Perceived neighborhood social cohesion and vaccination intentions for seasonal influenza and COVID-19 in the post-pandemic era

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Word Count: 3,493

Abstract

Objective: To examine the relationship between perceived neighborhood social cohesion (NSC) and intentions to obtain seasonal influenza and COVID-19 vaccines among US adults.

Methods: We surveyed a nationally representative sample of US residents (n=2,189) in 2023 on their perceived NSC, COVID-19 and seasonal influenza vaccination intentions, healthcare access, perceived risk of COVID-19 or flu infection, loneliness, and trust in doctors. We used bivariate probit regressions to examine associations between perceived NSC and joint intentions to receive influenza and COVID-19 vaccines, controlling for participant characteristics (e.g., race, gender, and ethnicity).

Results: Trust-related NSC (trust in neighbors) was positively associated with intentions to vaccinate against both influenza and COVID-19 viruses. Higher relational NSC (perception of a close-knit neighborhood) was associated with greater intentions to vaccinate against COVID-19 while higher value-based NSC (perception that neighbors share the same values) was associated with lower intentions to vaccinate against COVID-19. Healthcare access, perceived risk of COVID-19 or flu infection, and trust in doctors were positively associated with intentions to vaccinate against both viruses.

Conclusions: Different dimensions of NSC (trust-related and relational) may mitigate the pandemic's negative health impacts by increasing individuals' willingness to vaccinate. Fostering inclusive and supportive neighborhoods and maintaining public trust in healthcare providers may increase uptake of influenza and COVID-19 vaccines.

Key words: neighborhood social cohesion, seasonal influenza vaccine, COVID-19 vaccine, loneliness, risk perceptions, trust, healthcare access, psychosocial determinants, preventive healthcare use, COVID-19 pandemic

1. Introduction

1.1 Neighborhood social cohesion during the COVID-19 pandemic

Neighborhood social cohesion (NSC) is a construct capturing shared values, relationships, and norms of community residents, built upon trust, reciprocal actions, and a sense of belonging among neighbors.[1] Socially cohesive neighborhoods may foster inclusive and supportive environments where neighbors improve residents' quality of life by addressing common concerns and advocating for local initiatives. Within the context of traumatic events such as the COVID-19 pandemic, neighborhoods that are socially cohesive may strengthen community resilience by uniting individuals, as well as providing both social and instrumental support. During early stages of the pandemic, many individuals united to protect their community's health by social distancing, mask wearing, and delivering personal protective equipment to those at greater infection risk.

Concurrently, the pandemic created socio-political contexts in which some communities perhaps became less connected due to isolation, differences in political beliefs, and pandemic-related harassment.[2] Moreover, COVID-19 prevention strategies, such as wearing masks and being vaccinated against COVID-19, became contentious within some communities. These issues were examined in England, where NSC appeared to decline during the early pandemic period (June 2020) compared to pre-pandemic.[3] The relationship between NSC and preventive healthcare use in the US, particularly for vaccination against COVID-19 and seasonal influenza, has not been examined.

1.2. NSC and Social Capital Theory

Greater NSC promotes connectiveness among residents, social trust, and participation in communal activities, and in turn, may contribute to human capital gains as posited in Social Capital Theory.[4] Also, diverse social networks and community connections (social capital) may provide increased access to health resources and support, creating health- and wellbeing-promoting environments. Furthermore, social capital acts as a social determinant of community health regardless of individual characteristics, may buffer against socioeconomic inequalities in health, and was shown to mitigate negative health effects in patients following major health crises.[5]

1.3 Health-protective properties of NSC

The US Department of Health and Human Services recognizes social cohesion as a critical component in maintaining individual health-protective behaviors (e.g., vaccinations).[6] NSC may influence an individual's desire and ability to engage in preventive healthcare use through promoting collective advocacy for health resources, increasing dissemination of health-related information, providing greater psychosocial support, and increasing self-efficacy. Moreover, strong, dense social networks are associated with healthy habit formation and serve as a catalyst for preventive healthcare use by increasing perceived self-efficacy[7] and decreasing feelings of loneliness and depression.[8,9] For example, greater NSC was associated with uptake of the COVID-19 vaccine among Australian adults,[10] higher likelihood to obtain influenza vaccinations[11] among US adults,[12] and stronger antibody response when receiving the COVID-19 vaccine among British adults.[8]

1.4. NSC and vaccination-related behaviors in the US

Safe and effective vaccines are available in the US to protect against morbidity and mortality associated with seasonal influenza and COVID-19; however, achieving high uptake of these vaccines remains a challenge.[13] Specifically, while the Centers for Disease Control and Prevention recommended the 2023-2024 influenza vaccines and COVID-19 bivalent booster to protect against severe illness, only 48.1% and 22.6% of US adults reported receiving the COVID-19 and influenza vaccines, respectively as of April 2024.[13] Seasonal influenza vaccination rates in the US continue to fall far below current Healthy People 2030 goals of 70% of residents vaccinated. While there is no current Healthy People goal for COVID-19, eligible individuals are recommended to be vaccinated against COVID-19.[14] Mistrust in vaccines since the pandemic may also affect vaccination uptake, making the post-pandemic a critically important period to examine factors associated with vaccination likelihood. Many efforts in the US have focused on individual factors or community structural vulnerability,[15] leaving an important question unanswered: do community social ties play a role in vaccination uptake?

1.5 Other factors associated with vaccine uptake

Other health and several demographic factors (e.g., race) are known to influence the uptake of influenza,[16] and COVID-19 vaccinations,[17] such as perceived risk of seasonal influenza and COVID-19 infection. For example, perceived risk of COVID-19 infection was linked to acceptance of the COVID-19 vaccine and vaccination intentions.[17–19] Also, increased feelings of loneliness among older adults during the pandemic, such as due to quarantine mandates

implemented to prevent viral spread, was associated with reduced uptake of the COVID-19 vaccine.[8,20] Further, doctor-patient trust increased the uptake of COVID-19 booster and influenza vaccines.[21–23]

1.6. Research aims

To our knowledge, limited research has examined the role of NSC on individuals' intentions to become vaccinated against influenza and COVID-19 viruses. Existing research has primarily focused on populations outside the US.[10,24,25] For example, a study in Australia found significant associations between NSC and increased willingness to become vaccinated against the influenza[11] and COVID-19 viruses.[10] Studies examining US residents have focused on sub-populations (e.g., COVID-19 vaccination rates among Black individuals in Chicago),[26] or examined the relationship between COVID-19 vaccination rates and social capital or social trust, rather than NSC.[27–31]

Thus, we aimed to examine how perceived NSC is associated with individuals' intentions to obtain seasonal influenza and COVID-19 booster vaccines in the fall/winter of 2023 among a large, nationally representative US adult sample. These vaccination intentions were examined independently and jointly. We believe this to be the first study to examine three dimensions of NSC (trust, relational, and value-based) to better understand the complex dynamics between NSC and intentions to receive vaccines. Also, to our knowledge, no studies have considered possible unobserved factors influencing intentions to vaccinate against influenza and COVID-19 by jointly modeling vaccination intentions for both viruses. We hypothesize that perceived NSC will be positively associated with intentions to obtain an influenza and COVID-19 vaccine across all three dimensions of NSC, controlling for sociodemographic and health-status covariates, and including the following exploratory variables: healthcare access, perceived risk of influenza or COVID-19 infection, loneliness, and trust in doctors. Furthermore, we hypothesize that these associations will remain robust when jointly estimating both vaccination intentions.

2. Methods

2.1. Data

The global market research firm, Ipsos, interviewed a representative sample (n=2,189) of US adults aged 18-75 using its Global Omnibus panel from May 24-26th, 2023. This period was

marked by the end of the US public health emergency, a decrease in COVID-19 infections, hospitalizations, and deaths, and wide availability of COVID-19 vaccines.

Our survey was designed to examine health-related behaviors and their determinants as the pandemic wanes, including questions regarding NSC, intentions to receive vaccines (COVID-19 and influenza), healthcare access, risk perceptions of COVID-19 and influenza infection, feelings of loneliness, and trust in doctors. Participants were recruited until sample quotas set on age, gender, region, and working status were met. Additional surveys were sent to specific respondent quota groups to meet sample requirements. Respondents' demographic information (e.g. gender) was supplied by Ipsos. Study participants completed the web-based survey using their preferred method (e.g., mobile device). Data was weighted to the known offline population portions of this audience for gender within age and working status, household income, and region. Study protocol was approved by the [REDACTED] Institutional Review Board.

2.2. Measures

Primary dependent variables were intentions to receive the COVID-19 booster and influenza vaccines. The primary explanatory variable was perceived NSC, and additional explanatory variables were healthcare access, perceived risk of COVID-19 or influenza infection, feelings of loneliness, and trust in doctors.

2.2.1. Vaccination intentions

Participants were asked: *How likely or unlikely would you personally be to get the following vaccines in the fall/winter of 2023?*

COVID-19 booster (if recommended for annual seasonal boosters)

Seasonal flu (influenza)

Participants responded on a 4-point Likert Scale ('very likely' to 'not at all likely' or 'don't know' or 'prefer not to say'); responses were combined to create binary variables ('very'/'fairly likely' versus 'not very'/'not at all likely'). 'Don't know' and 'prefer not to say' responses were dropped from models after confirming lack of sample selection bias using the inverse mills ratio method.[32]

2.2.2. Perceived NSC

Participants responded to the following about their neighborhood: 1.*This is a close-knit neighborhood* 2.*People around here are willing to help their neighbors.* 3.*People in this*

neighborhood generally don't get along with each other. 4.*People in this neighborhood do not share the same values.* 5.*People in this neighborhood can be trusted.* Responses were on a 4-point Likert scale from 'strongly disagree' to 'strongly agree'. This question is from the National Institutes of Health (NIH) Rapid Acceleration of Diagnostics for Underserved Populations (RADx-UP), common data elements (CDEs):[33] Questions 1-3 were classified as relational dimensions of NSC, 4 as value-based NSC, and 5 as trust-related NSC. Questions 3 and 4 were reversed coded.

2.2.3 Healthcare access

Participants were asked: *Do you have a doctor or nurse who you usually see if you need a check-up, want advice about a health problem, or get sick or hurt?* Responses included 'yes', 'no', or 'prefer not to say'. Second, participants were asked: *What is your primary kind of health insurance or health care plan you have now?* Responses were 'I do not have health insurance', 'private (purchased directly or through employment)', 'public (Medicare, Medicaid, Tricare)', 'don't know', or 'prefer not to say'. These were CDEs drawn from the National Heart, Lung, and Blood Institute (NHLBI) and the NIH RADx-UP, respectively.[33]

2.2.4 Personal risk perceptions of infection

For COVID-19 and influenza, participants were asked the following for each virus: *What would you say the risk is of you personally becoming infected with the following types of illness in the next 12 months?* Participants responded on a scale from 0 to 100 (0-'no risk' to 100-'extreme risk', 'don't know', or 'not applicable'). This approach is similar to Viscusi (1990) by eliciting numerical assessment of risk using the range of 0-100.[34]

2.2.5 Feelings of loneliness

Participants were asked the following from the revised University of California Los Angeles Loneliness Scale: 1.*How often do you feel that you lack companionship?* 2.*How often do you feel left out?* 3.*How often do you feel isolated from others?* Responses were 'hardly ever,' 'some of the time,' and 'often'.[35]

2.2.6 Trust in healthcare provider

Participants were asked: *Do you trust your doctor to take care of people's problems?*, a CDE derived from the NIH Phenotypes for Exposures Toolkit.[33] Responses were 'a lot,' 'most of the time,' 'not very much,' or 'don't know'.

