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SPECIAL SECTION ON COVID-19: QUANTITATIVE RESEARCH

A cross-sectional analysis of the association between social capital and willingness to get COVID-19 vaccine in Ontario, Canada

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Abstract

Objective We examine the role of social capital in intention to take the vaccine at the end of the first wave of the COVID-19 pandemic.

Methods This study uses observational, cross-sectional data from the Ontario sample of the fall 2020 Canadian Community Health Survey (CCHS), a representative sample of the population with added questions relative to symptoms of COVID-19 and intentions to get vaccinated. Questions on social capital were asked to respondents from Ontario only, yielding a sample of 6516. Odds ratios (OR) and marginal effects at sample mean of an index of social capital (at the individual or aggregated level) on changes in intentions to get vaccinated are estimated from logistic regression models.

Results Individual-level social capital is associated with greater willingness to get vaccinated against COVID-19 (OR 1.09). Associations with aggregated-level social capital are less precisely estimated. Associations are the same for both males and females but vary across age categories: individual-level social capital is associated with higher willingness to get vaccinated among working-age respondents, but aggregate-level social capital is associated with higher willingness to get vaccinated among older adults.

Conclusion Vaccine hesitancy is not a random phenomenon, nor is it explained by individual characteristics such as education or income only. It also reflects the state of the social environment in which individuals live and public health messaging should take this into account if it is to be successful.

Résumé

Objectif Nous étudions le rôle du capital social dans les intentions de se faire vacciner à la fin de la première vague de la pandémie de COVID-19.

Méthodes Ce travail utilise des données observationnelles transversales tirées de l'échantillon pour l'Ontario de la vague d'automne 2020 de l'Enquête sur la santé dans les collectivités canadiennes (ESCC), un échantillon représentatif de la population, en particulier des questions supplémentaires sur les symptômes de COVID-19 et les intentions de se faire vacciner. Les questions sur le capital social n'ont été posées qu'aux répondants vivant en Ontario, nous donnant un échantillon de taille N = 6 516. Les rapports de chances (RC) et les effets marginaux au point moyen de l'échantillon de l'indice de capital social (individuel ou agrégé) sur les changements de la santé mentale auto-déclarée ainsi que sur l'intention de se faire vacciner sont estimés à partir d'une régression logistique.

Résultats Le capital social mesuré au niveau individuel est associé à des intentions plus élevées de se faire vacciner (RC de 1,09). L'association du capital social mesuré au niveau agrégé est moins précisément estimée et nous ne trouvons une association significativement différente de 0 qu'au seuil de 10 % seulement. Les associations sont les mêmes pour les hommes et les femmes mais varient selon la classe d'âge : le capital social individuel est associé à une intention élevée de se faire vacciner parmi les enquêtés en âge de travailler, mais le capital social agrégé est associé à une intention élevée de se faire vacciner parmi les enquêtés plus âgés.

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Conclusion La réticence devant le vaccin n'est pas distribuée au hasard et n'est pas non plus expliquée seulement par les caractéristiques individuelles comme l'éducation ou le revenu. Elle reflète aussi l'état de l'environnement social dans lequel les individus vivent et les messages de santé publique doivent en tenir compte pour être efficaces.

Keywords Social capital · Vaccine · Vaccine hesitancy · COVID-19

Mots-clés Capital social · vaccin · réticence devant le vaccin · COVID-19

Introduction

In the first months of the COVID-19 pandemic (February to December 2020), public health measures such as lockdowns were the only means societies had at their disposal to try to control the surge in mortality. Toward the end of 2020, it was becoming clear that a vaccine would be available soon and the main question became that of the time at which it would be made available. Less often discussed, however, was another phenomenon already emerging at that time, vaccine hesitancy: some segments of the population were not willing to get vaccinated and protected against a deadly virus (MacDonald et al., 2020). Griffith et al. (2021) found that only about 75% of people in Canada planned to receive one of the vaccines at the end of 2020. The anti-vaccine opinion was not new, of course, but its magnitude and the fact that it manifested after such a massive health scare prompted numerous studies to try to understand its origin.

