not considered to be confounders of the relation between social capital and self-rated health. Rather, our underlying hypothesized model is: social capital → physical activity/BMI → self-rated health.

10. Page 10 (results). "Girls reported a higher prevalence of poor self-rated health". I need to see a test statistic and a p-value to support this finding.

We have performed a chi-squared test to check the statistical significance of the gender difference.

11. I would advise the authors to include recent research from countries outside Western Europe and the U.S., such as the paper by Binbay (2012). Social capital in general and in particular levels of informal social control may depend on cultural norms and values.

We would like to thank for these valuable suggestions. An article by Binbay et al. (2012) gave us a lot of information how the wider social environment moderates the association between familial liability and psychosis spectrum outcome. Several recent references from countries outside Western Europe and US have been added (Drukker et al. 2004; Binbay et al. 2012).

Minor Concerns

12. The English language is not always adequate. Some sentences do not make sense and sometimes the authors forgot a word.

We have checked the English grammar again and made corrections where necessary.

13. Last sentence of first paragraph of introduction (page 5): "Investigation of possible……. has suggested that contextual influences may () the somatic and psychological development…". What word is missing between "may" and "somatic"?

The part "may have effects on" is missing. It's included now.

14. Page 6, line 8. … students who reports ◊ … students who report

Done.

15. Page 7, line 51: with each another ◊ with each other

Done.

16. Page 7 and 8: …. Responses were combined to create a dichotomous variable indicating lower group. Please rewrite, because to me it is totally unclear the authors mean by "lower group".

This sentence has been revised and now stands as follows: "Then, for each response, we created a dichotomous variable (high: 'strongly agree', 'agree', and 'neither agree or disagree'; low: 'disagree' and 'strongly disagree')."

17. Page 11, line 29. I am not a native speaker, but in my opinion "oral health" does not mean anything. It is not in the dictionary. Do the authors mean health of the mouth or perhaps perceived health as enquired in an oral questionnaire?

The term "oral health" is fairly widely used by oral health researchers (Locker, Clarke, & Payne, 2000; Cascaes, Peres, & Peres, 2009; Finlayson et al., 2010; Furuta et al., 2012). Self-rated oral health refers to the respondents' self-rating of their overall level of oral health – i.e. their teeth (e.g. absence of cavities) as well as gingiva.

18. I notice that the title of the paper is in British spelling (neighbourhood) and the text in American spelling (neighborhood). The authors should be consistent and because they submitted to BMJ, I would advise British spelling.

The manuscript now consistently uses the British spelling.

19. Page 6, line 8. The authors hypothesized that students have lower levels of poor health. This sentence is correct, but difficult to read. Is it possible to rewrite this sentence?

We agree that the phrase "lower levels of poor self-rated health" is difficult to read. We have changed it to "poorer self-rated health".

RESPONSES TO THE COMMENTS FROM REVIEWER 2 (DR. CARINA PERSSON):

1. The introduction states the hypothesis that family, neighbourhood and school social capital may be protective for adolescent`s poor health (line 5, page 6). The statistical analyses are performed to confirm this. In the conclusion (line 52, page 3) and in the discussion (line 34, page 12) the authors state that there exists a positive association between higher levels of social capital and better health. This is not shown with the present design. If the authors want to take a more salutogenic approach in this study, I strongly recommend the authors to change the outcome measure in the statistical analysis. Either as a binomial logistic regression with fair, poor and very poor health as reference group and good/excellent health as the studied outcome or as a multinomial logistic regression with poor/very poor health as reference group and two studied outcomes (fair and good/excellent respectively).

Thank you for the comment. As we have not adopted an explicit salutogenic framework, we have reworded the text to state that lower levels of social capital are associated with poorer self-rated health. There is substantial prior literature suggesting that poor self-rated health is a predictor of disease outcomes as well as increased risk of mortality and hospitalization (Fylkesnes, 1993; Lundberg & Manderbacka, 1996; Idler & Benyamini, 1997). There is less evidence that good self-rated health is a marker of "flourishing" or other concepts from the salutogenic framework.

2. The theoretical framework needs to be thoroughly described. The manuscript needs further explanation of how the factors in the statistical analyses are chosen. Is there a conceptual model or is the factors reduced by some statistical procedures? I am especially concerned about the fact that some health behaviour factors such as physical activity and Body mass index (if regarded as a health behaviour factor) are included in the model but alcohol and smoking habits are not. There is also the question of including psychological distress in the model as an explanatory factor. The authors motivate this with the statement that psychological distress is a possible confounder (line 23, page 9) and the inclusion in the model would adjust the risk of reverse causation. Is there any reference to support that theory? Is the interaction between psychological distress and gender tested?

We have inserted a brief explanation of our conceptual framework in the Introduction and Methods, i.e. social capital has been found in previous studies to be related to both physical activity and BMI (Lindstrom, Hanson, & Ostergren, 2001; Lindstrom, Moghaddassi, & Merlo, 2003; Ali & Lindstrom, 2006). At the same time, both physical activity and BMI are predictors of self-rated health. Therefore, physical activity and BMI are not considered to be confounders of the relation between social capital and self-rated health. Rather, our underlying hypothesized model is: social capital → physical activity/BMI → self-rated health.

We controlled for psychological distress in order to take account of common source bias, i.e. both the perceptions of social capital as well as self-ratings of health are subjective and self-reported. This raises the possibility that a third underlying factor (such as psychological distress) could spuriously result in an association between social capital and self-rated health. Therefore, it is important to adjust for individual differences in psychological distress in order to rule out this possible bias. There is statistical gender difference in psychological distress ($p<0.001$).

3. To save space for the theoretical framework, the authors might condense the description of participants (line 45-50, page 6) and perhaps some parts of the discussion regarding the limitations of the study (line 6-11, page 13).

Done.

4. Table 1 would be more informative if completed with Pearson's chi-squared tests of distributions between males and females.

We have performed a chi-squared test to check the statistical significance of the gender difference.

5. There are some minor spelling and grammatical errors in the manuscript in need to be corrected.

We have tried to correct all minor spelling and grammatical errors in the manuscript.

We thank the editor and the reviewers again for their helpful comments, which we feel have improved our manuscript. We hope that with these modifications, our paper can now be accepted for publication.

Sincerely,

Dario Novak

Etsuji Suzuki

Ichiro Kawachi

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **[Within the title page 1 and method section of the abstract page 2 and 3]**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **[See results section of abstract page 2 and 3]**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **[Pages 4 and 5]**
Objectives	3	State specific objectives, including any prespecified hypotheses **[Page 5]**
Methods		
Study design	4	Present key elements of study design early in the paper **[Methods pages 5-8]**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **[Methods page 5]**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up **[N/A]** *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls **[N/A]** *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **[Methods page 5]**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed **[N/A]** *Case-control study*—For matched studies, give matching criteria and the number of controls per case **[N/A]**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **[Pages 6-8]**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **[Pages 6-8]**
Bias	9	Describe any efforts to address potential sources of bias **[Page 5]**
Study size	10	Explain how the study size was arrived at **[Page 5]**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **[Pages 6-8]**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **[Page 5]**
		(*b*) Describe any methods used to examine subgroups and interactions **[Page 5]**
		(*c*) Explain how missing data were addressed **[N/A]**
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed **[N/A]** *Case-control study*—If applicable, explain how matching of cases and controls was addressed **[N/A]** *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy **[N/A]**
		(*e*) Describe any sensitivity analyses **[N/A]**

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **[Table 1]**
		(b) Give reasons for non-participation at each stage **[N/A]**
		(c) Consider use of a flow diagram **[N/A]**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **[Pages 7 and 8; Table 1]**
		(b) Indicate number of participants with missing data for each variable of interest **[Table 1]**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount) **[N/A]**
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time **[N/A]**
		Case-control study—Report numbers in each exposure category, or summary measures of exposure **[N/A]**
		Cross-sectional study—Report numbers of outcome events or summary measures **[N/A]**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **[Pages 7 and 8; Tables 2 and 3]**
		(*b*) Report category boundaries when continuous variables were categorized **[N/A]**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **[N/A]**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **[Tables 2 and 3]**
Discussion		
Key results	18	Summarise key results with reference to study objectives **[Pages 9 and 10]**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **[Pages 11 and 12]**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **[Pages 10-13]**
Generalisability	21	Discuss the generalisability (external validity) of the study results **[Page 12]**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **[N/A]**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

ARE FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL ASSOCIATED WITH HIGHER SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS? A POPULATION-BASED STUDY

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-007184.R2
Article Type:	Research
Date Submitted by the Author:	31-Mar-2015
Complete List of Authors:	Novak, Dario; University of Zagreb, Dept of General and Applied Kinesiology; Harvard University, Dept. of Social and Behavioral Sciences Suzuki, Etsuji; Okayama University, Department of Epidemiology Kawachi, Ichiro; Harvard University, Department of Social and Behvioral Sciences
Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, Community child health < PAEDIATRICS, PUBLIC HEALTH

ARE FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL ASSOCIATED WITH HIGHER SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS? A POPULATION-BASED STUDY

Dario Novak,[1,2] Etsuji Suzuki,[3] Ichiro Kawachi [4]

[1]Department of General and Applied Kinesiology, University of Zagreb Faculty of Kinesiology, Zagreb, Croatia

[2]Postdoctoral Fellow at Harvard University, Harvard School of Public Health, Takemi Program in International Health, Boston, Massachusetts, US

[3]Department of Epidemiology, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Okayama, Japan

[4]Department of Social and Behavioral Sciences, Harvard School of Public Health, Boston, Massachusetts, US

CORRESPONDIG AUTHOR:

Dario Novak

Laniste 1E 15, 10000 Zagreb, Croatia

00385994455699

dario.novak@kif.hr

Key words: health, social capital, students, high school

ABSTRACT

Objectives: We investigated the associations between self-rated health and social capital among Croatian high school students.