2.3. Empirical specification

Our empirical strategy assumes intentions to receive COVID-19 and influenza vaccines are dependent on several observable and unobservable factors. Let ψ_i stand for intentions to obtain COVID-19 and influenza vaccines in the fall/winter of 2023 with ($_i$) denoting specification at the individual level. Our main interest is the effects of perceived NSC (ρ_i) as a vector of five questions pertaining to NSC on likelihood to obtain a COVID-19 or influenza vaccine (ψ_i). Models include a set of controls (λ_i) (gender, race, rural residency, age, ethnicity, presence of children, marital status, work status, census region, household income, and self-reported mental and physical health status), a vector of healthcare access to include access to a healthcare provider and insurance status (v_i), a vector of personal risk perceptions of illness (COVID-19 or influenza specific to the vaccine type) (ρ_i), a vector of three questions pertaining to loneliness (χ_i), and trust in healthcare provider (Ω_i). The error term (ε_v) accounts for unspecified, unobserved variables. The full estimation is:

$$\psi_i = \beta_0 + \rho_i\beta_1 + \lambda_i\beta_{2+} v_i\beta_{3+} \rho_i\beta_4 + \chi_i\beta_5 + \Omega_i\beta_6 + \varepsilon_{vi}$$

The error term has the subscript ($_{vi}$) to denote variations at the individual level and according to each vaccination intention (ψ_i) specification. Estimation was performed for each vaccination type separately; however, COVID-19 and influenza vaccination intentions demonstrated moderate to high pairwise correlation (0.593, $p<0.000$). Therefore, we also estimated vaccination intentions jointly assuming each specifications' error terms (ε_v) were correlated.

2.4. Analysis

Survey sample weights were used to estimate means and standard deviations for model variables. In multivariate analysis, we ran stepwise ordinary least square regressions (OLS) for each vaccination type. Then, we ran a bivariate probit to estimate vaccination intentions jointly. The bivariate probit allowed for dependent variables specific to each vaccine type (personal risk perceptions of COVID-19 vs. influenza). All models used bootstrapped standard errors and 200 iterations to allow for within sample correlation.

Model goodness of fit was assessed using Wald chi-square values, adjusted R^2, and variance inflation factors to test for multicollinearity using ordinary least squares (OLS) models, and rho value and the likelihood ratio test of rho to ensure appropriateness of bivariate probit estimation. We report stepwise regressions adding explanatory variables to demonstrate parameter stability (Tables 2 & 3). Coefficient and bootstrapped standard errors are presented for all models (Tables 2-4).

3. Results

3.1 Study sample characteristics

The study sample had a mean age of 45.6, was mostly women (50.8%), White (79.1%), urban (88.1%), non-Hispanic (85.9%), with no children (66.1%), married (50.5%), and working (63.9%). Most reported positive perceptions of their mental and physical health, with participants indicating having good (35.6%; 46.7%) or very good (34.0%; 26.9%) mental or physical health, respectively (Table 1A).

Most reported intentions to obtain the COVID-19 (62.4%) and influenza (67.0%) vaccines in the fall/winter of 2023 (Table 1). Overall, perceived NSC was high; most believed that they live in a close-knit neighborhood (55.5%), people are willing to help their neighbors (82.8%), get along with each other (77.7%), share the same values (55.3%), and are trustworthy (77.7%). Most had access to a medical provider (78.4%) and had public (39.3%) or private (50.6%) insurance, compared to no insurance (6.6%). On average, participants had similar perceptions about personal risk of COVID-19 (39.5/100) or influenza infections (41.8/100) and about half felt lonely 'some of the time' or 'often' – lack companionship (51.1%), feel left out (50.7%), and feel isolated from others (50.7%). Last, most trusted in doctors to take care of people's problems ('most of the time', 59.1%; 'a lot', 28.1%).

3.2 Associations between perceived NSC and vaccination intentions

The roles of perceived NSC in vaccination intentions varied by vaccine type and NSC dimension (Tables 2 & 3, columns 4). Trust in people in their neighborhood (trust dimension) was positively associated (b=0.064, P <0.05) with influenza vaccination intentions, while perceiving their neighborhood to be close-knit (relational dimension) was positively associated (b=0.057, P <0.05) with COVID-19 vaccination intentions. Also, perceptions that neighbors share the same values (value-based dimension) was negatively associated (b=-0.068, P <0.01) with COVID-19 vaccination intentions.

Other explanatory variables had consistent results across both vaccine types. For healthcare access, not having a doctor (v. having a doctor) (b=-0.112, P <0.001 for influenza; b=-0.070, P <0.05 for COVID-19) was negatively associated, and having private (b=0.116, P <0.05; b=0.130, P <0.01) or public (b=0.109, P <0.05; b=0.094, P <0.05) insurance (vs. no insurance) were positively associated with influenza and COVID-19 vaccination intentions.

Personal perceived risk of influenza (b=0.003, *P* <0.001) and COVID-19 (b=0.004, *P* <0.001) infection were positively associated with intentions to become vaccinated against that virus. Lacking companionship 'some of the time' or 'often' (v. 'hardly ever') was positively associated (b=0.053, *P* <0.05) with COVID-19 vaccination intentions. Last, trusting in doctors 'most of the time' (vs. 'not very much') (b=0.253, *P* <0.001; b=0.180, *P* <0.001) or 'a lot' (b=0.414, *P* <0.001; b=0.393, *P* <0.001) were positively associated with influenza and COVID-19 vaccination intentions, respectively. Overall, trust in doctors had the largest effect size regarding the association with individuals' vaccination intentions.

The bivariate probit specification (Table 4) demonstrated overall robustness of these findings and a positive association between unobservable factors for intentions to receive both vaccines (ρ(s.e.) 0.741, 0.027). NSC demonstrated an even stronger association with COVID-19 vaccination intentions; more components of NSC (3 of 5 questions – relational, value-based and trust dimensions) had a significant relationship with COVID-19 vaccination intentions than when analyzed separately (2 of 5 – relational, value-based). Further, personal perceived risk of influenza (b=0.010, *P* <0.001) and COVID-19 (b=0.011, *P* <0.001) infection remained positively associated with intentions to become vaccinated against that virus. In terms of healthcare access, not having a doctor (v. having a doctor) (b=-0.323, *P* <0.01) remained negatively associated with influenza vaccination intentions only, while having private (b=0.508, *P* <0.01) or public (b=0.401, *P* <0.05) insurance (vs. no insurance) remained positively associated with COVID-19 vaccination intentions only. Feelings of loneliness remained insignificant across both vaccine types.

4. Discussion

This study employed a nationally representative survey of US adults to examine associations between three dimensions of perceived NSC and intentions to receive COVID-19 and influenza vaccines when the severity of the COVID-19 pandemic was waning (May 2023). Findings suggest that most US residents had high perceived NSC across all three dimensions: trust, value-based, and relational, and intended to receive the COVID-19 and influenza vaccines in the fall/winter of 2023. Higher perceived NSC, perceived personal risk of COVID-19 and influenza, and trust in doctors were associated with greater individual intentions to become vaccinated against COVID-19 and influenza. Having a doctor was associated with influenza

vaccination intentions, while having public or private insurance was associated with COVID-19 vaccination intentions.

Overall, the trust dimension of NSC was associated with influenza vaccination intentions, while all three dimensions of NSC (trust, relational, and value-based) were associated with COVID-19 vaccination intentions. Thus, NSC may play a greater role in COVID-19 than for influenza vaccination intentions. Specifically, greater trust in neighbors was associated with greater intentions to become vaccinated against influenza and COVID-19. However, perceiving one's neighborhood to be close-knit (relational) was associated with *greater* intentions, but perceiving neighbors to share the same values (value-based) was associated with *fewer* intentions to vaccinate against COVID-19, perhaps due to polarization of communities across political and religious lines.[36] Thus, an individual's decision to become vaccinated against COVID-19 may depend on beliefs and values of the surrounding community and on whether these values are shared or not. Thus, social bonds may play an effective role in community-based efforts encouraging preventive healthcare use like vaccination.

Similar to our findings, previous research has found greater perceived NSC to be associated with greater uptake and acceptance of COVID-19 vaccines,[10,24,25] and greater likelihood of obtaining influenza vaccines.[11] Other studies found individual values, social capital, political polarization, and barriers to accessing reliable vaccine information to be associated with COVID-19 vaccination intentions.[27–29,31] Further, one study found that access to social capital explained disparities in COVID-19 vaccine uptake.[30] Perhaps the divergent effects of perceived NSC on intentions to vaccinate against COVID-19 are explained by individual norms, values, and social capital, differing by subpopulation. Future studies should further explore mechanisms underpinning the relationship between perceived NSC and influenza and COVID-19 vaccination intentions.

Furthermore, unobserved factors related to COVID-19 and influenza vaccination intentions were strongly associated, suggesting that individuals' intentions to become vaccinated against COVID-19 and influenza are related due to similar underlying reasons. Greater perceived NSC may simultaneously shape individuals' COVID-19 and influenza vaccination decisions. Previous research has found increasing NSC to be associated with greater preventive healthcare use, including higher likelihood to obtain influenza vaccinations, cholesterol tests, and

mammograms/x-rays; however, the links between healthcare use types have not been fully explored.[11]

Greater healthcare access (having a doctor for influenza vaccination and insurance coverage for COVID-19 vaccination intentions), higher risk perceptions of illness, and trust in doctors were associated with greater intentions to become vaccinated against both illnesses. Prior research has demonstrated similar findings. For example, perceived risk of COVID-19 infection was linked to acceptance of and intentions to receive this vaccine.[17–19] Finally, strong trust of doctors was shown to increase uptake of both vaccines.[21–23]

4.1. Limitations

A few limitations should be mentioned. First, participants' electronic medical records were not accessible, which would have provided information on individual vaccination history. Second, lack of data collected on participants' political affiliations prevented us from better understanding how politically shared values of a neighborhood may influence individuals' decisions to become vaccinated. Third, greater theoretical and psychometric testing is needed to further develop and validate robust measures of NSC and its dimensions.

While models presented do not incorporate all factors associated with vaccination intentions following the pandemic and were limited to our survey questions, our rigorous empirical strategy ensured robustness of results. Availability of other parameters such as perceived effectiveness of and previous engagement with vaccines may further strengthen model specifications. Finally, while respondents may be susceptible to social desirability bias regarding vaccination intentions, survey administration methods employed strategies (e.g., assuring anonymity) to reduce socially desirable responses.

4.2 Conclusion

Understanding how NSC can mitigate the negative, long-term impacts of the pandemic is essential, particularly given that the pandemic has exacerbated existing health disparities for many communities. Our findings suggest that efforts to promote preventive healthcare use, such as vaccination, should go beyond addressing individual beliefs and hesitancy, and address factors that build neighborhood and community-level cohesion. Efforts to build cohesion may include strengthening relationships between community members and local healthcare providers, facilitating neighbor-to-neighbor health education, and engaging community health workers' knowledge about local contexts in vaccination promotion. Further, these results may help guide

the development of public health policies and interventions that foster stronger communities and protect against future global pandemics. Diverse stakeholders, including insurers and health systems, may advocate and facilitate vaccination by promoting NSC and fostering trust in providers. Equitable vaccine access and community engagement programs are key strategies to support such efforts.