Most of the literature on the determinants of vaccine hesitancy is concerned with belief systems about health or vaccines (e.g., Larson et al., 2014; Troiano & Nardi, 2021). We summarize the main determinants identified in the literature in Table 1.

In this study, we posit that social capital could explain some of the inter-individual variation in vaccine hesitancy. This has been suggested by studies of vaccine hesitancy showing that trust in the government or healthcare workers was a determinant of the willingness to take the vaccine (Biswas et al., 2021; Mesch & Schwirian, 2015; Steinert et al., 2022). Using data collected in Ontario from September to December 2020, before any COVID-19 vaccine was made available in that province, we test whether individuals with higher levels of social capital were also those with a higher willingness to get the vaccine when such a vaccine would be ready.

Coleman (1988) defines social capital as a productive resource that is located "in the structure of relations between actors and among actors." The measurement of social capital is multi-dimensional, encompassing cognitive (what people feel) as well as structural (what people do) elements (Xue

Table 1 Main determinants of vaccine hesitancy identified in the literature

Determinants	Hudson & Montelpare, 2021	Guay et al., 2019	Gerretsen et al., 2021	Biswas et al., 2021	Soares et al., 2021	Aw et al., 2021	Basta et al., 2022	Steinert et al., 2022	Mesch & Schwirian, 2015
Age	X	X	X	X	X	X	X		
Sex			X	X		X	X		
Employment			X						
Race			X			X	X		X
Income	X	X			X				
Education	X	X		X		X	X		
Language		X							
Health status	X	X	X			X			
Healthcare access		X							
Rurality	X						X		
Parental status	X								
Trust	X	X	X	X	X			X	X
Risk aversion	X		X						
Vaccine knowledge		X			X	X	X	X	
Having kid		X							
Perceived seriousness			X	X	X	X	X		X
Political affiliation			X						X

et al., 2020). Cognitive social capital includes social trust, the perception of social support, the perception of social cohesion, perceived reciprocity, sense of belonging, and loneliness. Structural social capital includes participation in some form of social activity, networks of personal relationships, social support, social engagement, volunteering, group membership, social integration, and social relationship (Xue et al., 2020). The idea that communities with higher levels of social capital are better positioned to fight epidemics has been suggested by Pitas and Ehmer (2020), who hypothesized that communities with more social capital would do better by sharing scarce recourses and information, trusting each other, and engaging in collective action.

Social capital has already been documented to have positive effects on individual health and health-related behaviours and it has been documented that social capital has played an important role to protect individuals from the effects of the COVID-19 pandemic. In a study of seven European countries, Bartscher et al. (2021) show that a one-standard-deviation increase in social capital reduces COVID-19 cases per capita by between 14% and 34%, depending on the country, and excess deaths by between 6% and 35%. They explain that informal rules of containments are more easily adopted in areas with higher levels of social capital, which may lead to a lower number of infections. A study of 37 countries (Imbulana Arachchi & Managi, 2021) mixing high- and low-income countries found that some aspects of social capital (family bonds and security) were associated with fewer deaths during the COVID-19 pandemic but others (community attachment and social trust) were associated with more deaths. In the early phases of the COVID-19 pandemic, before the vaccines, Americans living in counties with high levels of social capital were more likely to reduce mobility linked to retail and recreational activities than people living in counties with low levels of social capital (Borgonovi & Andrieu, 2020). Closer to our question, Hu et al. (2022) show that dense social capital is positively associated with the intention to take COVID-19 vaccine booster shots among urban workers in China.

Methods

Data collection and sampling

We use data from the 2020 Canadian Community Health Survey (CCHS) accessed in the Research Data Centre (RDC) at McMaster University. CCHS is a regular (annual) survey conducted by Statistics Canada to describe the health and health-related behaviours of the Canadian population living in the community. In the fall of 2020, Statistics Canada conducted a special version of the survey, adding questions relative to intentions to get vaccinated as well as having felt symptoms of COVID-19 to the usual survey.