Design: Cross-sectional survey among high school students was carried out in the 2013/14 school year.

Setting: High schools in Croatia.

Participants: Subjects were 3427 high school students (1688 males and 1739 females), aged 17-18 years.

Main outcome measure: Self-rated health was assessed by the single item: "How do you perceive your health?". Possible responses were arranged along a 5-item Likert type scale: 1 very poor, 2 poor, 3 fair, 4 good, or 5 excellent. The outcome was binarised as "good health" (excellent, good or fair) versus "poor health" (poor or very poor).

Methods: We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for good self-rated health associated with family, neighbourhood and school social capital, while adjusting for gender, self-perceived socioeconomic status, psychological distress, physical activity, and body mass index. We used generalised estimating equations using an exchangeable correlation matrix with robust standard errors.

Results: Good self-rated health was significantly associated with higher family social capital (OR 2.43; 95% CI: 1.55 to 3.80), higher neighbourhood trust (OR 2.02; 95% CI: 1.48 to 2.76) and higher norms of reciprocity at school (OR 1.79; 95% CI: 1.13 to 2.84). When all of the social capital variables were entered simultaneously, good self-rated health remained significantly associated with higher family social capital (OR 1.98; 95%

CI: 1.19 to 3.30), neighbourhood trust (OR 1.77; 95% CI: 1.25 to 2.51) and reciprocity at school (OR 1.71; 95% CI: 1.08 to 2.73).

Conclusions: Higher levels of social capital were independently associated with higher self-rated health among youth. Intervention and policies that leverage community social capital might serve as an avenue for health promotion in youth.

Article summary:

Strengths and limitations of this study

- This study is one of the fewer studies to date that have focused on social capital and health among children and youth.
- We used a random sampling approach to select 20 high schools in Zagreb, all of which agreed to take part in the survey. A total of 3427 students (93.8%) responded to the survey which was given during class.
- To clarify which source of social capital is likely to affect adolescents' health, we assessed three different sources of social capital – in the family, in the neighbourhood, and at school – among high school students.
- We used the generalised estimating equations using an exchangeable correlation matrix with robust standard errors in order to correct standard errors for clustering.
- Due to the cross-sectional design, we cannot exclude the possibility of reverse causation. Since we used a subjective measure of health and social capital, there is a possibility of common method bias.

INTRODUCTION

Social capital has been defined as the "resources embedded in a social structure which are accessed and/or mobilised in purposive actions".[1,2] Some scholars have conceptualised social capital as the social networks themselves, or as both the network structures and the resources channelled through the networks.[3,4] Social capital has garnered increasing attention as a potential influence on the development of youth. In the field of education, research has primarily focused on the role of social capital in children's academic performance;[5,6] however, subsequent research has expanded the range of outcomes to include health behaviours and population health outcomes.[4,7] Social capital theory posits that interpersonal trust, norms of reciprocity, and exchange of social support between members of a networks each constitutes a type of resource, and that access to these resources may facilitate the actions of group members.[4,7,8] Investigation of possible influences of social capital on health may be particularly salient in adolescents because previous work has suggested that contextual influences may have effects on the somatic and psychological development of young people throughout the life course.[9,10]

Associations between social capital and health have been extensively investigated in adult samples.[11-13] Social capital has been found in previous studies to be related to both physical activity and body mass index (BMI).[14-16] At the same time, both physical activity and BMI are predictors of self-rated health. Therefore, physical activity and BMI are not considered to be confounders of the relation between social capital and self-rated health. Rather, our underlying hypothesized model is: social capital → physical activity/BMI → self-rated health. However, fewer studies to date have focused on social capital and health among children and youth. According to Urie Bronfenbrenner's

ecological systems theory of child development, human development is conceptualised as being shaped by the interaction between an individual and his or her environment; and that furthermore there are many different levels of environmental influences that can affect a child's development, starting with people and institutions immediately surrounding the child (i.e. parents and families), to school environments, to residential neighbourhoods, and eventually the societal culture.[17] In line with this, we hypothesised that family, neighbourhood and school social capital may be associated with adolescent's good health and that students who report higher levels of social capital in all three domains will have higher self-rated health. However, few studies have simultaneously examined the contribution of different sources of social capital to youth health.

Accordingly in the present study we investigated the influences of different sources of social capital – in the family, in the neighbourhood, and at school – on levels of self-rated health among a sample of high school students in Croatia.

METHODS

Participants

We administered a survey among high school students in Zagreb, a mid-sized urban city in central Croatia with a population of about 1,000,000 people. A random sampling approach was used to select high schools. All of 20 schools that we approached agreed to take part in the survey, representing 3650 students enrolled in the 2013/14 school year. Of these, 3427 students (1688 males and 1739 females, aged 17–18 years) responded to the survey (93.8%) which was given during class. Finally, the data of 3427 students aged 17–18 years were analysed. The study was approved by the Institutional Review Board and one of the parents for each subject signed an informed consent form.

The students signed an assent form as well.

Self-rated health

Self-rated health was assessed in these young adolescents using the standard single item measure: "How do you perceive your health?". Possible responses were arranged along a 5-item Likert type scale: 1 very poor, 2 poor, 3 fair, 4 good, or 5 excellent. We binarised the outcome, i.e., fair, good and excellent were collapsed into one category (good health); while poor and very poor were designated as poor health. Perceived health is an easily administered and widely used outcome measure in social epidemiology studies and it has been shown to be a reliable predictor of mortality and health care use in adults.[18-20] The measure has also been used in adolescents.[21-24]

Social capital indicators

On the survey, we inquired about individual perceptions of social capital in the family, neighbourhood, and high school settings.[3,7,25] Family social capital was assessed by the question: 'Do you feel your family understands and gives attention to you?'.[7,26] Neighbourhood social capital was assessed by using two items; 'Do you feel people trust each other in your neighbourhood (neighbourhood trust)?' 'Do you feel that your neighbours step in to criticise someone's deviant behaviour during high school (informal social control)?'.[7] School social capital was assessed by three items; 'Do you feel teachers and students trust each other in your high school (vertical school trust)?' 'Do you feel students trust each other in your high school (horizontal school trust)?' 'Do you feel students collaborate with each other in your high school (reciprocity at school)?' The response options were: 'strongly agree'; 'agree'; 'neither agree or disagree'; 'disagree';

'strongly disagree'. Then, for each response, we created a dichotomous variable (high: 'strongly agree', 'agree' and 'neither agree or disagree'; low: 'disagree' and 'strongly disagree').[7] The Cronbach alpha of the school social capital scale was 0.71 and since other domains have fewer than three questions we consider not appropriate to check Cronbach alphas for these scales.

Covariates

As measure of physical activity, we considered students' total physical activity in the last 7 days. Physical activity was assessed using the validated short version of the International Physical Activity Questionnaire (IPAQ) and was expressed as metabolic equivalent-hours per week (MET-hour/week).[27] As additional potential mediators, we considered BMI based on the calculation from self-reported height and weight (scoring of responses in the range ≥25 kg/m^2 versus <25 kg/m^2 discriminates between respondents with and without high BMI). Socioeconomic status (SES) was entered in our regression models as a potential confounder, i.e. theoretically associated with both self-rated health and social capital.[28] The classification of SES was based on both parents' occupation at the time when research was conducted. Self-perceived SES was categorised into three levels as high SES (i.e., managers and professionals), middle SES (white collar) and low SES (blue collar),[29] and it was dichotomised as high/middle (responses in the range 2-4) and low (responses in the range 5-6). Psychological distress was also assessed as a potential confounder using the 6-item Kessler scale by the questions: 'About how often during the past 30 days did you feel nervous?', 'During the past 30 days, about how often did you feel hopeless?', 'During the past 30 days, about how often did you feel restless or fidgety?', 'How often did you feel so depressed that nothing could cheer you up?',

'During the past 30 days, about how often did you feel that everything was an effort?' and 'During the past 30 days, about how often did you feel worthless?'[30] Each question is scored from 0 (None of the time) to 4 (All of the time). Scores of the 6 questions were then summed (0-24), with lower score indicating low levels of psychological distress. Previous research has shown that dichotomous scoring of responses in the range 13+ versus 0–12 discriminates between respondents with and without significant psychological distress.[30,31] A test of interaction between psychological distress and gender is performed and there is statistical gender difference in psychological distress ($p<0.001$).

Data Analysis

We used the generalised estimating equations using an exchangeable correlation matrix with robust standard errors in order to correct standard errors for clustering. We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for good self-rated health according to levels of perceived social capital. The association of self-rated health with social capital indicators was examined by conducting a multiple logistic regression analysis. Furthermore, the study included students from 20 schools; thus, one of the assumptions was that the measurements within school might not be independent. Therefore, the cluster effect was considered in the analysis. For this purpose, we adjusted the standard errors by computing clustered robust standard errors for the coefficients. We also have performed a chi-squared test to check the statistical significance of the gender difference in proportion of boys vs. girls reporting good self-rated health. As potential confounders, we entered gender, self-perceived SES, and psychological distress. We also included physical activity and BMI as potential mediators of the association between

social capital and self-rated health. We investigated the association between self-rated health and family social capital (Model 1), neighbourhood social capital (Model 2), and school social capital (Model 3). Finally, we entered all of these social capital variables simultaneously (Model 4) to assess their independent contributions to self-rated health. The interaction term between social capital and gender was not statistically significant so we dropped the sex-stratified analyses. A p-value of <0.05 (two sided) was considered statistically significant. All statistical analyses were performed with Stata, version 12 (StataCorp, TX, USA).