Acknowledgements

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Table 1. Descriptive statistics of dependent and independent variables, weighted

Dependent variables	n	Mean	Linearized SE
How likely or unlikely would you personally be to get the following vaccines in the fall/winter 2023?			
COVID-19 booster (if recommended for annual seasonal boosters)			
Not at all likely/not very likely	818	0.376	0.012
Very likely/fairly likely	1240	0.624	0.012
Seasonal Flu (Influenza)			
Not at all likely/not very likely	742	0.330	0.011
Very likely/fairly likely	1345	0.670	0.011
Independent variables	**n**	**Mean**	**Linearized SE**
Neighborhood social cohesion			
Please answer the following questions pertaining to your neighborhood:			
This is a close-knit neighborhood			
Strongly disagree/disagree	1022	0.445	0.012
Strongly agree/agree	1167	0.555	0.012
People around here are willing to help their neighbors			
Strongly disagree/disagree	427	0.172	0.008
Strongly agree/agree	1762	0.828	0.008
People in this neighborhood generally don't get along with each other			
Strongly disagree/disagree	1691	0.777	0.010
Strongly agree/agree	498	0.223	0.010
People in this neighborhood do not share the same values			
Strongly disagree/disagree	1181	0.553	0.012
Strongly agree/agree	1008	0.447	0.012
People in this neighborhood can be trusted			
Strongly disagree/disagree	560	0.223	0.009
Strongly agree/agree	1629	0.777	0.009
Healthcare access			
Do you have a doctor or nurse who you usually see if you need a check-up, want advice about a health problem, or get sick or hurt?			
Yes	1661	0.784	0.009
No	464	0.200	0.009
What is your primary kind of health insurance or health care plan you have now?			
I do not have health insurance	163	0.066	0.006
Private (purchased directly or through employment)	946	0.506	0.012
Public (Medicare, Medicaid, Tricare)	962	0.393	0.011
Personal risk perception of infection			
What would you say the risk is of you personally becoming infected with the following types of illness in the next 12 months? (0-100)			

COVID-19	1929	39.5	0.704
Seasonal Flu (Influenza)	1951	41.8	0.673
Loneliness			
How often you feel that you lack companionship?			
Hardly ever	1017	0.489	0.012
Some of the time/ Often	1172	0.511	0.012
How often do you feel left out?			
Hardly ever	1034	0.493	0.012
Some of the time/ Often	1155	0.507	0.012
How often do you feel isolated from others?			
Hardly ever	1033	0.493	0.012
Some of the time/ Often	1156	0.507	0.012
Trust in doctors			
Do you trust doctors to take care of people's problems?			
A lot	584	0.281	0.011
Most of the time	1290	0.591	0.011
Not very much	269	0.110	0.007
Don't know	46	0.018	0.003

Note. SE = Standard Error.

Over May 24-26 2023, U.S. adults, ages 18-75 years-old, from the Ipsos Online I-Omnibus panel (N=2,189) were surveyed on intentions to vaccinate and neighborhood social cohesion. 2,164 respondents consented to answer questions about their general health and COVID-19. Survey weights, provided by Ipsos, were used to account for the sampling design and calculate the mean and linearized standard errors.

Table 2.

Association between neighborhood social cohesion and intentions to receive the seasonal influenza (flu) vaccine

Influenza (flu) vaccine	Coef. (1)	z	Coef. (2)	z	Coef. (3)	z	Coef. (4)	z
Neighborhood social cohesion								
This is a close-knit neighborhood								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.034	1.57	0.013	0.550	0.014	0.650	-0.002	-0.070
People around here are willing to help their neighbors								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.007	0.230	0.000	-0.010	0.001	0.050	-0.002	-0.060
People in this neighborhood generally don't get along with each other								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.076	-2.95**	-0.044	-1.66	-0.035	-1.28	-0.036	-1.41
People in this neighborhood do not share the same values								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.028	-1.220	-0.024	-0.930	-0.019	-0.870	-0.028	-1.27
People in this neighborhood can be trusted								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.076	2.38*	0.093	2.97**	0.092	3.38**	0.064	2.24*
Have a doctor								
Yes vs.								
No	-0.189	-6.54***	-0.171	-5.99***	-0.173	-5.84***	-0.112	-3.88***
Primary health insurance								
I do not have health insurance vs.								
Private	0.138	3.23**	0.151	3.27**	0.151	3.29**	0.116	2.54*
Public	0.130	3.13**	0.147	3.13**	0.146	3.19**	0.109	2.36*
Personal risk of seasonal influenza infection			0.004	11.23***	0.004	9.85***	0.003	10.05***
Loneliness								
Lack companionship								
Hardly ever vs.								
Some of the time/ Often					0.047	1.66	0.050	1.95
Feel left out								
Hardly ever vs.								
Some of the time/ Often					0.027	0.960	0.029	1.08
Feel isolated								
Hardly ever vs.								

Some of the time/ Often			0.000	-0.020	0.000	0.010

Trust in doctors

Not very much vs.

Most of the time					0.253	7.23***
A lot					0.414	10.9***

Model statistics

Observations (N)	2087	1900	1900	1900
Replications	200	194	194	194
Adjusted R2	0.081	0.136	0.139	0.195
Wald Chi2	280.06	702.42	716.41	1359.10
Significance	p<0.00	p<0.00	p<0.00	p<0.00

*p<0.05 **p<0.01 ***p<0.001

Note. N=2,189. All ordinary least squares regression models use bootstrap standard errors and control for gender, race, rural residency, age, ethnicity, children, marital status, working status, U.S. region, household income, self-reported mental and physical health status. Variance inflation factor is less than 10 for all models and 5.40 for the final model.

Table 3.

The association between neighborhood social cohesion and intentions to receive the COVID-19 booster vaccine

COVID-19 booster vaccine	Coef. (1)	z	Coef. (2)	z	Coef. (3)	z	Coef. (4)	z
Neighborhood social cohesion								
This is a close-knit neighborhood								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.073	3.11**	0.070	2.64**	0.072	3.05**	0.057	2.53*
People around here are willing to help their neighbors								
Strongly disagree/disagree vs.								
Strongly agree/agree	-0.007	-0.240	-0.009	-0.290	-0.008	-0.210	-0.013	-0.450
People in this neighborhood generally don't get along with each other								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.080	-2.58*	-0.030	-1.140	-0.021	-0.740	-0.020	-0.640
People in this neighborhood do not share the same values								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.070	-3.04**	-0.063	-2.72**	-0.057	-2.25*	-0.068	-2.87**
People in this neighborhood can be trusted								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.094	2.99**	0.088	2.81**	0.086	2.61**	0.057	1.87
Have a doctor								
Yes vs.								
No	-0.216	-4.57***	-0.119	-3.96***	-0.122	-4.27***	-0.070	-2.20*
Primary health insurance								
I do not have health insurance vs.								
Private	0.167	3.93***	0.159	3.35**	0.160	3.35**	0.130	2.85**
Public	0.142	3.27**	0.131	2.88**	0.132	2.72**	0.094	2.08*
Personal risk of COVID-19 infection			0.004	12.3***	0.004	11.4***	0.004	11.0***
Loneliness								
Lack companionship								
Hardly ever vs.								
Some of the time/ Often					0.046	1.59	0.053	1.98*
Feel left out								
Hardly ever vs.								
Some of the time/ Often					0.035	1.23	0.032	1.01
Feel isolated								
Hardly ever vs.								

Some of the time/ Often			0.006	0.190	0.012	0.380

Trust in doctors
  Not very much vs.

Most of the time					0.180	4.76***
A lot					0.393	9.47***

Model statistics

Observations (N)	2058	1854	1854	1854
Replications	198	192	191	194
Adjusted R2	0.073	0.142	0.145	0.201
Wald Chi2	301.54	643.98	729.93	1378.27
Significance	p<0.00	p<0.00	p<0.00	p<0.00

*p<0.05 **p<0.01 ***p<0.001

Note. N=2,189. All models use bootstrap standard errors and control for gender, race, rural residency, age, ethnicity, children, marital status, working status, U.S. region, household income, self-reported mental and physical health status. Variance inflation factor is less than 10 for all models and 5.32 for the final model.

Table 4.

The association between neighborhood social cohesion and intentions to vaccinate (COVID-19 booster and influenza vaccine)

	Coef. (1)	z	Coef. (2)	z
	COVID-19 booster vaccine		**Influenza (flu) vaccine**	
Neighborhood social cohesion				
This is a close-knit neighborhood				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.191	2.32*	-0.007	-0.090
People around here are willing to help their neighbors				
Strongly disagree/disagree vs.				
Strongly agree/agree	-0.059	-0.540	0.035	0.340
People in this neighborhood generally don't get along with each other				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.107	-1.13	-0.149	-1.62
People in this neighborhood do not share the same values				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.221	-2.65**	-0.141	-1.63
People in this neighborhood can be trusted				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.191	1.99*	0.227	2.24*
Have a doctor				
Yes vs.				
No	-0.136	-1.51	-0.323	-3.39**
Primary health insurance				
I do not have health insurance vs.				
Private	0.508	3.15**	0.309	1.75
Public	0.401	2.30*	0.288	1.60
Personal risk of COVID-19/seasonal influenza infection	0.011	8.79***	0.010	8.22***
Loneliness				
Lack companionship				
Hardly ever vs.				
Some of the time/ Often	0.155	1.62	0.180	1.82
Feel left out				
Hardly ever vs.				
Some of the time/ Often	0.096	0.890	0.083	0.840

Feel isolated				
Hardly ever vs.				
Some of the time/ Often	0.055	0.530	0.018	0.150
Trust in doctors				
Not very much vs.				
Most of the time	0.549	4.62***	0.741	6.14***
A lot	1.272	9.60***	1.35	9.94***
Model statistics				
Observations (N)				1790
Replications				196
Rho (SE)				0.741 (0.027)
Wald test of rho (Chi2)				1403.43
Significance				p<0.00
Loglikelihood				-1705.11

*p<0.05 **p<0.01 ***p<0.001

Note. N=2,189. Model uses bootstrap standard errors and control for gender, race, rural residency, age, ethnicity, children, marital status, working status, U.S. region, household income, self-reported mental and physical health status.

Appendix

Table 1A. Descriptive statistics for all control variables, weighted

Controls	n	Mean	Linearized SE
Gender			
Male	1057	0.485	0.012
Female	1117	0.508	0.012
Other	7	0.003	0.001
Prefer not to say	8	0.004	0.001
Race			
White	1683	0.791	0.009
Black/African American	247	0.096	0.006
Native American/Alaska Native	40	0.016	0.003
Asian	102	0.050	0.005
Pacific Islander	19	0.008	0.002
Other	71	0.028	0.004
Prefer not to answer	26	0.010	0.002
Consent not granted	1	0.000	0.000
Rural residency			
Urban	1901	0.881	0.007
Rural	288	0.119	0.007
Age	2189	45.6	0.378
Ethnicity			
Are you of Hispanic, Latino or of Spanish origin?			
Hispanic	302	0.130	0.008
non-Hispanic	1863	0.859	0.008
Prefer not to say	23	0.011	0.002
No consent	1	0.000	0.000
Has children			
No	1525	0.661	0.011
Yes	664	0.339	0.011
Marital status			
Single, never married	714	0.278	0.010
Living with partner	205	0.092	0.007
Married	931	0.505	0.012
Widowed	78	0.030	0.004
Divorced or separated	261	0.095	0.006
Working			
No	857	0.361	0.011

Yes	1332	0.639	0.011

U.S. region

New England	102	0.046	0.005
Middle Atlantic	280	0.126	0.008
East North Central	313	0.144	0.008
West North Central	140	0.064	0.006
South Atlantic	443	0.201	0.009
East South Central	128	0.058	0.005
West South Central	268	0.122	0.008
Mountain	166	0.075	0.006
Pacific	349	0.165	0.009

Household income

<$5,000-$24,999	468	0.111	0.005
$25,000-$49,999	473	0.166	0.007
$50,000-$74,999	430	0.163	0.008
$75,000-$99,999	309	0.227	0.011
$100,000-$250,000+	409	0.292	0.012
Prefer not to say	100	0.041	0.004

Self-reported health status

How is your mental health in general (e.g., anxiety, depression, stress, eating disorders)? How would you say it is now?