Data were collected between September and December 2020. The COVID-19 vaccination program started in Ontario on December 14, 2020, and vaccines became widely available in that province on April 8, 2021 (Mishra et al., 2021).

The sample was randomly selected by Statistics Canada among individuals aged 12 and over, living in private dwellings (institutional residents are excluded), in 100 regions covering all provinces, but excluding territories, Indian Reserves and Crown Lands, as well as remote areas. Because questions on social capital were not asked to respondents in all provinces, we chose to focus on the sample of respondents from Ontario. The sample size was determined by Statistics Canada so as to get enough power to be able to detect changes in health or health-related behaviours between annual cross-sections at the level of 80 health regions in the country.

Study sample

The initial sample is comprised of 7317 respondents. Five hundred eleven (511) observations were dropped due to missing values for our COVID-related variables (intention to get vaccinated and symptoms), another 143 observations due to missing values for social capital variables, and 147 observations due to missing values for other covariates. Thus, our final sample has 6516 observations.

The study sample is not different from the initial sample in age and sex distributions or in distributions by immigration status, marital status, or labour force participation status, as shown in Supplementary material (ESM Table A1).

Dependent variables

The binary dependent variable in this study is willingness to get the COVID-19 vaccine; it takes a value of 1 if the respondent intends to get vaccinated and 0 otherwise. It is based on the following question: "How likely is it that you would get a COVID-19 vaccine?", with four response items: very likely, somewhat likely, somewhat unlikely, and very unlikely. We created a binary variable taking the value 1 for individuals responding "very likely" and 0 otherwise.[1]

Independent variables

The independent variable of interest in this study is social capital.

In the literature on social capital, two types of measure exist, capturing different aspects of the concept (Kim et al., 2020). Social capital is often measured at the community

[1] We ran a sensitivity analysis defining willingness to get the vaccine as "very likely" or "somewhat likely". Results are similar and available in Supplementary material (Table A2).

level, using aggregate-level data to reflect that what matters is how well the community in which the individual lives functions. But it can also be measured at the individual level, reflecting the ability of the individual to muster resources such as trust or sense of security that are available in their community. In the current survey, we have data at the individual level only (self-reports) but we recreate community-level values by taking the mean of the individual values for all individuals living in a given community.

For each individual, we use five questions on relationships to build a numerical index, taking values between 0 (low level of social capital) and 5 (highest level). Each question is about whether the individual benefits from one aspect of social capital (Do the respondent's relationships provide a sense of emotional security and well-being? Does the respondent feel there is someone to talk to about important decisions in life? Do the respondent's relationships recognize their skills and competence? Do the respondent's relationships share their attitudes and beliefs? Are there people the respondent can count on in an emergency?) and has responses from "strongly agree" to "strongly disagree". We coded the variable as 1 if the respondent chose "strongly agree" (and 0 otherwise).[2] We then added all these variables to create an index of social capital (ISC) between 0 (lowest level of social capital) and 5. We aggregated individual values at the community level, using 76 Local Health Integration Networks (LHIN) Sub-regions provided by Statistics Canada to produce aggregate-level social capital. The main roles of 14 LHINs in Ontario are to plan, fund, and integrate healthcare services locally. LHINs were subdivided into 76 sub-LHINs to plan performance improvement and service integration at a community level (Land Information Ontario; https://www.ontario.ca/page/land-information-ontario). The sample size was increased in Ontario in order to produce estimates reliable at the sub-LHIN level, and the CCHS stratification had to be adjusted. Because values are averaged at the sub-LHIN level, the range of the aggregate-level of social capital (ALSC) is much narrower than for the ISC, between 1.6 and 3.3.