RESULTS

Boys reported higher percentage of good self-rated health (85.8%) compared to girls (75.6%). Roughly 20% of the participants reported poor health. It is worth noting that the prevalence of psychological distress in girls was twice as high as that in boys. Males do generally have higher BMI than females (22.95±2.85 kg/m^2 vs 20.81±2.54 kg/m^2). Most adolescents evaluated their family socioeconomic status as high/middle (60.2%) with no statistically significant differences between boys and girls. Boys are significantly more physically active than girls. It is worthwhile to note that a chi-squared test shows the statistical significance of the gender difference in proportion of boys vs. girls reporting good self-rated health (Table 1).

Table 1 Characteristics of the study subjects, Zagreb, Croatia, 2014

	Total (N=3427) N (%)	Males (N=1688) N (%)	Females (N=1739) N (%)	p-value*
Self-rated health				
Poor	664 (19.4)	239 (14.2)	425 (24.4)	
Good	2763 (80.6)	1449 (85.8)	1314 (75.6)	<0.001
Family social capital				
Low	185 (5.4)	90 (5.4)	95 (5.5)	
High	3242 (94.6)	1598 (94.6)	1644 (94.5)	0.808
Neighbourhood trust				
Low	1104 (32.2)	466 (27.6)	638 (36.6)	
High	2323 (67.8)	1222 (72.4)	1101 (63.4)	<0.001
Informal social control				
Low	828 (24.2)	419 (24.8)	409 (23.5)	
High	2599 (75.8)	1269 (75.2)	1330 (76.5)	0.342
Vertical school trust				
Low	1050 (30.6)	485 (28.7)	565 (32.5)	
High	2377 (69.4)	1203 (71.2)	1174 (67.5)	0.014
Horizontal school trust				
Low	840 (24.5)	339 (20.1)	501 (28.8)	
High	2587 (75.5)	1349 (79.9)	1238 (71.2)	<0.001
Reciprocity at school				
Low	459 (13.4)	186 (11.1)	273 (15.7)	
High	2968 (86.6)	1502 (88.9)	1466 (84.3)	<0.001
Body mass index				
Normal	3001 (87.6)	1367 (80.9)	1634 (93.9)	
Overweight/Obese	426 (12.4)	321 (19.1)	105 (6.1)	<0.001
Self-perceived socioeconomic status				
High/Middle	2064 (60.2)	1008 (59.7)	1056 (60.7)	
Low	1363 (39.8)	680 (40.3)	683 (39.3)	0.706
Psychological distress				
High	848 (24.7)	274 (16.3)	574 (33.0)	
Low	2579 (75.3)	1414 (83.7)	1165 (67.0)	<0.001
Physical activity				
High/Moderate	2943 (85.9)	1499 (88.8)	1444 (83.1)	
Low	484 (14.1)	189 (11.2)	295 (16.9)	<0.001

* Univariable, chi-squared test

The association between social capital and self-rated health is shown in Table 2. Overall, self-rated health was significantly associated with each domain of social capital. Good self-rated health was significantly associated with higher family social capital (OR 2.43; 95% CI: 1.55 to 3.80) and higher neighbourhood trust (OR 2.02; 95% CI: 1.48 to 2.76). Regarding school social capital, good-self health was significantly associated only with perceptions of reciprocity at school (OR 1.79; 95% CI: 1.13 to 2.84). When all social capital variables were entered into the model (Model 4), good self-rated health was significantly associated with higher family social capital (OR 1.98; 95% CI: 1.19 to 3.30), neighbourhood trust (OR 1.77; 95% CI: 1.25 to 2.51) and reciprocity at school (OR 1.71; 95% CI: 1.08 to 2.73).

Table 2 Odds ratios for good self-rated health among high school students, Zagreb, Croatia, 2014

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Family social capital				
Low				
High	2.43 (1.55 to 3.80) ***			1.98 (1.19 to 3.30) **
Neighbourhood trust				
Low				
High		2.02 (1.48 to 2.76) ***		1.77 (1.25 to 2.51) ***
Informal social control				
Low				
High		1.42 (0.99 to 2.04)		1.37 (0.95 to 1.98)
Vertical school trust				
Low				
High			1.34 (0.99 to 1.81)	1.19 (0.87 to 1.62)
Horizontal school trust				
Low				
High			1.24 (0.83 to 1.84)	1.19 (0.79 to 1.79)
Reciprocity at school				
Low				
High			1.79 (1.13 to 2.84) **	1.71 (1.08 to 2.73) *
Gender				
Male				
Female	0.46 (0.29 to 0.73) ***	0.49 (0.31 to 0.78) **	0.48 (0.30 to 0.78) **	0.48 (0.30 to 0.79) **
Body mass index				
Normal				
Overweight/Obese	0.44 (0.25 to 0.77) **	0.43 (0.23 to 0.78) **	0.43 (0.23 to 0.79) **	0.42 (0.23 to 0.77) **
Self-perceived socioeconomic status				
High/Middle				
Low	1.01 (0.64 to 1.60)	1.05 (0.66 to 1.68)	1.03 (0.65 to 1.64)	1.05 (0.66 to 1.65)
Psychological distress				
High				
Low	0.37 (0.24 to 0.57) ***	0.38 (0.24 to 0.59) ***	0.38 (0.24 to 0.59) ***	0.41 (0.26 to 0.64) ***
Physical activity				
High/Moderate				
Low	0.64 (0.42 to 1.00) *	0.65 (0.42 to 1.01) *	0.65 (0.41 to 1.01) *	0.66 (0.42 to 1.04) *

***p<0.001, **p<0.01, *p<0.05; OR – odds ratio; CI – confidence interval. These four models were examined in a sequence of four logistic regression models considering clustering for schools.

Model 1: Examine association between family social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighbourhood social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

Table 3 presents the association between family, neighbourhood and school social capital with good self-rated health among high school students. Good self-rated health was significantly associated with higher family social capital (Coefficient 0.88; 95% CI: 0.35 to 1.42), higher neighbourhood trust (Coefficient 0.70; 95% CI: 0.34 to 1.06) and higher norms of reciprocity at school (Coefficient 0.58; 95% CI: 0.13 to 1.04). When all types of social capital were entered simultaneously, good self-rated health remained significantly associated with higher family social capital (Coefficient 0.68; 95% CI: 0.13

to 1.23), neighbourhood trust (Coefficient 0.57; 95% CI: 0.20 to 0.94) and reciprocity at school (Coefficient 0.54; 95% CI: 0.08 to 0.99).

Table 3 Coefficients for good self-rated health associated with family, neighbourhood and school social capital among high school students, Zagreb, Croatia, 2014

	Model 1 Coefficient (95% CI)	Model 2 Coefficient (95% CI)	Model 3 Coefficient (95% CI)	Model 4 Coefficient (95% CI)
Family social capital				
Low				
High	0.88 (0.35 to 1.42) ***			0.68 (0.13 to 1.23) **
Neighbourhood trust				
Low				
High		0.70 (0.34 to 1.06) ***		0.57 (0.20 to 0.94) **
Informal social control				
Low				
High		0.35 (-0.03 to 0.74)		0.31 (-0.07 to 0.71)
Vertical school trust				
Low				
High			0.29 (-0.09 to 0.69)	0.17 (-0.22 to 0.57)
Horizontal school trust				
Low				
High			0.21 (-0.21 to 0.65)	0.17 (-0.25 to 0.61)
Reciprocity at school				
Low				
High			0.58 (0.13 to 1.04) **	0.54 (0.08 to 0.99) *
Gender				
Male				
Female	-0.77 (-1.18 to -0.36) ***	-0.70 (-1.11 to -0.29) ***	-0.71 (-1.12 to -0.30) ***	-0.71 (-1.12 to -0.30) ***
Body mass index				
Normal				
Overweight/Obese	-0.81 (-1.28 to -0.34) ***	-0.83 (-1.30 to -0.36) ***	-0.83 (-1.31 to -0.36) ***	-0.84 (-1.32 to -0.36) ***
Self-perceived socioeconomic status				
High/Middle				
Low	0.01 (-0.35 to 0.38)	0.05 (-0.31 to 0.42)	0.03 (-0.33 to 0.40)	0.04 (-0.32 to 0.42)
Psychological distress				
High				
Low	-0.97 (-1.33 to -0.60) ***	-0.96 (-0.32 to -0.59) ***	-0.95 (-1.32 to -0.59) ***	-0.87 (-1.24 to -0.50) ***
Physical activity				
High/Moderate				
Low	-0.43 (-0.87 to 0.00) *	-0.42 (-0.86 to 0.01) *	-0.42 (-0.87 to 0.01) *	-0.40 (-0.85 to 0.35)

***p<0.001, **p<0.01, *p<0.05; CI – confidence interval. These four models were estimated by generalised estimating equations using an exchangeable correlation matrix with robust standard errors.