Very poor	62	0.026	0.004
Poor	175	0.073	0.006
Fair	466	0.195	0.009
Good	755	0.356	0.011
Very Good	681	0.340	0.011
Don't know	15	0.007	0.002
Prefer not to say	10	0.004	0.001

How is your physical health (e.g., pain, disease) in general? How would you say it is now?

Very poor	31	0.013	0.003
Poor	115	0.044	0.004
Fair	503	0.203	0.009
Good	967	0.467	0.012
Very Good	534	0.269	0.011
Don't know	7	0.003	0.001
Prefer not to say	7	0.002	0.001

Note. SE = Standard Error.

In May 2023, U.S. adults, ages 18-75 years-old, from the Ipsos Online I-Omnibus panel (N=2,189) were surveyed on intentions to vaccinate and neighborhood social cohesion. 2,164 respondents consented to answer questions about their general health and COVID-19. Survey

weights, provided by Ipsos, were used to account for the sampling design and calculate the mean and linearized standard errors.

Impact of perceived neighborhood social cohesion on vaccination intentions in the post-pandemic era

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Main text word count: 3,499/3,500
Abstract word count: 250/250

1   Abstract
2
3   Objective: To examine the relationship between perceived neighborhood social cohesion (NSC) and intentions to obtain seasonal
4   influenza and COVID-19 vaccines among US adults post COVID-19 pandemic.
5
6   Methods: We conducted a cross-sectional, nationally representative survey of US residents (N=2,189) in May 2023 on their perceived
7   NSC, COVID-19 and seasonal influenza vaccination intentions, healthcare access, perceived risk of COVID-19 or flu infection,
8   loneliness, and trust in doctors. We used bivariate probit regressions to examine joint associations between perceived NSC and
9   intentions to receive influenza and COVID-19 vaccines, controlling for several participant characteristics (e.g., race).
10
11   Results: 2,164 respondents provided consent to study questions. Trust-related NSC (trust in neighbors) was positively associated with
12   intentions to become vaccinated against both influenza and COVID-19 viruses. Higher relational NSC (perception of a close-knit
13   neighborhood) was positively associated while higher value-based NSC (perception that neighbors share the same values) was
14   negatively associated with intentions to become vaccinated against COVID-19. Healthcare access, perceived risk of infection
15   (COVID-19 or flu), and trust in doctors were positively associated with intentions to become vaccinated against both viruses.
16
17   Conclusions: In a post-pandemic era, higher trust-related and relational, perceived NSC (vaccine-dependent), greater access to
18   healthcare, higher perceived risk of infection, and greater trust in doctors were related to higher influenza and COVID-19 vaccination
19   intentions, while higher value-based NSC was related to lower COVID-19 vaccination intentions among US adults. Thus, specific
20   aspects of NSC, healthcare access barriers, misinformation on infection risk, and medical mistrust may influence an individual's
21   willingness and ultimate decision to become vaccinated.
22
23
24   Key words: neighborhood social cohesion, seasonal influenza vaccine, COVID-19 vaccine, loneliness, risk perceptions, medical trust,
25   healthcare access, psychosocial determinants, preventive healthcare use, COVID-19 pandemic
26

1. Introduction

1.1. Neighborhood social cohesion during the COVID-19 pandemic

Neighborhood social cohesion (NSC) is a construct capturing shared values, relationships, and norms of community residents, built upon trust, reciprocal actions, and a sense of belonging among neighbors.[1] Socially cohesive neighborhoods may foster inclusive and supportive environments where neighbors improve their quality of life by addressing common concerns and advocating for local initiatives. This perceived cohesiveness and unity may be crucial during traumatic events, such as the COVID-19 pandemic. During early stages of the pandemic, NSC manifested in community efforts like social distancing, mask wearing, and delivering personal protective equipment to those at greater infection risk.

Concurrently, some communities became less connected during the pandemic due to isolation, differences in political beliefs, pandemic-related harassment,[2] and contentions over COVID-19 prevention strategies (e.g., vaccine). These issues were examined in England, where NSC appeared to decline during the early pandemic period (June 2020) compared to pre-pandemic levels.[3] The relationship between NSC and US preventive healthcare use, particularly for COVID-19 and influenza vaccination, has not been examined.

1.2. NSC and Social Capital Theory

While NSC is a neighborhood-level construct which focuses on the quality of relationships within a community and may bolster an individual's capacity to gain social capital, social capital represents the value of relationships for accessing resources, opportunities, and information within and outside a community, thus encompassing broader social networks.[4] Greater NSC promotes connectiveness among residents, social trust, and participation in communal activities; thus, possibly contributing to human capital gains as posited in Social Capital Theory.[5] Social capital includes diverse connections that may increase access to health resources and support, promoting healthy environments. Additionally, social capital is a social determinant of community health regardless of individual characteristics, buffers against socioeconomic health inequalities, and mitigates negative health effects following health crises.[6]

49 1.3. NSC health-protective properties

50   The US Department of Health and Human Services recognizes social cohesion as a critical component for maintaining

51 individual health-protective behaviors (e.g., vaccinations).[7] NSC may influence an individual's desire and participation in preventive

52 healthcare use by promoting collective advocacy for health resources, increasing dissemination of health-related information,

53 providing greater psychosocial support, and increasing self-efficacy. Moreover, strong, dense social networks were associated with

54 healthy habit formation,[8] and increased resilience to loneliness and depression.[9–11] For example, greater NSC was associated with

55 uptake of COVID-19 vaccines among Australian adults,[12] higher likelihood to obtain influenza vaccinations among US adults,[13] and

56 stronger antibody response to the COVID-19 vaccine among British adults.[9]

57 1.4. NSC and vaccination in the US

58   Safe and effective vaccines are available in the US to protect against morbidity and mortality associated with COVID-19 and

59 influenza; however, achieving high uptake of these vaccines remains a challenge.[14] While the Centers for Disease Control and

60 Prevention recommended the 2023-2024 COVID-19 bivalent booster and influenza vaccines to protect against severe illness, only

61 22.5% and 48.3% of US adults reported receiving the COVID-19 and influenza vaccines, respectively, as of March 2024.[14] US

62 influenza vaccination rates remain well below current Healthy People's 2030 goal of 70% of residents vaccinated. While there is no

63 Healthy People goal for COVID-19, vaccination remains recommended for eligible individuals.[15] Post-pandemic mistrust in vaccines

64 could also affect vaccine uptake, making this period crucial for examining factors associated with vaccination likelihood. Many efforts

65 in the US have focused on individual factors or community structural vulnerability,[16] leaving an important question unanswered: do

66 community social ties affect vaccination uptake?

67 1.5. Additional factors affecting vaccine uptake

68   Other health and demographic factors (e.g., race) are related to uptake of influenza[17] and COVID-19 vaccinations.[18] For

69 example, perceived risk of COVID-19 infection was associated with acceptance of and intentions to receive the COVID-19 vaccine.[18–]

70   [20] Also, loneliness among older adults during the pandemic was associated with reduced uptake of the COVID-19 vaccine.[9,21]

71   Moreover, doctor-patient trust was associated with increased uptake of COVID-19 and influenza vaccines.[22–24]

72   1.6. Research aims

73   To our knowledge, limited research has examined the role of NSC in individuals' vaccination intentions for COVID-19 and

74   influenza. Existing research has primarily focused on populations outside the US.[12,25,26] For example, a study in Australia found

75   associations between NSC and increased willingness to become vaccinated against influenza[13] and COVID-19 viruses.[12] Studies

76   examining US residents have focused on sub-populations (e.g., COVID-19 vaccination rates among Black individuals in Chicago),[27]

77   or examined the relationship between COVID-19 vaccination rates and social capital or social trust, rather than NSC.[28–32]

78   Thus, we examined how perceived NSC is associated with individuals' intentions to obtain COVID-19 booster and seasonal

79   influenza vaccines in the fall/winter of 2023 among a large, nationally representative US adult sample. These vaccination intentions

80   were examined independently and jointly. We believe this is the first study to examine three dimensions of NSC (trust, relational, and

81   value-based) to better understand the complex dynamics between NSC and intentions to receive vaccines. Also, to our knowledge, no

82   studies have considered unobserved factors influencing vaccination intentions by jointly modeling vaccination intentions for influenza

83   and COVID-19. We hypothesize that perceived NSC will be positively associated with intentions to obtain an influenza and COVID-

84   19 vaccine across all three dimensions of NSC, controlling for sociodemographic and health-status covariates, and several exploratory

85   variables: healthcare access, risk perceptions of COVID-19 or flu infection, loneliness, and trust in doctors. We hypothesize that these

86   associations will remain robust when jointly estimating both vaccination intentions.

87

88   2. Methods

89   2.1. Data

90   The global market research firm, Ipsos, conducted a cross-sectional, representative survey (N=2,189) of US adults aged 18-75

91   using its Global Omnibus panel from May 24-26th, 2023. Due to a lack of consent for some questions used in analysis (N=25), the

92   final study sample was reduced (N=2,164). The survey period was marked by the end of the US public health emergency, a decrease

93   in COVID-19 infections, hospitalizations, and deaths, and wide availability of COVID-19 vaccines. Our survey was designed to

94   examine health-related behaviors and their determinants as the pandemic wanes, including NSC, intentions to receive vaccines

95   (COVID-19 and influenza), healthcare access, risk perceptions of COVID-19 or flu infection, loneliness, and trust in doctors.

96   Participants were recruited until quotas for age, gender, region, and working status were met. Additional surveys were sent to specific

97   respondent quota groups to meet sample requirements. Respondents' demographic information (e.g. gender) was supplied by Ipsos.

98   Study participants completed the web-based survey using their preferred method (e.g., mobile device). To create a representative

99   sample of US adults, sampling quotas were set on age, gender, region, and working status. To account for the offline US population

100   excluded from participation in the survey, Ipsos supplied survey weights based on gender within age groups, working status,

101   household income, and region. The study protocol was approved by the [REDACTED] Institutional Review Board.

102   2.2. Measures

103   The primary dependent variables were intentions to receive the COVID-19 and influenza vaccines. The primary explanatory

104   variable was perceived NSC. Additional explanatory variables included healthcare access, perceived risk of COVID-19 or flu

105   infection, loneliness, and trust in doctors. Controls included gender, race, rurality, age, ethnicity, presence of children, marital status,

106   work status, US region, household income, and self-reported mental and physical health status (Table 1).