Our objective is to measure how much social capital adds to our understanding of the individual variation in willingness to get vaccinated beside usual determinants such as demographic factors (age, sex, marital status), socio-economic background (education, income, immigration, and labour-force participation status), and geography (the urban density of residence). Age is entered in quadratic form (age and age squared divided by 100), to capture non-linear effects; the reference category for sex is female (all our observations are either male or female and we study the effect of being male on willingness to get vaccinated). The reference for marital status is "not in couple", including single, separated, divorced, and widowed, and we study the effect of being in couple versus being isolated. Education is entered in three categories, the reference being "less than secondary", and other categories being "secondary graduation but no post-secondary education" and "post-secondary degree/diploma or above". Income is entered as the natural log value of total household income. We enter immigration status (the reference is Canadian-born) as a proxy for race/ethnicity, and labour-force participation measured as "having worked in the past week" (the reference is those who did not work) as a proxy for labour market status. The urban density of residence is in four categories, with "rural" as the reference, and other categories being "small city", "medium size city", and "large city".

We also control for possible confounding factors, individual characteristics susceptible to varying with social capital and the willingness to get vaccinated identified in the literature, such as self-reported health status (the reference is poor, with four possible categories: fair, good, very good, and excellent) and self-perceived symptoms of COVID-19 since the beginning of the pandemic (the reference is no reported symptoms).

Statistical analysis

The design of the study is observational cross-sectional. As the dependent variable is binary, we estimate logistic regressions (one with social capital measured at the individual level and one with social capital measured at the aggregate level).

One issue worth noting is the response rate: whereas Statistics Canada usually achieves a high response rate on its surveys, this one, being conducted in the middle of a pandemic, was accepted by only one selected individual out of five, yielding a sample of 7317 respondents in Ontario. This is an issue, but we address it as follows: (a) We use post-sampling weights provided by Statistics Canada that help guarantee the weighted sample reproduces the distribution of the Ontarian population by age and sex in each province; (b) We do not produce any univariate statistics (e.g., proportion willing to get tested), but only estimate multivariate relationships: if it is highly likely that non-response biases the mean or other statistics of some variables, it is much less likely that a relationship between several variables is significantly affected by non-responses (Gelman, 2007).

Results

Table 2 shows that the study sample is close to the Ontarian population aged 12 and older on basic demographic characteristics: 49% are males and the average age is 45, close to the average age of the population 12 and older in Ontario (at

[2] If we define the variable as 1 if the individual answers "strongly" or "somewhat" agree, the distribution of social capital becomes meaningless: around 90% of respondents have a score of 5 on the index (versus 36% if we define the variable as 1 if the individual answers "strongly" only).

Table 2 Descriptive statistics

Variable	Description	Mean/prevalence	Std. dev	95% conf. interval	
Sex	= 1 if male	0.487	0.006	0.475	0.499
Age	Individual year indicators for age at time of interview	45.157	0.239	44.688	45.626
Immigrant	= 1 if born outside Canada	0.340	0.006	0.329	0.352
Labour force status	= 1 if work at job or business last week	0.546	0.006	0.534	0.558
Marital status	= 1 if married or have a common law partner	0.585	0.006	0.573	0.597
Hhd income	Household income	136,010.700	2044.798	132,002.200	140,019.100
Physical health condition					
	Poor	0.022	0.002	0.018	0.025
	Fair	0.075	0.003	0.069	0.082
	Good	0.259	0.005	0.249	0.270
	Very good	0.404	0.006	0.392	0.416
	Excellent	0.239	0.005	0.229	0.250
Education					
	Less than secondary school graduation	0.129	0.004	0.120	0.137
	Secondary school graduation, no post-secondary education	0.223	0.005	0.213	0.233
	Post-secondary certificate/diploma or university degree	0.649	0.006	0.637	0.660
Urban density of residence					
	Rural area (less than 1000)	0.133	0.004	0.124	0.141
	Small population centre (1000 to 29,999)	0.093	0.004	0.086	0.100
	Medium population centre (30,000 to 99,999)	0.075	0.003	0.068	0.081
	Large urban population centre (100,000 or more)	0.700	0.006	0.689	0.711
Social capital 1	= 1 if strongly agree that have close relationships that provide with a sense of emotional security and well-being	0.553	0.006	0.541	0.565
Social capital 2	= 1 if strongly agree that there is someone could talk to about important decisions in life	0.652	0.006	0.641	0.664
Social capital 3	= 1 if strongly agree that have relationships where my competence and skill are recognized	0.518	0.006	0.505	0.530
Social capital 4	= 1 if strongly agree that feel part of a group of people who share attitudes and beliefs	0.476	0.006	0.464	0.488
Social capital 5	= 1 if strongly agree that there are people can count on in an emergency	0.680	0.006	0.668	0.691
Index of social capital, individual level	Individual-level social capital index (ISC)	2.879	0.025	2.831	2.928
Index of social capital, sub-LHIN level	Aggregate-level social capital index (ALSC)	2.787	0.003	2.780	2.794
COVID-19 symptoms	= 1 if has experienced COVID-19 symptoms—since beginning of pandemic	0.124	0.004	0.116	0.132
Willingness to get vaccinated	Very unlikely	0.121	0.004	0.113	0.129
	Somewhat unlikely	0.114	0.004	0.107	0.122
	Somewhat likely	0.259	0.005	0.248	0.270
	Very likely	0.505	0.006	0.493	0.517