Model 1: Examine association between family social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighbourhood social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

DISCUSSION

Previous studies in the US and Europe have suggested that higher levels of informal social control were associated with higher levels of perceived health.[10] Drukker et al. found that higher levels of community informal social control in the Netherlands may directly prevent young people from engaging in deleterious health behaviours as

well as indirectly provide them with self-confidence and a sense of protection.[32] Furuta et al. have shown that the association of social capital with self-rated oral health is not uniform; higher trust is associated with better oral health, whereas higher informal control in the community is associated with worse oral health.[7]

To better understand findings of this research, it is very important to briefly explain the Croatian social context and the theoretical approach to young people. The mid 1980s in Croatia was a period of socialism before the collapse of the Soviet bloc. The first decade of the 1990s was more turbulent in Croatia compared to other post-socialist countries. Croatia experienced armed conflicts that lasted for several years. Finally, at the beginning of the 1990s with the state's declaration of independence, and the abolition of the totalitarian regime, the nation became one of many transition countries. Young people in Croatia are one of the population segments most rapidly affected by these processes and changes. The reasons for this are multiple and related to timing of political transition with the transition from childhood to adulthood.[33]

In this study, we have found a statistically significant association between higher levels of family social capital and higher self-rated health. For young people, family should be important for 'being there' in times of need and family members are often regarded as a crucial source of support[34]. Morgan and Haglund reported that a sense of belonging in family was related to self-rated health and health behaviours in adolescents.[35] In transitional societies, the changes in hierarchical order and value structures accompanying the shift from socialism to free markets meant that families became especially important as a source of social support.[36]

We also found that those living in high trust communities reported better health

compared to youth living in low trust communities. According to surveys, Croatian youth frequently spend their time with friends in the neighbourhood engaged in sport or other activities (i.e., watching TV and videos, listening to the radio).[33]

The indicators based in the school social environment suggested that higher reciprocity at school (collaboration between pupils) was associated with higher self-rated health, whereas vertical and horizontal social capital were not significantly associated with self-rated health. Spending time with peers at school may engender a sense of belonging,[34] and it may promote better health. The data shows that 78% of Croatian youth frequently talk to their school peers about going out and leisure, music, movies and books.[33] A previous study in Denmark found that school connectedness and sense of belonging may have a strong impact on adolescent psychological health.[37]

Our study has some limitations. First, due to the cross-sectional design, we cannot exclude the possibility of reverse causation, i.e., poor health led to low level of trust and other indicators of social capital. To mitigate this, we adjusted for psychological distress. In other words, the students with psychological distress would report lower levels of social capital in all three domains and simultaneously, psychological distress could potentially affect their self-ratings of health. Therefore, we adjusted for individual differences in psychological distress in order to rule out this possible bias. Moreover, the differential effect estimates of each type of social capital on health cannot be fully explained by the reverse causation. Second, we used a subjective measure of health and social capital, and therefore there is a possibility of common method bias which may have resulted in bias away from the null. Again, the differential findings for each type of social capital suggest that this is less likely. Third, because the students responded the

questionnaires during the class, there is a possibility of measurement error of school social capital, in particular vertical social capital. Additionally, possibility of type 1 error is high because of the clustering. We used the generalised estimating equations using an exchangeable correlation matrix with robust standard errors in order to correct standard errors for clustering. Fourth, the social capital variables in our study are analysed at the individual level. Therefore, we are referring to the students' individual perceptions of social capital. Unfortunately, we did not have information about which neighbourhoods the respondents lived in nor about which classrooms the students attended within each school. We cannot fully disentangle the effects of school social capital and neighbourhood social capital in this study, partly because of the lack of information about class and neighbourhood. And fifth, all types of social capital were assessed in primary sample. Future studies are warranted to assess all three domains (family, neighbourhood and school social capital) by approaching different sample subjects who are not participating in primary sample.

The present study shows that higher levels of family social capital, neighbourhood trust and reciprocity school (i.e., collaboration relationships between pupils) were associated with better health among youth. Interestingly, the interaction term between social capital and gender was not statistically significant in this study although there are some researches showing that, among adolescents, girls tend to report higher levels of social capital, especially school and family belonging than do boys.[38] We can speculate that this was found since adolescent girls have a greater number of friends than do boys, they expect and desire more nurturing behaviour from their friends and family members, and experience more empathy, more self-disclosure, and less overt hostility in their

friendships than do boys.[39] Additional studies are needed to identify interventions that can increase social capital to engender healthy habits with the ultimate goal of achieving healthier students. More studies exploring social capital and health in different countries should be conducted since social capital in general and in particular levels of informal social control may depend on different cultural norms and values.[40,41]

What is already known on this subject?

Associations between social capital and health have been extensively investigated in adult samples showing that human development is shaped by the interaction between an individual and his or her environment. However, fewer studies to date have focused on social capital and health among children and youth. Few studies have simultaneously examined the contribution of different sources of social capital to youth health.

What this study adds?

Based on Bronfenbrenner's ecological systems theory of child development, we posited that family, neighbourhood and school social capital may be associated with adolescent's good health and that students who report higher levels of social capital in all three domains will have higher self-rated health.

ACKNOWLEDGMENTS

The authors would like to thank students and teachers for their enthusiastic participation in this study.

Funding

This research was self-funded.

Competing interests

The authors declare no competing interests.

Contributorship statement

DN conceptualised and designed the study, conducted the statistical analyses, and interpreted the data and wrote the article. ES participated in conceptualisation of the study, contributed to drafting the article and reviewed the paper. IK reviewed the results and contributed to drafting the article. All authors approved the final manuscript.

REFERENCES

1 Lin N. Social capital: a theory of social structure and action. New York: Cambridge University Press 2001:95-139.

2 Kim D, Subramanian SV, Kawachi I. Bonding versus bridging social capital and their associations with self rated health: a multilevel analysis of 40 US communities. J Epidemiol Community Health 2006; 60:116-122.

3 Putnam RD. Bowling alone. New York: Simon & Schuster 2000: 296.

4 Kawachi I, Subramanian SV, Kim D. Social capital and health. New York: Springer Science 2010: 215–228.

5 Coleman JS. Social Capital and the Development of Youth. Momentum 1987; 18:6-8.

6 Coleman JS. Foundations of social theory. London: The Belknap Press of Harvard University Press 1990: 300-302.

7 Furuta M, Ekuni D, Takao S, et al. Social capital and self-rated oral health among young people. Community Dent Oral Epidemiol 2012; 40:97–104.

8 Putnam RD. Making democracy work: civic traditions in modern Italy. Princeton: Princeton University Press 1993:167.

9 Kalff AC, Kroes M, Vles JSH, et al. Neighbourhood level and individual level SES effects on child problem behaviour: a multilevel analysis. J Epidemiol Community Health 2001; 55:246–250.

10 Drukker M, Buka, S, Kaplan C. Social capital and young adolescents' perceived health in different sociocultural settings. Soc Sci Med 2005; 61:185-198.

11 Kim D, Subramanian SV, Kawachi I. Social capital and physical health: A systematic review of the literature. In: Kawachi I, Subramanian SV, Kim D, eds. Social capital and health. New York: Springer 2008: 139–190.

12 Murayama H, Fujiwara Y, Kawachi I. Social capital and health: A review of prospective multilevel studies. J Epidemiol 2012; 22:179–187.

13 Virtanen M, Ervasti M, Oksanen T, et al. Social capital in Schools. In: Kawachi I, Takao S, Subramanian SV, eds. Global Perspectives on Social Capital and Health. New York: Springer 2013: 65–85.

14 Lindstrom M, Hanson BS, Ostergren PO. Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in sharping health related behavior. Soc Sci Med 2001; 52:441-451.

15 Lindstrom M, Moghaddassi M, Merlo J. Social capital and leisure-time physical activity: A population-based multilevel analysis of individual- and neighbourhood level data in Malmo. J Epidemiol Community Health 2003; 57:23-28.

16 Ali SM, Lindstrom M. Psychosocial work conditions and leisure time physical activity: A population base study. Scand J Public Health 2006; 34:209-216.

17 Bronfenbrenner U. Ecological models of human development. Oxford: Elsevier 1994: 37-43.

18 Fylkesnes K. Determinants of health care utilization—visits and referrals. Scand J Sociol Med 1993; 21:40–50.

19 Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. J Health Sociol Behav 1997; 38:21–37.

20 Lundberg O, Manderbacka K. Assessing reliability of a measure of self -rated health. Scand J Soc Med 1996; 24:218–224.

21 Johnson PB, Richter L. The relationship between smoking, drinking, and adolescents' self-perceived health and frequency of hospitalization: analyses from the 1997 National Household Survey on Drug Abuse. J Adolesc Health 2002; 30:175–183.

22 Koivusilta L, Arja R, Andres V. Health behaviours and health in adolescence as predictors of educational level in adulthood: a follow-up study from Finland. Soc Sci Med 2003; 57:577–593.

23 Pastor Y, Balaguer I, Pons D, et al. Testing direct and indirect effects of sports participation on perceived health in Spanish adolescents between 15 and 18 years of age. J Adolesc 2003; 26:717–730.

24 Tobi H, Meijer WM, Tuinstra J, et al. Socio-economic differences in prescription and OTC drug use in Dutch adolescents. Pharm World Sci 2003; 25:203–206.

25 Morrow V. Conceptualising social capital in relation to the well-being of children and young people: a critical review. Sociol Rev 1999; 44:744–65.

26 Duke NN, Skay CL, Pettingell SL, et al. From adolescent connections to social

capital: predictors of civic engagement in young adulthood. J Adolesc Health 2009; 44:161–8.

27 Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003; 35: 1381-95.

28 Subramanian SV, Kim DJ, Kawachi I. Social trust and self-rated health in us communities: a multilevel analysis. J Urban Health 2002; 79(Suppl 1):S21–34.

29 Wang Z, Byrne NM, Kenardy JA, et al. Influences of Ethnicity and Socioeconomic Status on the Body Dissatisfaction and Eating Behaviour of Australian Children and Adolescents. Eat Behav 2005; 6:23–33.

30 Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry 2003; 60:184-189.