107   *2.2.1 Vaccination intentions*

108   Participants were asked: *How likely or unlikely would you personally be to get the following vaccines in the fall/winter of*

109   *2023?*

110   *1.COVID-19 booster (if recommended for annual seasonal boosters)*

111   *2.Seasonal flu (influenza)*

112   Participants responded on a 4-point Likert Scale ('very likely' to 'not at all likely', 'don't know', or 'prefer not to say'); responses

113   were combined to create binary variables ('not very'/'not at all likely' versus 'very'/'fairly likely'. 'Don't know' and 'prefer not to

114   say' responses were dropped from models after confirming lack of sample selection bias using the inverse mills ratio method.[33]

115   *2.2.2. Perceived NSC*

116   Participants responded to the following about their neighborhood: 1.*This is a close-knit neighborhood 2.People around here*

117   *are willing to help their neighbors. 3.People in this neighborhood generally don't get along with each other. 4.People in this*

118   *neighborhood do not share the same values. 5.People in this neighborhood can be trusted.* Responses were on a 4-point Likert scale

119   from 'strongly disagree' to 'strongly agree'. This question is from the National Institutes of Health (NIH) Rapid Acceleration of

120   Diagnostics for Underserved Populations (RADx-UP), common data elements (CDEs):[34] Questions 1-3 were classified as relational, 4

121   as value-based, and 5 as trust-related NSC. Questions 3 and 4 were reverse coded. The scale as a whole demonstrated good internal

122   consistency (Cronbach α=0.83),[35] and construct validity (i.e., strong association with informal social control; r=0.80, *P*<0.001).[36]

123   *2.2.3 Additional explanatory variables*

124   For healthcare access, participants were asked: *Do you have a doctor or nurse who you usually see if you need a check-up,*

125   *want advice about a health problem, or get sick or hurt?* Responses included 1-'yes', 2-'no', or 3-'prefer not to say'. Second,

126   participants were asked: *What is your primary kind of health insurance or health care plan now?* Responses were 0-'I do not have

127   health insurance', 1-'private (purchased directly or through employment)', 2-'public (Medicare, Medicaid, Tricare)', 3-'don't know',

128   or 4-'prefer not to say'. These were CDEs drawn from the National Heart, Lung, and Blood Institute and the NIH RADx-UP,

129   respectively.[34] For risk perceptions of infection (COVID-19 and influenza), participants were asked the following for each virus: *What*

130   *would you say the risk is of you personally becoming infected with the following types of illness in the next 12 months?* Participants

131   responded on a scale from 0-'no risk' to 100-'extreme risk', 'don't know', or 'not applicable', similar to previous literature assessing

132   lung cancer risk.[37] For loneliness, participants were asked the following from the revised University of California Los Angeles

133   Loneliness Scale: 1.*How often do you feel that you lack companionship? 2.How often do you feel left out? 3.How often do you feel*

134   *isolated from others?* Responses were 'hardly ever,' 'some of the time,' and 'often'.[38] For trust in doctors, participants were asked: *Do*

135   *you trust your doctor to take care of people's problems?*, a CDE derived from the NIH Phenotypes for Exposures Toolkit.[34] Responses

136   were 'a lot,' 'most of the time,' 'not very much,' or 'don't know'.

137   2.3. Empirical specification

138   Our empirical strategy assumes intentions to receive COVID-19 and influenza vaccines are dependent on several observable

139   and unobservable factors. Let ψ_i stand for intentions to obtain COVID-19 and influenza vaccines in the fall/winter of 2023 with ($_i$)

140   denoting specification at the individual level. Our main interest is the effects of perceived NSC (ρ_i) as a vector of five questions

141   pertaining to NSC on likelihood to obtain a COVID-19 or influenza vaccine (ψ_i). Models include a set of controls (λ_i) (gender, race,

142   rurality, age, ethnicity, presence of children, marital status, work status, US region, household income, and self-reported mental and

143   physical health status), a vector of healthcare access to include access to a healthcare provider and insurance status (v_i), a vector of risk

144   perceptions of illness (COVID-19 or influenza specific to vaccine type) (ρ_i), a vector of three questions pertaining to loneliness (χ_i),

145   and one item regarding trust in doctors (Ω_i). The error term (ε_v) accounts for unspecified, unobserved variables. The full estimation is:

146       $\psi_i = \beta_0 + \rho_i\beta_1 + \lambda_i\beta_{2+} v_i\beta_{3+} \rho_i\beta_4 + \chi_i\beta_5 + \Omega_i\beta_6 + \varepsilon_{vi}$

147   The error term has the subscript ($_{vi}$) to denote variations at the individual level and according to each vaccination intention (ψ_i)

148   specification. Estimation was performed for each vaccination type separately; however, COVID-19 and influenza vaccination

149   intentions demonstrated moderate to high pairwise correlation (0.593, $p<0.001$). Therefore, we estimated vaccination intentions jointly

150   assuming each specifications' error terms (ε_v) were correlated.

151   2.4. Analysis

152   Survey sample weights were used to estimate means for model variables. In multivariate analysis, we ran hierarchical, ordinary

153   least squares (OLS) regressions for each vaccine type. Then, we ran bivariate probits to estimate vaccination intentions jointly and

154   allow for explanatory variables specific to each vaccine type (risk perceptions of COVID-19 vs. influenza). All models used

155 bootstrapped standard errors and 200 iterations to allow for within sample correlation. Missing values were removed when running

156 regressions.

157 Model goodness of fit was assessed using Wald chi-square values, adjusted R^2, and variance inflation factors to test for

158 multicollinearity using OLS models, and rho value and its likelihood ratio test to ensure appropriateness of bivariate probit estimation.

159 We report hierarchical regressions adding explanatory variables to demonstrate parameter stability (Tables 2 & 3). Coefficient and

160 bootstrapped standard errors are presented for all models (Tables 2-4 & 2A). A p-value of 0.05 determined statistical significance. All

161 analyses were conducted in STATA 17.0.

162

163 3. Results

164 3.1. Study sample characteristics

165 The study sample varied by age (mean=45.6, range=18-75 years), gender (women-50.8%, men-48.5%, other-0.30%), and

166 marital status (e.g., married-50.5%, never married-27.8%, divorced/separated-9.50%). Most participants were White (79.1%), urban

167 residents (88.1%), non-Hispanic (85.9%), had no children (66.1%), were working (63.9%), and reported positive perceptions of their

168 mental and physical health; participants reported good (35.6%; 46.7%) or very good (34.0%; 26.9%) mental or physical health,

169 respectively (Table 1A). Most reported intentions to obtain the COVID-19 (59.1%) and influenza (64.5%) vaccines in the fall/winter

170 of 2023 (Table 1). Overall, perceived NSC was high; most believed that people are willing to help their neighbors (82.8%), get along

171 with each other (77.7%), and are trustworthy (77.7%); however, beliefs about living in a close-knit neighborhood (agree/strongly

172 agree-55.5%), and neighbors sharing the same values (agree/strongly agree-55.3%) were split. Most had access to a medical provider

173 (77.7%) and had public (38.9%) or private (50.1%) insurance, compared to no insurance (6.5%). On average, perceived risk of

174 COVID-19 (39.5/100) and influenza infections (41.8/100) were moderate, and about half felt lonely 'some of the time' or 'often' –

175 lack companionship (51.1%), felt left out (50.7%), and felt isolated from others (50.7%). Last, most trusted doctors to take care of

176 people's problems (most of the time-59.1%; a lot-28.1%).

177 3.2. Perceived NSC and vaccination intentions

178 The roles of perceived NSC in vaccination intentions varied by vaccine type and NSC dimension (Tables 2 & 3, columns 4).

179 Trust in people in their neighborhood (trust dimension) was positively associated (b=0.06, $P<0.05$) with influenza, while perceiving

180 their neighborhood to be close-knit (relational dimension) was positively associated (b=0.06, $P<0.05$) with COVID-19 vaccination

181 intentions. Also, perceptions that neighbors share the same values (value-based dimension) was negatively associated (b=-0.07,

182 $P<0.01$) with COVID-19 vaccination intentions. Relational and value-based NSC were not associated with influenza while trust-based

183 NSC was not associated with COVID-19 vaccination intentions.

184 Other explanatory variables had consistent results across both vaccine types. For healthcare access, not having a doctor (vs.

185 having a doctor) (b=-0.11, $P<.001$) for influenza (b=-0.07, $P<0.05$ for COVID-19) was negatively associated, and having private

186 (b=0.12, $P<0.05$; b=0.13, $P<0.01$) or public (b=0.11, $P<0.05$; b=0.09, $P<0.05$) insurance (vs. no insurance) were positively associated

187 with influenza and COVID-19 vaccination intentions. Perceived risk of influenza (b=0.00, $P<.001$) and COVID-19 (b=0.00, $P<0.001$)

188 infection were positively associated with intentions to become vaccinated against that virus. Lacking companionship 'some of the

189 time' or 'often' (vs. 'hardly ever') was positively associated (b=0.05, $P<0.05$) with COVID-19 vaccination intentions while feeling

190 left out or isolated was not associated with COVID-19 vaccination intentions. All three items pertaining to loneliness were not

191 associated with influenza vaccination intentions. Lastly, trusting in doctors 'most of the time' (b=0.25, $P<.001$; b=0.18, $P<.001$) or 'a

192 lot' (b=0.41, $P<.001$; b=0.39, $P<.001$) (vs. 'not very much') were positively associated with influenza and COVID-19 vaccination

193 intentions. Overall, trust in doctors had the largest effect size regarding the association with individuals' vaccination intentions.

194 The bivariate probit specification (Tables 4 & 2A) demonstrated overall robustness of these findings and a positive association

195 between unobservable factors for intentions to receive both vaccines (ρ(s.e.) 0.74, 0.03). NSC demonstrated a stronger association with

196 COVID-19 vaccination intentions; more components of NSC (3 of 5 – relational, value-based, and trust dimensions) were significantly

197 associated with COVID-19 vaccination intentions than when analyzed separately (2 of 5 – relational, value-based). Further, perceived

198 risk of influenza (b=0.01, $P<.001$) and COVID-19 (b=0.01, $P<.001$) infection remained positively associated with intentions to

199 become vaccinated against that virus. In terms of healthcare access, not having a doctor (vs. having a doctor) (b=-0.32, *P*<0.01)

200 remained negatively associated with influenza vaccination intentions only, while having private (b=0.51, *P*<0.01) or public (b=0.40,

201 *P*<0.05) insurance (vs. no insurance) remained positively associated with COVID-19 vaccination intentions only. Loneliness and

202 COVID-19 vaccination intentions became non-significant.

203 4. Discussion

204   This study employed a nationally representative survey of US adults to examine associations between three dimensions of

205 perceived NSC and COVID-19 and influenza vaccination intentions as severity of the COVID-19 pandemic waned. While most US

206 residents had high trust-related NSC, value-based and relational NSC varied. Most intended to receive the COVID-19 and influenza

207 vaccines in the fall/winter of 2023.

208   When both vaccination intentions were estimated jointly, higher perceived risk of COVID-19 and influenza, and greater trust

209 in doctors were associated with greater intentions to become vaccinated against COVID-19 and influenza. Having a doctor was

210 associated with influenza vaccination intentions, while having public or private insurance was associated with COVID-19 vaccination

211 intentions only. Only the trust dimension of NSC was associated with influenza vaccination intentions, while items from all three

212 dimensions of NSC (trust, relational, and value-based) were associated with COVID-19 vaccination intentions. Thus, NSC may play a

213 greater role in COVID-19 vaccination intentions than in influenza. Specifically, greater trust in neighbors was associated with greater

214 COVID-19 and influenza vaccination intentions. However, perceiving one's neighborhood to be close-knit (relational) was associated

215 with *greater* intentions, but perceiving neighbors to share the same values (value-based) was associated with *fewer* intentions to

216 vaccinate against COVID-19, perhaps due to polarization of communities across political and religious lines.[39] Thus, an individual's

217 decision to become vaccinated against COVID-19 may depend on appraised beliefs and values of the surrounding community and on

218 whether these values are shared.