Std. dev standard deviation, *95% conf. interval* 95% confidence interval, *LHIN* Local Health Integration Network

46, authors' calculations based on the life table for 2020), meaning the non-response was not concentrated on some age groups. Immigrants were more likely to respond than Canadian-born, yielding a proportion of immigrants in the sample of 34% versus 29% in Ontario (according to census 2016). Table 2 also shows that 50% of respondents were very

likely to get the COVID-19 vaccine (and 76% very or somewhat likely).

Tables 3 and 4 present the results (odds ratios and their confidence intervals, and marginal effect calculated at the sample mean on all other variables with its standard error and *p*-value) of the models, Table 3 for social capital measured at the individual level and Table 4 for social capital measured at the aggregated level.

At the sample mean for all other independent variables, each level of individual-level social capital is associated with an increase in the intention to get vaccinated by 2 percentage points. Therefore, from the lowest level of social capital to the highest, the intention to get vaccinated increases by 10 percentage points. To check that our results did not reflect our linear assumption (treating ISC as a continuous variable), we ran a regression using all levels of ISC as dummy variables (level 0 being the reference); we confirm a positive association, with levels 0 to 2 being associated with the same willingness to get vaccinated and levels 3 to 5 being associated with a higher willingness.

The association between aggregate-level social capital and willingness to get vaccinated is not significantly different from 0 at the 5% level (the confidence interval for the odds ratio includes 1) but the marginal effect is quite large (suggesting a 9.5-percentage point difference across the range of values for aggregate-level social capital (1.6–3.3)). The association remains not significant when we define ALSC as a binary variable (low: lower than first quintile of the distribution, versus other values).

Other determinants: once social capital is controlled, we find no effect of self-assessed health on the willingness to get vaccinated for COVID-19; controlling for social capital at the individual level neutralizes the effect of marital status, but those living in couple are more likely to get vaccinated when social capital is controlled at the aggregate level. Other determinants remain statistically significant when social capital is controlled whether at the individual or the aggregate level: the willingness decreases with age until approximately 30 and then increases rapidly (see Fig. 1). Men are more likely to get the vaccine, as are those who are more educated, live in medium or large cities, are born in Canada, have a higher income, or have experienced symptoms of COVID-19.