31 Greif Green J, Gruber MJ, Sampson NA, et al. Improving the K6 short scale to predict serious emotional disturbance in adolescents in the USA. Int J Methods Psychiatr Res 2010; 19:23–35.

32 Drukker, M, Kaplan C, Feron F. Children's health related quality of life, neighborhood socio-economic deprivation and social capital. A contextual analyses. Soc Sci Med 2003; 57:825-841.

33 Ilisin V, Potocnik D. A sociological portrait of contemporary Croatian youth. Ser Hist Sociol 2 2010; 20:41-56.

34 Morrow V. Young people's explanations and experiences of social exclusion: retrieving bourdieu's concept of social capital. Int J Sociol Soc Policy 2001; 21:37–63.

35 Morgan A, Haglund BJ. Social capital does matter for adolescent health: evidence from the English HBSC study. Health Promot Int 2009; 24:363-372.

36 Kennedy BP, Kawachi I, Brainerd E. The role of social capital in the Russian mortality crisis. World Dev 1998; 26:2029-2043.

37 Due P, Lynch J, Holstein B, et al. Socioeconomic health inequalities among a nationally representative sample of Danish adolescents: the role of different types of social relations. J Epidemiol Community Health 2003; 57:692-698.

38 Newman BM, Lohman BJ, Newman PR. Peer group membership and a sense of belonging: their relationship to adolescent behavior problems. Adolesc 2007; 42:241-263.

39 Galambos N. Gender and gender-role development in adolescence. In: Lemer R, Steinberg L, eds. The handbook of adolescent psychology. New York: Wiley 2004: 233-262.

40 Binbay T, Drukker K, Alptekin H, et al. Evidence that the wider social environment moderates the association between familial liability and psychosis spectrum outcome. Psychol Med 2012; 42:2499-2510.

41 Onyx L, Bullen P. Measuring Social Capital in Five Communities. J Appl Behav Sci 2000; 36:23-42.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **[Within the title page 1 and method section of the abstract page 2 and 3]**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **[See results section of abstract page 2 and 3]**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **[Pages 4 and 5]**
Objectives	3	State specific objectives, including any prespecified hypotheses **[Page 5]**
Methods		
Study design	4	Present key elements of study design early in the paper **[Methods pages 5-8]**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **[Methods page 5]**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up **[N/A]** *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls **[N/A]** *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **[Methods page 5]**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed **[N/A]** *Case-control study*—For matched studies, give matching criteria and the number of controls per case **[N/A]**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **[Pages 6-8]**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **[Pages 6-8]**
Bias	9	Describe any efforts to address potential sources of bias **[Page 5]**
Study size	10	Explain how the study size was arrived at **[Page 5]**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **[Pages 6-8]**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **[Page 5]**
		(*b*) Describe any methods used to examine subgroups and interactions **[Page 5]**
		(*c*) Explain how missing data were addressed **[N/A]**
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed **[N/A]** *Case-control study*—If applicable, explain how matching of cases and controls was addressed **[N/A]** *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy **[N/A]**
		(*e*) Describe any sensitivity analyses **[N/A]**

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **[Table 1]**
		(b) Give reasons for non-participation at each stage **[N/A]**
		(c) Consider use of a flow diagram **[N/A]**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **[Pages 7 and 8; Table 1]**
		(b) Indicate number of participants with missing data for each variable of interest **[Table 1]**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount) **[N/A]**
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time **[N/A]**
		Case-control study—Report numbers in each exposure category, or summary measures of exposure **[N/A]**
		Cross-sectional study—Report numbers of outcome events or summary measures **[N/A]**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **[Pages 7 and 8; Tables 2 and 3]**
		(*b*) Report category boundaries when continuous variables were categorized **[N/A]**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **[N/A]**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **[Tables 2 and 3]**
Discussion		
Key results	18	Summarise key results with reference to study objectives **[Pages 9 and 10]**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **[Pages 11 and 12]**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **[Pages 10-13]**
Generalisability	21	Discuss the generalisability (external validity) of the study results **[Page 12]**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **[N/A]**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

ARE FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL ASSOCIATED WITH HIGHER SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS? A POPULATION-BASED STUDY

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-007184.R3
Article Type:	Research
Date Submitted by the Author:	30-Apr-2015
Complete List of Authors:	Novak, Dario; University of Zagreb, Dept of General and Applied Kinesiology; Harvard University, Dept. of Social and Behavioral Sciences Suzuki, Etsuji; Okayama University, Department of Epidemiology Kawachi, Ichiro; Harvard University, Department of Social and Behvioral Sciences
Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology
Keywords:	EPIDEMIOLOGY, Community child health < PAEDIATRICS, PUBLIC HEALTH

ARE FAMILY, NEIGHBOURHOOD, AND SCHOOL SOCIAL CAPITAL ASSOCIATED WITH HIGHER SELF-RATED HEALTH AMONG CROATIAN HIGH SCHOOL STUDENTS? A POPULATION-BASED STUDY

Dario Novak,[1,2] Etsuji Suzuki,[3] Ichiro Kawachi [4]

[1]Department of General and Applied Kinesiology, University of Zagreb Faculty of Kinesiology, Zagreb, Croatia

[2]Postdoctoral Fellow at Harvard University, Harvard T.H. Chan School of Public Health, Takemi Program in International Health, Boston, Massachusetts, US

[3]Department of Epidemiology, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Okayama, Japan

[4]Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, Massachusetts, US

CORRESPONDIG AUTHOR:

Dario Novak

Laniste 1E 15, 10000 Zagreb, Croatia

00385994455699

dario.novak@kif.hr

Key words: health, social capital, students, high school

ABSTRACT

Objectives: We investigated the associations between self-rated health and social capital among Croatian high school students.

Design: Cross-sectional survey among high school students was carried out in the 2013/14 school year.

Setting: High schools in Croatia.

Participants: Subjects were 3427 high school students (1688 males and 1739 females), aged 17-18 years.

Main outcome measure: Self-rated health was assessed by the single item: "How do you perceive your health?". Possible responses were arranged along a 5-item Likert type scale: 1 very poor, 2 poor, 3 fair, 4 good, or 5 excellent. The outcome was binarised as "good health" (excellent, good or fair) versus "poor health" (poor or very poor).

Methods: We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for good self-rated health associated with family, neighbourhood and school social capital, while adjusting for gender, self-perceived socioeconomic status, psychological distress, physical activity, and body mass index. We used generalised estimating equations using an exchangeable correlation matrix with robust standard errors.

Results: Good self-rated health was significantly associated with higher family social capital (OR 2.43; 95% CI: 1.55 to 3.80), higher neighbourhood trust (OR 2.02; 95% CI: 1.48 to 2.76) and higher norms of reciprocity at school (OR 1.79; 95% CI: 1.13 to 2.84). When all of the social capital variables were entered simultaneously, good self-rated health remained significantly associated with higher family social capital (OR 1.98; 95%

CI: 1.19 to 3.30), neighbourhood trust (OR 1.77; 95% CI: 1.25 to 2.51) and reciprocity at school (OR 1.71; 95% CI: 1.08 to 2.73).

Conclusions: Higher levels of social capital were independently associated with higher self-rated health among youth. Intervention and policies that leverage community social capital might serve as an avenue for health promotion in youth.

Article summary:

Strengths and limitations of this study

- This study is one of the fewer studies to date that have focused on social capital and health among children and youth.
- We used a random sampling approach to select 20 high schools in Zagreb, all of which agreed to take part in the survey. A total of 3427 students (93.8%) responded to the survey which was given during class.
- To clarify which source of social capital is likely to affect adolescents' health, we assessed three different sources of social capital – in the family, in the neighbourhood, and at school – among high school students.
- We used the generalised estimating equations using an exchangeable correlation matrix with robust standard errors in order to correct standard errors for clustering.
- Due to the cross-sectional design, we cannot exclude the possibility of reverse causation. Since we used a subjective measure of health and social capital, there is a possibility of common method bias.

INTRODUCTION

Social capital has been defined as the "resources embedded in a social structure which are accessed and/or mobilised in purposive actions".[1,2] Some scholars have conceptualised social capital as the social networks themselves, or as both the network structures and the resources channelled through the networks.[3,4] Social capital has garnered increasing attention as a potential influence on the development of youth. In the field of education, research has primarily focused on the role of social capital in children's academic performance;[5,6] however, subsequent research has expanded the range of outcomes to include health behaviours and population health outcomes.[4,7] Social capital theory posits that interpersonal trust, norms of reciprocity, and exchange of social support between members of a networks each constitutes a type of resource, and that access to these resources may facilitate the actions of group members.[4,7,8] Investigation of possible influences of social capital on health may be particularly salient in adolescents because previous work has suggested that contextual influences may have effects on the somatic and psychological development of young people throughout the life course.[9,10]

Associations between social capital and health have been extensively investigated in adult samples.[11-13] Social capital has been found in previous studies to be related to both physical activity and body mass index (BMI).[14-16] At the same time, both physical activity and BMI are predictors of self-rated health. Therefore, physical activity and BMI are not considered to be confounders of the relation between social capital and self-rated health. Rather, our underlying hypothesized model is: social capital → physical activity/BMI → self-rated health. However, fewer studies to date have focused on social capital and health among children and youth. According to Urie Bronfenbrenner's

ecological systems theory of child development, human development is conceptualised as being shaped by the interaction between an individual and his or her environment; and that furthermore there are many different levels of environmental influences that can affect a child's development, starting with people and institutions immediately surrounding the child (i.e. parents and families), to school environments, to residential neighbourhoods, and eventually the societal culture.[17] In line with this, we hypothesised that family, neighbourhood and school social capital may be associated with adolescent's good health and that students who report higher levels of social capital in all three domains will have higher self-rated health. However, few studies have simultaneously examined the contribution of different sources of social capital to youth health.