219   Similar to our findings, previous research has found greater perceived NSC was associated with greater uptake and acceptance

220 of COVID-19 vaccines,[12,25] and greater likelihood of obtaining influenza vaccines.[13] These studies examined Australian,[12] older

221 Chinese,[25] and older American adults during the pandemic, post-pandemic, and pre-pandemic, respectively.[13] While this study

222 examined individual aspects of NSC, previous studies measured NSC as a single composite score derived from

223 multidimensional/multi-item scales with similar (trust-related) and different (neighborhood attractiveness) items. Other studies found

224 individual values, social capital, political polarization, barriers to reliable vaccine information, risk perceptions, and health-protective

225 behaviors to be associated with COVID-19 vaccination intentions.[26,28–32]

226   Unobserved factors related to COVID-19 and influenza vaccination intentions were strongly associated, suggesting that

227 individuals' intentions to become vaccinated against COVID-19 and influenza are due to similar underlying reasons. Previous

228 research found increasing NSC to be associated with greater preventive healthcare use, including higher likelihood to obtain influenza

229 vaccinations, but did not explore how different types of preventive healthcare use might be jointly related by unobserved factors.[13]

230   Greater healthcare access (having a doctor for influenza and insurance coverage for COVID-19 vaccination intentions), higher

231 risk perceptions of illness, and trust in doctors were associated with greater intentions to become vaccinated against both illnesses.

232 Prior research has demonstrated similar findings regarding perceived risk of COVID-19 infection and vaccination acceptance and

233 intentions [18–20] as well as strong trust in doctors and increased uptake of both vaccines.[22–24]

234 4.1. Limitations

235   First, cross-sectional data limit our ability to make causal inferences and observe changes in NSC and vaccine intentions over

236 time. Second, vaccination intentions do not equate to actual vaccination behaviors, thus additional information (e.g., vaccination

237 history from medical records) is needed to determine whether greater perceived NSC is also associated with vaccination uptake. Third,

238 lack of sample size and data prevented better understanding of how politically and religiously shared values influence vaccination

239 decisions. Also, greater theoretical and psychometric testing is needed to further develop and validate the unique dimensions of NSC.

240 Last, social desirability bias may have influenced participants' vaccination intentions despite survey administration efforts to minimize

241 bias (e.g., ensure anonymity).

242   While the models presented do not incorporate all factors associated with vaccination intentions following the pandemic and

243   were limited to survey questions, rigorous empirical strategy ensured robustness of results. Other parameters like perceived vaccine

244   effectiveness and previous vaccination could strengthen model specifications. Although the effects of perceived NSC on individuals'

245   vaccination intentions were modest (e.g., 19.1% increase in COVID-19 vaccination intentions associated with 1-unit increase in

246   relational NSC; Table 4), the population-level impact could be substantial (19,100 out of 100,000 people more willing to receive

247   COVID-19 vaccines).

248

249   5. Conclusion

250   Understanding how NSC can mitigate the negative, long-term impacts of the pandemic is particularly valuable, given that the

251   pandemic exacerbated existing health disparities for many communities. We believe this study is the first to examine multiple

252   dimensions of NSC to better understand the complex dynamics between NSC and vaccination intentions and to consider unobserved

253   factors influencing vaccination intentions by jointly modeling vaccination intentions for influenza and COVID-19. Our findings

254   suggest that efforts to promote vaccination intentions, should go beyond addressing individual beliefs and hesitancy and address

255   factors that build neighborhood-level cohesion, address healthcare barriers, and reduce provider mistrust. Future studies should further

256   explore mechanisms (e.g., values, norms, etc.) underpinning the relationship between NSC and vaccination intentions. Furthermore,

257   longitudinal interventions are needed to verify the causal effects of NSC on and determine aspects of NSC most effective for driving

258   vaccination behavior.

259

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Table 1.

Weighted descriptive statistics of US adults aged 18-75 (N=2,189) from the Ipsos Online Omnibus panel – surveyed on intentions to vaccinate and perceived neighborhood social cohesion, post COVID-19 pandemic (May 24th-26th, 2023)

Dependent variables	n	Mean	Linearized SE
How likely or unlikely would you personally be to get the following vaccines in the fall/winter 2023?			
COVID-19 booster (if recommended for annual seasonal boosters)			
Not at all likely/not very likely	818	0.36	0.01
Very likely/fairly likely	1240	0.59	0.01
Don't know	77	0.03	0.00
Prefer not to say	29	0.01	0.00
Seasonal flu (influenza)			
Not at all likely/not very likely	742	0.32	0.01
Very likely/fairly likely	1345	0.65	0.01
Don't know	58	0.02	0.00
Prefer not to say	19	0.01	0.00
Exploratory variables	n	Mean	Linearized SE
Neighborhood social cohesion			
Please answer the following questions pertaining to your neighborhood:			
This is a close-knit neighborhood			
Strongly disagree/disagree	1022	0.45	0.01
Strongly agree/agree	1167	0.56	0.01
People around here are willing to help their neighbors			
Strongly disagree/disagree	427	0.17	0.01
Strongly agree/agree	1762	0.83	0.01
People in this neighborhood generally don't get along with each other			
Strongly disagree/disagree	1691	0.78	0.01
Strongly agree/agree	498	0.22	0.01
People in this neighborhood do not share the same values			

Strongly disagree/disagree	1181	0.55	0.01
Strongly agree/agree	1008	0.45	0.01

People in this neighborhood can be trusted

Strongly disagree/disagree	560	0.22	0.01
Strongly agree/agree	1629	0.78	0.01

Healthcare access

Do you have a doctor or nurse who you usually see if you need a check-up, want advice about a health problem, or get sick or hurt?

Yes	1661	0.78	0.01
No	464	0.20	0.01
Prefer not to say	39	0.02	0.00

What is your primary kind of health insurance or health care plan you have now?

I do not have health insurance	163	0.07	0.01
Private (purchased directly or through employment)	946	0.50	0.01
Public (Medicare, Medicaid, Tricare)	962	0.39	0.01
Don't know	51	0.02	0.00
Prefer not to say	42	0.02	0.00

Risk perception of infection

What would you say the risk is of you personally becoming infected with the following types of illness in the next 12 months? (0-100)

COVID-19	1929	39.5	0.70
Don't know	235	-	-
Seasonal Flu (Influenza)	1951	41.8	0.67
Don't know	213	-	-

Loneliness

How often do you feel that you lack companionship?

Hardly ever	1017	0.49	0.01
Some of the time/ Often	1172	0.51	0.01

How often do you feel left out?

Hardly ever	1034	0.49	0.01

Some of the time/ Often	1155	0.51	0.01
How often do you feel isolated from others?			
Hardly ever	1033	0.49	0.01
Some of the time/ Often	1156	0.51	0.01
<u>Trust in doctors</u>			
Do you trust doctors to take care of people's problems?			
A lot	584	0.28	0.01
Most of the time	1290	0.59	0.01
Not very much	269	0.11	0.01
Don't know	46	0.02	0.00
Controls	n	Mean	Linearized SE
<u>Gender</u>			
Male	1057	0.49	0.01
Female	1117	0.51	0.01
Other	7	0.00	0.00
Prefer not to say	8	0.00	0.00
<u>Race</u>			
White	1683	0.79	0.01
Black/African American	247	0.10	0.01
Native American/Alaska Native	40	0.02	0.00
Asian	102	0.05	0.01
Pacific Islander	19	0.01	0.00
Other	71	0.03	0.00
Prefer not to answer	26	0.01	0.00
No consent	1	0.00	0.00
<u>Rurality</u>			
Urban	1901	0.88	0.01
Rural	288	0.12	0.01
Age	2189	45.6	0.38

Ethnicity

Are you of Hispanic, Latino or of Spanish origin?

Hispanic	302	0.13	0.01
non-Hispanic	1863	0.86	0.01
Prefer not to say	23	0.01	0.00
No consent	1	0.00	0.00

Has children

No	1525	0.66	0.01
Yes	664	0.34	0.01

Marital status

Single, never married	714	0.28	0.01
Living with partner	205	0.09	0.01
Married	931	0.51	0.01
Widowed	78	0.03	0.00
Divorced or separated	261	0.10	0.01

Working

No	857	0.36	0.01
Yes	1332	0.64	0.01

US region

New England	102	0.05	0.01
Middle Atlantic	280	0.13	0.01
East North Central	313	0.14	0.01
West North Central	140	0.06	0.01
South Atlantic	443	0.20	0.01
East South Central	128	0.06	0.01
West South Central	268	0.12	0.01
Mountain	166	0.08	0.01
Pacific	349	0.17	0.01

Household income

<$5,000-$24,999	468	0.11	0.01
$25,000-$49,999	473	0.17	0.01
$50,000-$74,999	430	0.16	0.01
$75,000-$99,999	309	0.23	0.01
$100,000-$250,000+	409	0.29	0.01
Prefer not to say	100	0.04	0.00

<u>Self-reported health status</u>

How is your mental health in general (e.g., anxiety, depression, stress, eating disorders)? How would you say it is now?

Very poor	62	0.03	0.00
Poor	175	0.07	0.01
Fair	466	0.20	0.01
Good	755	0.36	0.01
Very Good	681	0.34	0.01
Don't know	15	0.01	0.00
Prefer not to say	10	0.00	0.00

How is your physical health (e.g., pain, disease) in general? How would you say it is now?

Very poor	31	0.01	0.00
Poor	115	0.04	0.00
Fair	503	0.20	0.01
Good	967	0.47	0.01
Very Good	534	0.27	0.01
Don't know	7	0.00	0.00
Prefer not to say	7	0.00	0.00

355 *Note*. SE = linearized standard error.
356 Due to lack of consent, data were missing (n=25) for COVID-19 and influenza vaccination intentions, risk perception of COVID-19 and influenza
357 infection, healthcare access to a doctor or nurse, primary healthcare insurance, and self-reported mental and physical health status. Survey weights,
358 provided by Ipsos, were used to account for the sampling design and calculate the mean and linearized standard errors. The mean represents the
359 proportion of participants for all categorical variables.

Table 2.

Associations between perceived neighborhood social cohesion and intentions to receive the influenza (flu) vaccine among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24th-26th, 2023) as part of the Ipsos Online Omnibus panel – Hierarchical regression results

Influenza (flu) vaccine	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[d]	
	Coef. 1 (SE)	z	Coef. 2 (SE)	z	Coef. 3 (SE)	z	Coef. 4 (SE)	z
Neighborhood social cohesion								
This is a close-knit neighborhood								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.03 (0.03)	1.57	0.01 (0.02)	0.55	0.01 (0.02)	0.65	-0.00 (0.02)	-0.07
People around here are willing to help their neighbors								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.01 (0.03)	0.23	0.00 (0.03)	-0.01	0.00 (0.03)	0.05	-0.00 (0.03)	-0.06
People in this neighborhood generally don't get along with each other								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.08 (0.03)	-2.95**	-0.04 (0.03)	-1.66	-0.04 (0.03)	-1.28	-0.04 (0.03)	-1.41
People in this neighborhood do not share the same values								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.03 (0.02)	-1.22	-0.02 (0.02)	-0.93	-0.02 (0.02)	-0.87	-0.03 (0.03)	-1.27
People in this neighborhood can be trusted								
Strongly disagree/disagree vs.								