We check whether these associations between social capital and willingness to get vaccinated were homogeneous

Table 3 Association between individual-level social capital and willingness to get vaccinated

	Very likely to get vaccinated					
	Odds ratio	95% conf. interval		Marginal effect	Standard error	*p*-value
Age	0.971	0.944	0.998	−0.007	0.004	0.039
Age*age	1.044	1.015	1.073	0.011	0.004	0.002
Married	1.110	0.906	1.360	0.026	0.026	0.315
Male	1.291	1.079	1.544	0.064	0.023	0.005
Immigrant	0.719	0.581	0.890	−0.083	0.027	0.002
Work	1.149	0.928	1.422	0.035	0.027	0.202
Physical health						
Fair	1.243	0.703	2.196	0.054	0.072	0.452
Good	1.205	0.709	2.048	0.046	0.067	0.488
Very good	1.250	0.740	2.114	0.056	0.066	0.401
Excellent	1.334	0.770	2.311	0.072	0.069	0.301
Education						
Secondary school	1.641	1.172	2.298	0.123	0.042	0.003
Post-secondary	1.587	1.160	2.173	0.114	0.039	0.003
Urban density of residence						
Small city	1.235	0.943	1.618	0.052	0.034	0.125
Medium city	1.456	1.090	1.944	0.093	0.037	0.011
Large city	1.489	1.190	1.863	0.099	0.028	0.000
Log household income	1.210	1.077	1.359	0.048	0.015	0.001
Symptom	1.551	1.183	2.034	0.110	0.035	0.002
Index of Social Capital (ISC)	1.083	1.032	1.137	0.020	0.006	0.001
_cons	0.038	0.008	0.178			
N	6516					

95% conf. interval 95% confidence interval, *_cons* constant

Table 4 Association between aggregate-level social capital and willingness to get vaccinated

	Very likely to get vaccinated					
	Odds ratio	95% conf. interval		Marginal effect	Standard error	*p*-value
Age	0.968	0.942	0.995	−0.008	0.004	0.022
Age*age	1.047	1.018	1.076	0.011	0.004	0.001
Married	1.137	0.931	1.389	0.032	0.026	0.209
Male	1.232	1.030	1.473	0.052	0.023	0.023
Immigrant	0.703	0.568	0.869	−0.088	0.027	0.001
Work	1.157	0.934	1.432	0.036	0.027	0.183
Physical health						
Fair	1.252	0.714	2.195	0.056	0.071	0.430
Good	1.249	0.740	2.108	0.055	0.066	0.401
Very good	1.340	0.799	2.249	0.073	0.065	0.262
Excellent	1.477	0.863	2.528	0.097	0.068	0.151
Education						
Secondary school	1.663	1.186	2.331	0.126	0.042	0.003
Post-secondary	1.654	1.212	2.257	0.124	0.038	0.001
Urban density of residence						
Small city	1.266	0.966	1.659	0.058	0.034	0.087
Medium city	1.478	1.111	1.967	0.097	0.036	0.007
Large city	1.506	1.206	1.879	0.102	0.028	0.000
Log household income	1.214	1.080	1.365	0.049	0.015	0.001
Symptom	1.562	1.191	2.050	0.112	0.035	0.001
ALSC	1.251	0.888	1.761	0.056	0.044	0.200
_cons	0.024	0.004	0.146			
N	6516					

95% conf. interval 95% confidence interval, *ALSC* aggregate-level social capital, *_cons* constant

across age categories by re-running the analyses separately for three age groups: younger than 20 (teenage), 20 to 60 (working-aged people), and greater than 60 (older people).

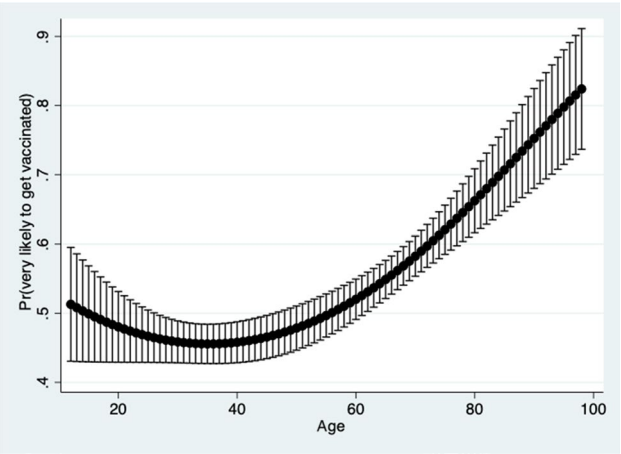

Fig. 1 Probability (Pr) of being very likely to get the vaccine by age (marginal effect)