Accordingly in the present study we investigated the influences of different sources of social capital – in the family, in the neighbourhood, and at school – on levels of self-rated health among a sample of high school students in Croatia.

METHODS

Participants

We administered a survey among high school students in Zagreb, a mid-sized urban city in central Croatia with a population of about 1,000,000 people. A random sampling approach was used to select high schools. All of 20 schools that we approached agreed to take part in the survey, representing 3650 students enrolled in the 2013/14 school year. Of these, 3427 students (1688 males and 1739 females, aged 17–18 years) responded to the survey (93.8%) which was given during class. Finally, the data of 3427 students aged 17–18 years were analysed. The study was approved by the Institutional Review Board and one of the parents for each subject signed an informed consent form.

The students signed an assent form as well.

Self-rated health

Self-rated health was assessed in these young adolescents using the standard single item measure: "How do you perceive your health?". Possible responses were arranged along a 5-item Likert type scale: 1 very poor, 2 poor, 3 fair, 4 good, or 5 excellent. We binarised the outcome, i.e., fair, good and excellent were collapsed into one category (good health); while poor and very poor were designated as poor health. Perceived health is an easily administered and widely used outcome measure in social epidemiology studies and it has been shown to be a reliable predictor of mortality and health care use in adults.[18-20] The measure has also been used in adolescents.[21-24]

Social capital indicators

On the survey, we inquired about individual perceptions of social capital in the family, neighbourhood, and high school settings.[3,7,25] Family social capital was assessed by the question: 'Do you feel your family understands and gives attention to you?'.[7,26] Neighbourhood social capital was assessed by using two items; 'Do you feel people trust each other in your neighbourhood (neighbourhood trust)?' 'Do you feel that your neighbours step in to criticise someone's deviant behaviour during high school (informal social control)?'.[7] School social capital was assessed by three items; 'Do you feel teachers and students trust each other in your high school (vertical school trust)?' 'Do you feel students trust each other in your high school (horizontal school trust)?' 'Do you feel students collaborate with each other in your high school (reciprocity at school)?' The response options were: 'strongly agree'; 'agree'; 'neither agree or disagree'; 'disagree';

'strongly disagree'. Then, for each response, we created a dichotomous variable (high: 'strongly agree', 'agree' and 'neither agree or disagree'; low: 'disagree' and 'strongly disagree').[7] The Cronbach alpha of the school social capital scale was 0.71 and since other domains have fewer than three questions we consider not appropriate to check Cronbach alphas for these scales.

Covariates

As measure of physical activity, we considered students' total physical activity in the last 7 days. Physical activity was assessed using the validated short version of the International Physical Activity Questionnaire (IPAQ) and was expressed as metabolic equivalent-hours per week (MET-hour/week).[27] As additional potential mediators, we considered BMI based on the calculation from self-reported height and weight (scoring of responses in the range ≥25 kg/m^2 versus <25 kg/m^2 discriminates between respondents with and without high BMI). Socioeconomic status (SES) was entered in our regression models as a potential confounder, i.e. theoretically associated with both self-rated health and social capital.[28] The classification of SES was based on both parents' occupation at the time when research was conducted. Self-perceived SES was categorised into three levels as high SES (i.e., managers and professionals), middle SES (white collar) and low SES (blue collar),[29] and it was dichotomised as high/middle (responses in the range 2-4) and low (responses in the range 5-6). Psychological distress was also assessed as a potential confounder using the 6-item Kessler scale by the questions: 'About how often during the past 30 days did you feel nervous?', 'During the past 30 days, about how often did you feel hopeless?', 'During the past 30 days, about how often did you feel restless or fidgety?', 'How often did you feel so depressed that nothing could cheer you up?',

'During the past 30 days, about how often did you feel that everything was an effort?' and 'During the past 30 days, about how often did you feel worthless?'[30] Each question is scored from 0 (None of the time) to 4 (All of the time). Scores of the 6 questions were then summed (0-24), with lower score indicating low levels of psychological distress. Previous research has shown that dichotomous scoring of responses in the range 13+ versus 0–12 discriminates between respondents with and without significant psychological distress.[30,31] A test of interaction between psychological distress and gender is performed and there is statistical gender difference in psychological distress ($p<0.001$).

Data Analysis

We used the generalised estimating equations using an exchangeable correlation matrix with robust standard errors in order to correct standard errors for clustering. We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for good self-rated health according to levels of perceived social capital. The association of self-rated health with social capital indicators was examined by conducting a multiple logistic regression analysis. Furthermore, the study included students from 20 schools; thus, one of the assumptions was that the measurements within school might not be independent. Therefore, the cluster effect was considered in the analysis. For this purpose, we adjusted the standard errors by computing clustered robust standard errors for the coefficients. We also have performed a chi-squared test to check the statistical significance of the gender difference in proportion of boys vs. girls reporting good self-rated health. As potential confounders, we entered gender, self-perceived SES, and psychological distress. We also included physical activity and BMI as potential mediators of the association between

social capital and self-rated health. We investigated the association between self-rated health and family social capital (Model 1), neighbourhood social capital (Model 2), and school social capital (Model 3). Finally, we entered all of these social capital variables simultaneously (Model 4) to assess their independent contributions to self-rated health. The interaction term between social capital and gender was not statistically significant so we dropped the sex-stratified analyses. A p-value of <0.05 (two sided) was considered statistically significant. All statistical analyses were performed with Stata, version 12 (StataCorp, TX, USA).

RESULTS

Boys reported higher percentage of good self-rated health (85.8%) compared to girls (75.6%). Roughly 20% of the participants reported poor health. It is worth noting that the prevalence of psychological distress in girls was twice as high as that in boys. Males do generally have higher BMI than females (22.95±2.85 kg/m^2 vs 20.81±2.54 kg/m^2). Most adolescents evaluated their family socioeconomic status as high/middle (60.2%) with no statistically significant differences between boys and girls. Boys are significantly more physically active than girls. It is worthwhile to note that a chi-squared test shows the statistical significance of the gender difference in proportion of boys vs. girls reporting good self-rated health (Table 1).

Table 1 Characteristics of the study subjects, Zagreb, Croatia, 2014

	Total (N=3427) N (%)	Males (N=1688) N (%)	Females (N=1739) N (%)	p-value*
Self-rated health				
Poor	664 (19.4)	239 (14.2)	425 (24.4)	
Good	2763 (80.6)	1449 (85.8)	1314 (75.6)	<0.001
Family social capital				
Low	185 (5.4)	90 (5.4)	95 (5.5)	
High	3242 (94.6)	1598 (94.6)	1644 (94.5)	0.808
Neighbourhood trust				
Low	1104 (32.2)	466 (27.6)	638 (36.6)	
High	2323 (67.8)	1222 (72.4)	1101 (63.4)	<0.001
Informal social control				
Low	828 (24.2)	419 (24.8)	409 (23.5)	
High	2599 (75.8)	1269 (75.2)	1330 (76.5)	0.342
Vertical school trust				
Low	1050 (30.6)	485 (28.7)	565 (32.5)	
High	2377 (69.4)	1203 (71.2)	1174 (67.5)	0.014
Horizontal school trust				
Low	840 (24.5)	339 (20.1)	501 (28.8)	
High	2587 (75.5)	1349 (79.9)	1238 (71.2)	<0.001
Reciprocity at school				
Low	459 (13.4)	186 (11.1)	273 (15.7)	
High	2968 (86.6)	1502 (88.9)	1466 (84.3)	<0.001
Body mass index				
Normal	3001 (87.6)	1367 (80.9)	1634 (93.9)	
Overweight/Obese	426 (12.4)	321 (19.1)	105 (6.1)	<0.001
Self-perceived socioeconomic status				
High/Middle	2064 (60.2)	1008 (59.7)	1056 (60.7)	
Low	1363 (39.8)	680 (40.3)	683 (39.3)	0.706
Psychological distress				
High	848 (24.7)	274 (16.3)	574 (33.0)	
Low	2579 (75.3)	1414 (83.7)	1165 (67.0)	<0.001
Physical activity				
High/Moderate	2943 (85.9)	1499 (88.8)	1444 (83.1)	
Low	484 (14.1)	189 (11.2)	295 (16.9)	<0.001

* Univariable, chi-squared test

The association between social capital and self-rated health is shown in Table 2. Overall, self-rated health was significantly associated with each domain of social capital. Good self-rated health was significantly associated with higher family social capital (OR 2.43; 95% CI: 1.55 to 3.80) and higher neighbourhood trust (OR 2.02; 95% CI: 1.48 to 2.76). Regarding school social capital, good-self health was significantly associated only with perceptions of reciprocity at school (OR 1.79; 95% CI: 1.13 to 2.84). When all social capital variables were entered into the model (Model 4), good self-rated health was significantly associated with higher family social capital (OR 1.98; 95% CI: 1.19 to 3.30), neighbourhood trust (OR 1.77; 95% CI: 1.25 to 2.51) and reciprocity at school (OR 1.71; 95% CI: 1.08 to 2.73).