	(1)		(2)		(3)		(4)	
Strongly agree/agree	0.08 (0.03)	2.38*	0.09 (0.03)	2.97**	0.09 (0.03)	3.38**	0.06 (0.03)	2.24*
Have a doctor								
Yes vs.								
No	-0.19 (0.03)	-6.54***	-0.17 (0.03)	-5.99***	-0.17 (0.03)	-5.84***	-0.11 (0.03)	-3.88***
Primary health insurance								
I do not have health insurance vs.								
Private	0.14 (0.05)	3.23**	0.15 (0.04)	3.27**	0.15 (0.05)	3.29**	0.12 (0.05)	2.54*
Public	0.13 (0.04)	3.13**	0.15 (0.04)	3.13**	0.15 (0.05)	3.19**	0.11 (0.05)	2.36*
Risk of influenza infection			0.00 (0.00)	11.23***	0.00 (0.00)	9.85***	0.00 (0.00)	10.05***
Loneliness								
Lack companionship								
Hardly ever vs.								
Some of the time/ Often					0.05 (0.03)	1.66	0.05 (0.03)	1.95
Feel left out								
Hardly ever vs.								
Some of the time/ Often					0.03 (0.03)	0.96	0.03 (0.03)	1.08
Feel isolated								
Hardly ever vs.								
Some of the time/ Often					0.00 (0.03)	-0.02	0.00 (0.03)	0.01
Trust in doctors								
Not very much vs.								
Most of the time							0.25 (0.03)	7.23***
A lot							0.41 (0.04)	10.9***

Model statistics	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
Observations (N)	2087	1900	1900	1900
Replications	200	197	195	197
Adjusted R^2	0.08	0.14	0.14	0.20
Wald Chi^2	471.63	569.79	576.24	953.66
Significance	p<0.001	p<0.001	p<0.001	p<0.001

*p<.05. **p<.01. ***p<.001

Note. *SE*=bootstrapped standard error

[a] Model 1 includes social cohesion and healthcare access

[b] Model 2 adds risk of seasonal influenza (flu) infection

[c] Model 3 adds loneliness

[d] Model 4 (final model) adds trust in doctors

Table 2 shows the results for the ordinary least squares regressions with bootstrapped standard errors. All models (1-4) control for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status. Variance inflation factor is less than 10 for all models and 5.40 for Model 4.

Table 3.
Associations between perceived neighborhood social cohesion and intentions to receive the COVID-19 booster vaccine among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24th-26th, 2023) as part of the Ipsos Online Omnibus panel - Hierarchical regression results

COVID-19 booster vaccine	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[d]	
	Coef. 1 (SE)	z	Coef. 2 (SE)	z	Coef. 3 (SE)	z	Coef. 4 (SE)	z
Neighborhood social cohesion								
This is a close-knit neighborhood								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.07 (0.02)	3.11**	0.07 (0.02)	2.64**	0.07 (0.02)	3.05**	0.06 (0.03)	2.53*
People around here are willing to help their neighbors								
Strongly disagree/disagree vs.								
Strongly agree/agree	-0.01 (0.03)	-0.24	-0.01 (0.03)	-0.29	-0.01 (0.03)	-0.21	-0.01 (0.04)	-0.45
People in this neighborhood generally don't get along with each other								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.08 (0.02)	-2.58*	-0.03 (0.03)	-1.14	-0.02 (0.03)	-0.74	-0.02 (0.03)	-0.64
People in this neighborhood do not share the same values								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.07 (0.02)	-3.04**	-0.06 (0.02)	-2.72**	-0.06 (0.02)	-2.25*	-0.07 (0.02)	-2.87**
People in this neighborhood can be trusted								
Strongly disagree/disagree vs.								

	Coef. (SE)	t	Coef. (SE)	t	Coef. (SE)	t	Coef. (SE)	t
Strongly agree/agree	0.09 (0.03)	2.99**	0.09 (0.03)	2.81**	0.09 (0.03)	2.61**	0.06 (0.03)	1.87
Have a doctor								
Yes vs.								
No	-0.22 (0.03)	-4.57***	-0.12 (0.03)	-3.96***	-0.12 (0.03)	-4.27***	-0.07 (0.03)	-2.20*
Primary health insurance								
I do not have health insurance vs.								
Private	0.17 (0.05)	3.93***	0.16 (0.05)	3.35**	0.16 (0.04)	3.35**	0.13 (0.05)	2.85**
Public	0.14 (0.04)	3.27**	0.13 (0.05)	2.88**	0.13 (0.05)	2.72**	0.09 (0.05)	2.08*
Risk of COVID-19 infection			0.00 (0.00)	12.3***	0.00 (0.00)	11.4***	0.00 (0.00)	11.0***
Loneliness								
Lack companionship								
Hardly ever vs.								
Some of the time/ Often					0.05 (0.03)	1.59	0.05 (0.03)	1.98*
Feel left out								
Hardly ever vs.								
Some of the time/ Often					0.04 (0.03)	1.23	0.03 (0.03)	1.01
Feel isolated								
Hardly ever vs.								
Some of the time/ Often					0.01 (0.04)	0.19	0.01 (0.03)	0.38
Trust in doctors								
Not very much vs.								
Most of the time							0.18 (0.03)	4.76***
A lot							0.39 (0.04)	9.47***

Model statistics	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
Observations (N)	2058	1854	1854	1854
Replications	198	198	197	198
Adjusted R^2	0.07	0.14	0.15	0.20
Wald Chi^2	324.45	715.03	627.37	1095.27
Significance	p<0.001	p<0.001	p<0.001	p<0.001

*p<.05. **p<.01. ***p<.001.

Note. *SE*=bootstrapped standard error

[a] Model 1 includes social cohesion and healthcare access

[b] Model 2 adds risk of COVID-19 infection

[c] Model 3 adds loneliness

[d] Model 4 (final model) adds trust in doctors

Table 3 shows the results for the ordinary least squares regressions with bootstrapped standard errors. All models (1-4) control for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status. Variance inflation factor is less than 10 for all models and 5.32 for Model 4.

Table 4.
Associations between perceived neighborhood social cohesion and intentions to receive the COVID-19 booster and influenza (flu) vaccines among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24th-26th, 2023) as part of the Ipsos Online Omnibus panel - Bivariate probit regression results

	COVID-19 booster		Seasonal Influenza (flu)	
	Coef. (SE)	z	Coef. (SE)	z
Neighborhood social cohesion				
This is a close-knit neighborhood				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19 (0.08)	2.32*	-0.01 (0.07)	-0.09
People around here are willing to help their neighbors				
Strongly disagree/disagree vs.				
Strongly agree/agree	-0.06 (0.11)	-0.54	0.04 (0.11)	0.34
People in this neighborhood generally don't get along with each other				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.11 (0.10)	-1.13	-0.15 (0.10)	-1.62
People in this neighborhood do not share the same values				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.22 (0.09)	-2.65**	-0.14 (0.09)	-1.63
People in this neighborhood can be trusted				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19 (0.08)	1.99*	0.23 (0.10)	2.24*
<u>Have a doctor</u> (Yes vs.)				
No	-0.14 (0.10)	-1.51	-0.32 (0.09)	-3.39**
Prefer not to say	0.00 (0.05)	0.03	-0.04 (0.12)	-0.38

Primary health insurance (I do not have health insurance vs.)					362
Private	0.51 (0.14)	3.15**	0.31 (0.15)	1.75	
Public	0.40 (0.15)	2.30*	0.29 (0.16)	1.60	
Don't Know	0.01 (0.04)	0.24	0.08 (0.09)	0.86	
Prefer not to say	0.01 (0.05)	0.24	0.10 (0.10)	1.08	
Perceived risk of COVID-19/flu infection	0.01 (0.00)	8.79***	0.01 (0.00)	8.22***	
Loneliness					
Lack companionship (Hardly ever vs.)					
Some of the time/ Often	0.16 (0.10)	1.62	0.18 (0.10)	1.82	
Feel left out (Hardly ever vs.)					
Some of the time/ Often	0.10 (0.12)	0.89	0.08 (0.12)	0.84	
Feel isolated (Hardly ever vs.)					
Some of the time/ Often	0.06 (0.13)	0.53	0.02 (0.11)	0.15	
Trust in doctors (Not very much vs.)					
Most of the time	0.55 (0.12)	4.62***	0.74 (0.12)	6.14***	
A lot	1.27 (0.15)	9.60***	1.35 (0.15)	9.94***	
Don't know	0.08 (0.07)	1.18	-0.09 (0.10)	-0.90	
Model statistics					
Observations (N)					1790
Replications					196
Rho (SE)					0.74 (0.03)
Wald test of rho (Chi2)					1403.43
Significance					p<0.001
Loglikelihood					-1705.11

*p<.05. **p<.01. ***p<.001
Note. *SE*=bootstrapped standard error
The model controls for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status.

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Table 1A.
Weighted descriptive statistics of US adults aged 18-75 (N=2,189) from the Ipsos Online Omnibus panel – surveyed on intentions to vaccinate and perceived neighborhood social cohesion, post COVID-19 pandemic (May 24th-26th, 2023) – non-transformed dependent variables

Dependent variables	n	Mean	Linearized SE
How likely or unlikely would you personally be to get the following vaccines in the fall/winter 2023?			
COVID-19 booster (if recommended for annual seasonal boosters)			
Not at all likely	551	0.24	0.01
Not very likely	267	0.12	0.01
Fairly likely	383	0.19	0.01
Very likely	857	0.41	0.01
Don't know	77	0.03	0.00
Prefer not to say	29	0.01	0.00
Seasonal flu (influenza)			
Not at all likely	468	0.20	0.01
Not very likely	274	0.12	0.01
Fairly likely	384	0.18	0.01
Very likely	961	0.47	0.01
Don't know	58	0.02	0.00
Prefer not to say	19	0.01	0.00

Note. SE = linearized standard error.
Due to lack of consent, data were missing (n=25) for COVID-19 and influenza vaccination intentions. Survey weights, provided by Ipsos, were used to account for the sampling design and calculate the mean and linearized standard errors. The mean represents the proportion of participants.

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Table 2A.
Associations between perceived neighborhood social cohesion and intentions to receive the COVID-19 booster and influenza (flu) vaccines among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24th-26th, 2023) as part of the Ipsos Online Omnibus panel - Bivariate probit regression results

	COVID-19 booster		Seasonal Influenza (flu)	
	Coef. (SE)	z	Coef. (SE)	z
Neighborhood social cohesion				
This is a close-knit neighborhood				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19(0.08)	2.32*	-0.01 (0.07)	-0.09
People around here are willing to help their neighbors				
Strongly disagree/disagree vs.				
Strongly agree/agree	-0.06 (0.11)	-0.54	0.04 (0.11)	0.34
People in this neighborhood generally don't get along with each other				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.11 (0.10)	-1.13	-0.15 (0.10)	-1.62
People in this neighborhood do not share the same values				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.22 (0.09)	-2.65**	-0.14 (0.09)	-1.63
People in this neighborhood can be trusted				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19 (0.08)	1.99*	0.23 (0.10)	2.24*
Gender (male vs.)				
Female	0.00 (0.01)	0.06	-0.02 (0.02)	-0.77
Other	-0.04 (0.03)	-1.42	0.37 (0.13)	2.83**