The upper panel of Table 5 shows that individual-level social capital is significantly positively associated with the intention to get vaccinated after 20, but not for teenagers. When social capital is measured at the aggregate level, the association is not significant among active age adults (20–60) but significant and strong (an effect of 28.6-percentage point over the range of ALSC) among older adults.

The association between social capital and willingness to get vaccinated is the same for both genders (Table 6).

Discussion

Using data from 2020 CCHS September to December special interviews, Ontario sample, we find that individuals with higher levels of trust in their community as well as larger social networks were more likely to plan to get the COVID-19 vaccine when available than individuals with lower levels of trust and smaller social networks, controlling for other determinants of the willingness to be vaccinated. On the other hand, living in a community with higher level of social capital is not

Table 5 Analyses of heterogeneity of associations by age

	Age ≤ 20						20 < Age ≤ 60						Age > 60					
	Odds ratio	95% conf. interval		dy/dx	Std. err	*p*-value	Odds ratio	95% conf. interval		dy/dx	Std. err	*p*-value	Odds ratio	95% conf. interval		dy/dx	Std. err	*p*-value
Individual-level social capital																		
Symptom	3.308	1.571	6.966	0.091	0.029	0.002	1.311	0.941	1.826	0.068	0.042	0.109	1.401	0.819	2.396	0.082	0.067	0.218
ISC	1.106	0.944	1.296	0.024	0.019	0.213	1.099	1.028	1.176	0.024	0.009	0.006	1.050	0.988	1.116	0.012	0.008	0.113
Aggregate-level social capital																		
Symptom	1.198	1.626	6.727	0.285	0.086	0.001	1.323	0.949	1.845	0.070	0.042	0.099	1.389	0.819	2.354	0.080	0.066	0.223
ALSC	2.272	0.793	6.508	0.196	0.127	0.124	1.032	0.644	1.653	0.008	0.060	0.897	1.991	1.251	3.170	0.168	0.058	0.004
N	488							2958						3070				

95% conf. interval 95% confidence interval, *dy/dx* linear marginal effect, *Std. err* standard error, *ISC* individual-level social capital, *ALSC* aggregate-level social capital

meaningfully associated with the willingness to be vaccinated, except for older adults: after age 60, our model predicts a variation of 29 percentage points in the willingness to be vaccinated across the range of aggregate-level social capital (the variation in actual vaccination rates observed across neighbourhoods in Ottawa is 15 percentage points, https://www.neighbourhoodstudy.ca/covid-19-vaccination-coverage-in-ottawa-neighbourhoods/).

Socio-economic determinants of vaccine hesitancy are highly context dependent. Our main contribution is to show that social capital, measured as the amount of trust in the community and the perception one has to have a social network, is associated with the willingness to get vaccinated: the association of individual-level social capital with willingness to get vaccinated is comparable to that of education (12 percentage points between lowest and highest levels of education and 10.5 percentage points between lowest and highest levels of social capital). The association between aggregate-level social capital, which represents the fact of living in a community where individuals have more trust or a better perception of their own social network, and willingness to get vaccinated, is large among older adults, suggesting that, for them, what matters is to live in a sharing community rather than the amount of social capital they can muster for themselves. We are not aware of any previous study of the association between social capital and willingness to get vaccinated, but our results confirm findings that level of trust in institutions or the healthcare system is associated with vaccine hesitancy or acceptability.