Table 2 Odds ratios for good self-rated health among high school students, Zagreb, Croatia, 2014

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Family social capital				
Low				
High	2.43 (1.55 to 3.80) ***			1.98 (1.19 to 3.30) **
Neighbourhood trust				
Low				
High		2.02 (1.48 to 2.76) ***		1.77 (1.25 to 2.51) ***
Informal social control				
Low				
High		1.42 (0.99 to 2.04)		1.37 (0.95 to 1.98)
Vertical school trust				
Low				
High			1.34 (0.99 to 1.81)	1.19 (0.87 to 1.62)
Horizontal school trust				
Low				
High			1.24 (0.83 to 1.84)	1.19 (0.79 to 1.79)
Reciprocity at school				
Low				
High			1.79 (1.13 to 2.84) **	1.71 (1.08 to 2.73) *
Gender				
Male				
Female	0.46 (0.29 to 0.73) ***	0.49 (0.31 to 0.78) **	0.48 (0.30 to 0.78) **	0.48 (0.30 to 0.79) **
Body mass index				
Normal				
Overweight/Obese	0.44 (0.25 to 0.77) **	0.43 (0.23 to 0.78) **	0.43 (0.23 to 0.79) **	0.42 (0.23 to 0.77) **
Self-perceived socioeconomic status				
High/Middle				
Low	1.01 (0.64 to 1.60)	1.05 (0.66 to 1.68)	1.03 (0.65 to 1.64)	1.05 (0.66 to 1.65)
Psychological distress				
High				
Low	0.37 (0.24 to 0.57) ***	0.38 (0.24 to 0.59) ***	0.38 (0.24 to 0.59) ***	0.41 (0.26 to 0.64) ***
Physical activity				
High/Moderate				
Low	0.64 (0.42 to 1.00) *	0.65 (0.42 to 1.01) *	0.65 (0.41 to 1.01) *	0.66 (0.42 to 1.04) *

***p<0.001, **p<0.01, *p<0.05; OR – odds ratio; CI – confidence interval. These four models were examined in a sequence of four logistic regression models considering clustering for schools.

Model 1: Examine association between family social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighbourhood social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for gender, body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

Table 3 presents the association between family, neighbourhood and school social capital with good self-rated health among high school students. Good self-rated health was significantly associated with higher family social capital (Coefficient 0.88; 95% CI: 0.35 to 1.42), higher neighbourhood trust (Coefficient 0.70; 95% CI: 0.34 to 1.06) and higher norms of reciprocity at school (Coefficient 0.58; 95% CI: 0.13 to 1.04). When all types of social capital were entered simultaneously, good self-rated health remained significantly associated with higher family social capital (Coefficient 0.68; 95% CI: 0.13

to 1.23), neighbourhood trust (Coefficient 0.57; 95% CI: 0.20 to 0.94) and reciprocity at school (Coefficient 0.54; 95% CI: 0.08 to 0.99).

Table 3 Coefficients for good self-rated health associated with family, neighbourhood and school social capital among high school students, Zagreb, Croatia, 2014

	Model 1 Coefficient (95% CI)	Model 2 Coefficient (95% CI)	Model 3 Coefficient (95% CI)	Model 4 Coefficient (95% CI)
Family social capital				
Low				
High	0.88 (0.35 to 1.42) ***			0.68 (0.13 to 1.23) **
Neighbourhood trust				
Low				
High		0.70 (0.34 to 1.06) ***		0.57 (0.20 to 0.94) **
Informal social control				
Low				
High		0.35 (-0.03 to 0.74)		0.31 (-0.07 to 0.71)
Vertical school trust				
Low				
High			0.29 (-0.09 to 0.69)	0.17 (-0.22 to 0.57)
Horizontal school trust				
Low				
High			0.21 (-0.21 to 0.65)	0.17 (-0.25 to 0.61)
Reciprocity at school				
Low				
High			0.58 (0.13 to 1.04) **	0.54 (0.08 to 0.99) *
Gender				
Male				
Female	-0.77 (-1.18 to -0.36) ***	-0.70 (-1.11 to -0.29) ***	-0.71 (-1.12 to -0.30) ***	-0.71 (-1.12 to -0.30) ***
Body mass index				
Normal				
Overweight/Obese	-0.81 (-1.28 to -0.34) ***	-0.83 (-1.30 to -0.36) ***	-0.83 (-1.31 to -0.36) ***	-0.84 (-1.32 to -0.36) ***
Self-perceived socioeconomic status				
High/Middle				
Low	0.01 (-0.35 to 0.38)	0.05 (-0.31 to 0.42)	0.03 (-0.33 to 0.40)	0.04 (-0.32 to 0.42)
Psychological distress				
High				
Low	-0.97 (-1.33 to -0.60) ***	-0.96 (-0.32 to -0.59) ***	-0.95 (-1.32 to -0.59) ***	-0.87 (-1.24 to -0.50) ***
Physical activity				
High/Moderate				
Low	-0.43 (-0.87 to 0.00) *	-0.42 (-0.86 to 0.01) *	-0.42 (-0.87 to 0.01) *	-0.40 (-0.85 to 0.35)

***p<0.001, **p<0.01, *p<0.05; CI – confidence interval. These four models were estimated by generalised estimating equations using an exchangeable correlation matrix with robust standard errors.

Model 1: Examine association between family social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 2: Examine association between neighbourhood social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 3: Examine association between school social capital and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.
Model 4: Examine association between all social capital variables and youth self-rated health adjusting for body mass index, self-perceived socioeconomic status, psychological distress and physical activity.

DISCUSSION

Previous studies in the US and Europe have suggested that higher levels of informal social control were associated with higher levels of perceived health.[10] Drukker et al. found that higher levels of community informal social control in the Netherlands may directly prevent young people from engaging in deleterious health behaviours as

well as indirectly provide them with self-confidence and a sense of protection.[32] Furuta et al. have shown that the association of social capital with self-rated oral health is not uniform; higher trust is associated with better oral health, whereas higher informal control in the community is associated with worse oral health.[7]

To better understand findings of this research, it is very important to briefly explain the Croatian social context and the theoretical approach to young people. The mid 1980s in Croatia was a period of socialism before the collapse of the Soviet bloc. The first decade of the 1990s was more turbulent in Croatia compared to other post-socialist countries. Croatia experienced armed conflicts that lasted for several years. Finally, at the beginning of the 1990s with the state's declaration of independence, and the abolition of the totalitarian regime, the nation became one of many transition countries. Young people in Croatia are one of the population segments most rapidly affected by these processes and changes. The reasons for this are multiple and related to timing of political transition with the transition from childhood to adulthood.[33]

In this study, we have found a statistically significant association between higher levels of family social capital and higher self-rated health. For young people, family should be important for 'being there' in times of need and family members are often regarded as a crucial source of support[34]. Morgan and Haglund reported that a sense of belonging in family was related to self-rated health and health behaviours in adolescents.[35] In transitional societies, the changes in hierarchical order and value structures accompanying the shift from socialism to free markets meant that families became especially important as a source of social support.[36]

We also found that those living in high trust communities reported better health

compared to youth living in low trust communities. According to surveys, Croatian youth frequently spend their time with friends in the neighbourhood engaged in sport or other activities (i.e., watching TV and videos, listening to the radio).[33]

The indicators based in the school social environment suggested that higher reciprocity at school (collaboration between pupils) was associated with higher self-rated health, whereas vertical and horizontal social capital were not significantly associated with self-rated health. Spending time with peers at school may engender a sense of belonging,[34] and it may promote better health. The data shows that 78% of Croatian youth frequently talk to their school peers about going out and leisure, music, movies and books.[33] A previous study in Denmark found that school connectedness and sense of belonging may have a strong impact on adolescent psychological health.[37]

Our study has some limitations. First, due to the cross-sectional design, we cannot exclude the possibility of reverse causation, i.e., poor health led to low level of trust and other indicators of social capital. To mitigate this, we adjusted for psychological distress. In other words, the students with psychological distress would report lower levels of social capital in all three domains and simultaneously and psychological distress could potentially affect their self-ratings of health. Therefore, we adjusted for individual differences in psychological distress in order to rule out this possible bias. When we included an interaction term between psychological distress and gender, its coefficient was statistically significant. However, we observed no substantial change in the association between social capital indicators and good health. Moreover, the differential effect estimates of each type of social capital on health cannot be fully explained by the reverse causation. Second, we used a subjective measure of health and social capital, and

therefore there is a possibility of common method bias which may have resulted in bias away from the null. Again, the differential findings for each type of social capital suggest that this is less likely. Third, because the students responded the questionnaires during the class, there is a possibility of measurement error of school social capital, in particular vertical social capital. Additionally, possibility of type 1 error is high because of the clustering. We used the generalised estimating equations using an exchangeable correlation matrix with robust standard errors in order to correct standard errors for clustering. Fourth, the social capital variables in our study are analysed at the individual level. Therefore, we are referring to the students' individual perceptions of social capital. Unfortunately, we did not have information about which neighbourhoods the respondents lived in nor about which classrooms the students attended within each school. We cannot fully disentangle the effects of school social capital and neighbourhood social capital in this study, partly because of the lack of information about class and neighbourhood. And fifth, all types of social capital were assessed in primary sample. Future studies are warranted to assess all three domains (family, neighbourhood and school social capital) by approaching different sample subjects who are not participating in primary sample.

The present study shows that higher levels of family social capital, neighbourhood trust and reciprocity school (i.e., collaboration relationships between pupils) were associated with better health among youth. Interestingly, the interaction term between social capital and gender was not statistically significant in this study although there are some researches showing that, among adolescents, girls tend to report higher levels of social capital, especially school and family belonging than do boys.[38] We can speculate that this was found since adolescent girls have a greater number of friends than do boys,

they expect and desire more nurturing behaviour from their friends and family members, and experience more empathy, more self-disclosure, and less overt hostility in their friendships than do boys.[39] Additional studies are needed to identify interventions that can increase social capital to engender healthy habits with the ultimate goal of achieving healthier students. More studies exploring social capital and health in different countries should be conducted since social capital in general and in particular levels of informal social control may depend on different cultural norms and values.[40,41]

What is already known on this subject?

Associations between social capital and health have been extensively investigated in adult samples showing that human development is shaped by the interaction between an individual and his or her environment. However, fewer studies to date have focused on social capital and health among children and youth. Few studies have simultaneously examined the contribution of different sources of social capital to youth health.

What this study adds?

Based on Bronfenbrenner's ecological systems theory of child development, we posited that family, neighbourhood and school social capital may be associated with adolescent's good health and that students who report higher levels of social capital in all three domains will have higher self-rated health.

ACKNOWLEDGMENTS

The authors would like to thank students and teachers for their enthusiastic participation in this study.

Funding

This research was self-funded.

Competing interests

The authors declare no competing interests.

Contributorship statement

DN conceptualised and designed the study, conducted the statistical analyses, and interpreted the data and wrote the article. ES participated in conceptualisation of the study, contributed to drafting the article and reviewed the paper. IK reviewed the results and contributed to drafting the article. All authors approved the final manuscript.

REFERENCES

1 Lin N. Social capital: a theory of social structure and action. New York: Cambridge University Press 2001:95-139.

2 Kim D, Subramanian SV, Kawachi I. Bonding versus bridging social capital and their associations with self rated health: a multilevel analysis of 40 US communities. J Epidemiol Community Health 2006; 60:116-122.

3 Putnam RD. Bowling alone. New York: Simon & Schuster 2000: 296.

4 Kawachi I, Subramanian SV, Kim D. Social capital and health. New York: Springer Science 2010: 215–228.

5 Coleman JS. Social Capital and the Development of Youth. Momentum 1987; 18:6-8.

6 Coleman JS. Foundations of social theory. London: The Belknap Press of Harvard University Press 1990: 300-302.

7 Furuta M, Ekuni D, Takao S, et al. Social capital and self-rated oral health among young people. Community Dent Oral Epidemiol 2012; 40:97–104.

8 Putnam RD. Making democracy work: civic traditions in modern Italy. Princeton: Princeton University Press 1993:167.

9 Kalff AC, Kroes M, Vles JSH, et al. Neighbourhood level and individual level SES effects on child problem behaviour: a multilevel analysis. J Epidemiol Community Health 2001; 55:246–250.

10 Drukker M, Buka, S, Kaplan C. Social capital and young adolescents' perceived health in different sociocultural settings. Soc Sci Med 2005; 61:185-198.

11 Kim D, Subramanian SV, Kawachi I. Social capital and physical health: A systematic review of the literature. In: Kawachi I, Subramanian SV, Kim D, eds. Social capital and health. New York: Springer 2008: 139–190.

12 Murayama H, Fujiwara Y, Kawachi I. Social capital and health: A review of prospective multilevel studies. J Epidemiol 2012; 22:179–187.

13 Virtanen M, Ervasti M, Oksanen T, et al. Social capital in Schools. In: Kawachi I, Takao S, Subramanian SV, eds. Global Perspectives on Social Capital and Health. New York: Springer 2013: 65–85.

14 Lindstrom M, Hanson BS, Ostergren PO. Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in sharping health related behavior. Soc Sci Med 2001; 52:441-451.

15 Lindstrom M, Moghaddassi M, Merlo J. Social capital and leisure-time physical activity: A population-based multilevel analysis of individual- and neighbourhood level data in Malmo. J Epidemiol Community Health 2003; 57:23-28.

16 Ali SM, Lindstrom M. Psychosocial work conditions and leisure time physical activity: A population base study. Scand J Public Health 2006; 34:209-216.

17 Bronfenbrenner U. Ecological models of human development. Oxford: Elsevier 1994: 37-43.

18 Fylkesnes K. Determinants of health care utilization—visits and referrals. Scand J Sociol Med 1993; 21:40–50.

19 Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. J Health Sociol Behav 1997; 38:21–37.

20 Lundberg O, Manderbacka K. Assessing reliability of a measure of self -rated health. Scand J Soc Med 1996; 24:218–224.

21 Johnson PB, Richter L. The relationship between smoking, drinking, and adolescents' self-perceived health and frequency of hospitalization: analyses from the 1997 National Household Survey on Drug Abuse. J Adolesc Health 2002; 30:175–183.

22 Koivusilta L, Arja R, Andres V. Health behaviours and health in adolescence as predictors of educational level in adulthood: a follow-up study from Finland. Soc Sci Med 2003; 57:577–593.

23 Pastor Y, Balaguer I, Pons D, et al. Testing direct and indirect effects of sports participation on perceived health in Spanish adolescents between 15 and 18 years of age. J Adolesc 2003; 26:717–730.

24 Tobi H, Meijer WM, Tuinstra J, et al. Socio-economic differences in prescription and OTC drug use in Dutch adolescents. Pharm World Sci 2003; 25:203–206.

25 Morrow V. Conceptualising social capital in relation to the well-being of children

and young people: a critical review. Sociol Rev 1999; 44:744–65.

26 Duke NN, Skay CL, Pettingell SL, et al. From adolescent connections to social capital: predictors of civic engagement in young adulthood. J Adolesc Health 2009; 44:161–8.

27 Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003; 35: 1381-95.

28 Subramanian SV, Kim DJ, Kawachi I. Social trust and self-rated health in us communities: a multilevel analysis. J Urban Health 2002; 79(Suppl 1):S21–34.

29 Wang Z, Byrne NM, Kenardy JA, et al. Influences of Ethnicity and Socioeconomic Status on the Body Dissatisfaction and Eating Behaviour of Australian Children and Adolescents. Eat Behav 2005; 6:23–33.

30 Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry 2003; 60:184-189.

31 Greif Green J, Gruber MJ, Sampson NA, et al. Improving the K6 short scale to predict serious emotional disturbance in adolescents in the USA. Int J Methods Psychiatr Res 2010; 19:23–35.

32 Drukker, M, Kaplan C, Feron F. Children's health related quality of life, neighborhood socio-economic deprivation and social capital. A contextual analyses. Soc Sci Med 2003; 57:825-841.

33 Ilisin V, Potocnik D. A sociological portrait of contemporary Croatian youth. Ser Hist Sociol 2 2010; 20:41-56.

34 Morrow V. Young people's explanations and experiences of social exclusion:

retrieving bourdieu's concept of social capital. Int J Sociol Soc Policy 2001; 21:37–63.

35 Morgan A, Haglund BJ. Social capital does matter for adolescent health: evidence from the English HBSC study. Health Promot Int 2009; 24:363-372.

36 Kennedy BP, Kawachi I, Brainerd E. The role of social capital in the Russian mortality crisis. World Dev 1998; 26:2029-2043.

37 Due P, Lynch J, Holstein B, et al. Socioeconomic health inequalities among a nationally representative sample of Danish adolescents: the role of different types of social relations. J Epidemiol Community Health 2003; 57:692-698.

38 Newman BM, Lohman BJ, Newman PR. Peer group membership and a sense of belonging: their relationship to adolescent behavior problems. Adolesc 2007; 42:241-263.

39 Galambos N. Gender and gender-role development in adolescence. In: Lemer R, Steinberg L, eds. The handbook of adolescent psychology. New York: Wiley 2004: 233-262.

40 Binbay T, Drukker K, Alptekin H, et al. Evidence that the wider social environment moderates the association between familial liability and psychosis spectrum outcome. Psychol Med 2012; 42:2499-2510.

41 Onyx L, Bullen P. Measuring Social Capital in Five Communities. J Appl Behav Sci 2000; 36:23-42.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **[Within the title page 1 and method section of the abstract page 2 and 3]**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **[See results section of abstract page 2 and 3]**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **[Pages 4 and 5]**
Objectives	3	State specific objectives, including any prespecified hypotheses **[Page 5]**
Methods		
Study design	4	Present key elements of study design early in the paper **[Methods pages 5-8]**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **[Methods page 5]**
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up **[N/A]** *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls **[N/A]** *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants **[Methods page 5]**
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed **[N/A]** *Case-control study*—For matched studies, give matching criteria and the number of controls per case **[N/A]**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **[Pages 6-8]**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **[Pages 6-8]**
Bias	9	Describe any efforts to address potential sources of bias **[Page 5]**
Study size	10	Explain how the study size was arrived at **[Page 5]**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **[Pages 6-8]**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **[Page 5]**
		(*b*) Describe any methods used to examine subgroups and interactions **[Page 5]**
		(*c*) Explain how missing data were addressed **[N/A]**
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed **[N/A]** *Case-control study*—If applicable, explain how matching of cases and controls was addressed **[N/A]** *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy **[N/A]**
		(*e*) Describe any sensitivity analyses **[N/A]**

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed **[Table 1]**
		(b) Give reasons for non-participation at each stage **[N/A]**
		(c) Consider use of a flow diagram **[N/A]**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **[Pages 7 and 8; Table 1]**
		(b) Indicate number of participants with missing data for each variable of interest **[Table 1]**
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount) **[N/A]**
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time **[N/A]**
		Case-control study—Report numbers in each exposure category, or summary measures of exposure **[N/A]**
		Cross-sectional study—Report numbers of outcome events or summary measures **[N/A]**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included **[Pages 7 and 8; Tables 2 and 3]**
		(*b*) Report category boundaries when continuous variables were categorized **[N/A]**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **[N/A]**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **[Tables 2 and 3]**
Discussion		
Key results	18	Summarise key results with reference to study objectives **[Pages 9 and 10]**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **[Pages 11 and 12]**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **[Pages 10-13]**
Generalisability	21	Discuss the generalisability (external validity) of the study results **[Page 12]**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **[N/A]**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.