Our study is cross-sectional and, as a result, we cannot infer causality and recommend that investing on social capital would improve vaccine acceptance. We can, however, point toward the fact that, in this sample, communities with lower levels of social capital (where lower income and lower education individuals tend to live) can be less receptive to traditional public health messages based on the rational cost–benefit analysis of the outcomes of the vaccine. Also, the results from our sample confirm that receptiveness to messages on vaccines are linked to levels of trust in society in general. If we could understand why some individuals are less integrated in society and feel marginalized, we could certainly find ways to convince them to get vaccinated and protect their own community. Or, in a more pessimistic way, we can conclude that vaccine hesitancy is not something that public health can really cure, as it reflects a deeper social ill, that sociologists call anomy (Durkheim, 1897) and that a recent study of mortality among Americans without a bachelor's degree (BA) described as a deprivation of meaning and structure for working-class communities (Case & Deaton, 2021).

Table 6 Analyses of heterogeneity of associations by gender

	Male						Female					
	Odds ratio	95% conf. interval		dy/dx	Std. err	*p*-value	Odds ratio	95% conf. interval		dy/dx	Std. err	*p*-value
Individual-level social capital												
Symptom	2.274	1.482	3.488	0.204	0.054	0.000	1.129	0.792	1.609	0.030	0.045	0.504
ISC	1.069	0.993	1.152	0.017	0.009	0.078	1.095	1.029	1.164	0.023	0.008	0.004
Aggregate-level social capital												
Symptom	2.258	1.465	3.482	0.202	0.055	0.000	1.151	0.812	1.633	0.035	0.044	0.430
ALSC	1.329	0.774	2.282	0.071	0.069	0.303	1.133	0.744	1.725	0.031	0.053	0.561
N	2878						3638					

95% conf. interval 95% confidence interval, *dy/dx* linear marginal effect, *Std. err* standard error, *ISC* individual-level social capital, *ALSC* aggregate-level social capital

Strengths and limitations

A limitation of our analysis is that the response rate is lower than that in previous years of CCHS. Using post-stratification weights, and focusing on co-variations rather than univariate statistics, we do not think this limitation prevents us from concluding there is a protective effect of social capital, at least in Ontario. We were reassured to see that intention to get the vaccine (very or somewhat likely) as estimated in our sample is very close to the figure found by Griffith et al. (2021), using Twitter profiles in Canada. Also, all associations with variables such as age or having had symptoms of COVID-19 have the expected signs.

Another limitation is that the questions on social capital have not been posed to respondents from other provinces and we cannot therefore test for our hypotheses outside of Ontario.

The main strength of this study is to prove the association of vaccine hesitancy with a community-driven determinant, something that had been suggested but never established in previous literature.

Conclusion

Using a representative sample of the population living in Ontario, we show that social capital, measured as the perception to benefit from social support, was associated at the end of 2020 with intentions to get vaccinated against COVID-19. The effect is strong at all ages except teenagers when social capital is measured at the individual level, and strong among seniors when measured at the community level. We cannot claim any causal link but our results are suggestive of a plausible explanation for vaccine hesitancy among socially disadvantaged Canadians.

Contributions to knowledge

What does this study add to existing knowledge?

- We find that social capital has a positive effect on the willingness to get the vaccine against the COVID-19 pandemic after controlling for demographic and socio-economic factors in Ontario.

What are the key implications for public health interventions, practice, or policy?

- Social capital plays an important role against the pandemic. Thus, our study encourages policymakers to make efforts to strengthen and expand social capital through social transfer, or local community programs during the pandemic.

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Author contributions Bai suggested the initial idea. Bai and Grignon conceived of the analyses. Bai wrote the code. Bai and Grignon conducted the analyses and co-wrote the manuscript. Both authors approved the final version for publication.

Data availability The data cannot be made available due to confidentiality and anonymity reasons (Statistics Canada does not allow sharing of the data by the researchers).

Code availability The code (in Stata) is available upon request.

Declarations

Ethics approval Not applicable (the study uses data collected by Statistics Canada). The project was approved by Statistics Canada, through the Research Data Centre (SSHRC) approval system.

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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