	Estimate (SE)	t	Estimate (SE)	t
Prefer not to say	0.12 (0.12)	1.05	0.24 (0.24)	0.98
Race (White vs.)				
Black/African American	0.01 (0.01)	0.82	0.05 (0.04)	1.35
Native American/Alaska Native	-0.00 (0.03)	-0.01	0.03 (0.09)	0.37
Asian	0.02 (0.02)	0.80	0.08 (0.04)	1.96*
Pacific Islander	0.02 (0.06)	0.37	0.11 (0.13)	0.87
Other	0.04 (0.04)	1.03	0.09 (0.06)	1.44
Prefer not to say	0.10 (0.08)	1.29	-0.20 (0.12)	-1.69
Urban (vs. rural)	0.00 (0.01)	0.00	0.07 (0.03)	2.20*
Age^2	0.00 (0.00)	1.12	0.00 (0.00)	2.50*
Ethnicity (Hispanic vs.)				
Non-Hispanic	0.00 (0.01)	0.31	-0.06 (0.03)	-1.78
Prefer not to say	-0.01 (0.05)	-0.13	0.09 (0.13)	0.66
Has Children (vs. no)	0.01 (0.01)	0.85	-0.06 (0.03)	-1.95
Working (vs. no)	0.01 (0.01)	0.60	-0.01 (0.03)	-0.25
Marital status (single, never married vs.)				
Living with partner	0.02 (0.02)	0.78	-0.05 (0.05)	-1.20
Married	-0.02 (0.01)	-1.27	0.02 (0.03)	0.73
Widowed	0.01 (0.03)	0.24	-0.01 (0.06)	-0.08
Divorced or separated	-0.01 (0.02)	-0.69	-0.04 (0.04)	-1.06
US Region (New England vs.)				
Middle Atlantic	0.01 (0.02)	0.53	-0.12 (0.06)	-2.16*
East North Central	-0.01 (0.02)	-0.42	-0.10 (0.05)	-1.87
West North Central	0.01 (0.02)	0.33	-0.06 (0.06)	-0.89
South Atlantic	0.00 (0.02)	0.23	-0.14 (0.05)	-2.66**
East South Central	0.02 (0.03)	0.59	-0.16 (0.06)	-2.63**
West South Central	0.03 (0.02)	1.27	-0.10 (0.05)	-1.85
Mountain	-0.01 (0.02)	-0.31	-0.14 (0.06)	-2.23*
Pacific	0.01 (0.02)	0.34	-0.07 (0.05)	-1.45

Household income (<$5,000-$24,999 vs.)				
$25,000-$49,999	0.01 (0.02)	0.39	-0.03 (0.04)	-0.77
$50,000-$74,999	0.01 (0.01)	0.41	-0.03 (0.04)	-0.75
$75,000-$99,999	-0.00 (0.01)	-0.41	0.02 (0.03)	0.48
$100,000-$250,000+	0.00 (0.01)	0.19	0.02 (0.03)	0.72
Prefer not to say	0.03 (0.03)	1.08	0.07 (0.06)	1.06
Mental health status (very poor/poor/fair vs.)				
Good/very good	-0.00 (0.01)	-0.06	-0.03 (0.03)	-0.92
Don't know/ Prefer not to say	0.07 (0.09)	0.83	-0.01 (0.17)	-0.04
Physical health status (very poor/poor/fair vs.)				
Good/very good	-0.00 (0.01)	-0.35	0.06 (0.03)	2.20*
Don't know/ Prefer not to say	0.08 (0.20)	0.40	0.23 (0.18)	1.29
Have a doctor (Yes vs.)				
No	-0.14 (0.10)	-1.51	-0.32 (0.09)	-3.39**
Prefer not to say	0.00 (0.05)	0.03	-0.04 (0.12)	-0.38
Primary health insurance (I do not have health insurance vs.)				
Private	0.51 (0.14)	3.15**	0.31 (0.15)	1.75
Public	0.40 (0.15)	2.30*	0.29 (0.16)	1.60
Don't Know	0.01 (0.04)	0.24	0.08 (0.09)	0.86
Prefer not to say	0.01 (0.05)	0.24	0.10 (0.10)	1.08
Perceived risk of COVID-19/flu infection	0.01 (0.00)	8.79***	0.01 (0.00)	8.22***
Loneliness				
Lack companionship (Hardly ever vs.)				
Some of the time/ Often	0.16 (0.10)	1.62	0.18 (0.10)	1.82
Feel left out (Hardly ever vs.)				
Some of the time/ Often	0.10 (0.12)	0.89	0.08 (0.12)	0.84
Feel isolated (Hardly ever vs.)				
Some of the time/ Often	0.06 (0.13)	0.53	0.02 (0.11)	0.15
Trust in doctors (Not very much vs.)				

Most of the time	0.55 (0.12)	4.62***	0.74 (0.12)	6.14***
A lot	1.27 (0.15)	9.60***	1.35 (0.15)	9.94***
Don't know	0.08 (0.07)	1.18	-0.09 (0.10)	-0.90

Model statistics

Observations (N)	1790
Replications	196
Rho (SE)	0.74 (0.03)
Wald test of rho (Chi2)	1403.43
Significance	p<0.001
Loglikelihood	-1705.11

*p<.05. **p<.01. ***p<.001

Note. *SE*=bootstrapped standard error

The model controls for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status.

Impact of perceived neighborhood social cohesion on vaccination intentions in the post-pandemic era

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Main text word count: 3,499/3,500
Abstract word count: 250/250

1   Abstract
2
3   Objective: To examine the relationship between perceived neighborhood social cohesion (NSC) and intentions to obtain seasonal
4   influenza and COVID-19 vaccines among US adults post COVID-19 pandemic.
5
6   Methods: We conducted a cross-sectional, nationally representative survey of US residents (N=2,189) in May 2023 on their perceived
7   NSC, COVID-19 and seasonal influenza vaccination intentions, healthcare access, perceived risk of COVID-19 or flu infection,
8   loneliness, and trust in doctors. We used bivariate probit regressions to examine joint associations between perceived NSC and
9   intentions to receive influenza and COVID-19 vaccines, controlling for several participant characteristics (e.g., race).
10
11   Results: 2,164 respondents provided consent to study questions. Trust-related NSC (trust in neighbors) was positively associated with
12   intentions to become vaccinated against both influenza and COVID-19 viruses. Higher relational NSC (perception of a close-knit
13   neighborhood) was positively associated while higher value-based NSC (perception that neighbors share the same values) was
14   negatively associated with intentions to become vaccinated against COVID-19. Healthcare access, perceived risk of infection
15   (COVID-19 or flu), and trust in doctors were positively associated with intentions to become vaccinated against both viruses.
16
17   Conclusions: In a post-pandemic era, higher trust-related and relational, perceived NSC (vaccine-dependent), greater access to
18   healthcare, higher perceived risk of infection, and greater trust in doctors were related to higher influenza and COVID-19 vaccination
19   intentions, while higher value-based NSC was related to lower COVID-19 vaccination intentions among US adults. Thus, specific
20   aspects of NSC, healthcare access barriers, misinformation on infection risk, and medical mistrust may influence an individual's
21   willingness and ultimate decision to become vaccinated.
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23
24   Key words: neighborhood social cohesion, seasonal influenza vaccine, COVID-19 vaccine, loneliness, risk perceptions, medical trust,
25   healthcare access, psychosocial determinants, preventive healthcare use, COVID-19 pandemic
26

27 1. Introduction

28 1.1. Neighborhood social cohesion during the COVID-19 pandemic

29   Neighborhood social cohesion (NSC) is a construct capturing shared values, relationships, and norms of community residents,

30 built upon trust, reciprocal actions, and a sense of belonging among neighbors.[1] Socially cohesive neighborhoods may foster inclusive

31 and supportive environments where neighbors improve their quality of life by addressing common concerns and advocating for local

32 initiatives. This perceived cohesiveness and unity may be crucial during traumatic events, such as the COVID-19 pandemic. During

33 early stages of the pandemic, NSC manifested in community efforts like social distancing, mask wearing, and delivering personal

34 protective equipment to those at greater infection risk.

35   Concurrently, some communities became less connected during the pandemic due to isolation, differences in political beliefs,

36 pandemic-related harassment,[2] and contentions over COVID-19 prevention strategies (e.g., vaccine). These issues were examined in

37 England, where NSC appeared to decline during the early pandemic period (June 2020) compared to pre-pandemic levels.[3] The

38 relationship between NSC and US preventive healthcare use, particularly for COVID-19 and influenza vaccination, has not been

39 examined.

40 1.2. NSC and Social Capital Theory

41   While NSC is a neighborhood-level construct which focuses on the quality of relationships within a community and may

42 bolster an individual's capacity to gain social capital, social capital represents the value of relationships for accessing resources,

43 opportunities, and information within and outside a community, thus encompassing broader social networks.[4] Greater NSC promotes

44 connectiveness among residents, social trust, and participation in communal activities; thus, possibly contributing to human capital

45 gains as posited in Social Capital Theory.[5] Social capital includes diverse connections that may increase access to health resources and

46 support, promoting healthy environments. Additionally, social capital is a social determinant of community health regardless of

47 individual characteristics, buffers against socioeconomic health inequalities, and mitigates negative health effects following health

48 crises.[6]

49 1.3. NSC health-protective properties

50 The US Department of Health and Human Services recognizes social cohesion as a critical component for maintaining

51 individual health-protective behaviors (e.g., vaccinations).[7] NSC may influence an individual's desire and participation in preventive

52 healthcare use by promoting collective advocacy for health resources, increasing dissemination of health-related information,

53 providing greater psychosocial support, and increasing self-efficacy. Moreover, strong, dense social networks were associated with

54 healthy habit formation,[8] and increased resilience to loneliness and depression.[9–11] For example, greater NSC was associated with

55 uptake of COVID-19 vaccines among Australian adults,[12] higher likelihood to obtain influenza vaccinations among US adults,[13] and

56 stronger antibody response to the COVID-19 vaccine among British adults.[9]

57 1.4. NSC and vaccination in the US

58 Safe and effective vaccines are available in the US to protect against morbidity and mortality associated with COVID-19 and

59 influenza; however, achieving high uptake of these vaccines remains a challenge.[14] While the Centers for Disease Control and

60 Prevention recommended the 2023-2024 COVID-19 bivalent booster and influenza vaccines to protect against severe illness, only

61 22.5% and 48.3% of US adults reported receiving the COVID-19 and influenza vaccines, respectively, as of March 2024.[14] US

62 influenza vaccination rates remain well below current Healthy People's 2030 goal of 70% of residents vaccinated. While there is no

63 Healthy People goal for COVID-19, vaccination remains recommended for eligible individuals.[15] Post-pandemic mistrust in vaccines

64 could also affect vaccine uptake, making this period crucial for examining factors associated with vaccination likelihood. Many efforts

65 in the US have focused on individual factors or community structural vulnerability,[16] leaving an important question unanswered: do

66 community social ties affect vaccination uptake?

67 1.5. Additional factors affecting vaccine uptake

68 Other health and demographic factors (e.g., race) are related to uptake of influenza[17] and COVID-19 vaccinations.[18] For

69 example, perceived risk of COVID-19 infection was associated with acceptance of and intentions to receive the COVID-19 vaccine.[18–]

70   [20] Also, loneliness among older adults during the pandemic was associated with reduced uptake of the COVID-19 vaccine.[9,21]

71   Moreover, doctor-patient trust was associated with increased uptake of COVID-19 and influenza vaccines.[22–24]

72   1.6. Research aims

73   To our knowledge, limited research has examined the role of NSC in individuals' vaccination intentions for COVID-19 and

74   influenza. Existing research has primarily focused on populations outside the US.[12,25,26] For example, a study in Australia found

75   associations between NSC and increased willingness to become vaccinated against influenza[13] and COVID-19 viruses.[12] Studies

76   examining US residents have focused on sub-populations (e.g., COVID-19 vaccination rates among Black individuals in Chicago),[27]

77   or examined the relationship between COVID-19 vaccination rates and social capital or social trust, rather than NSC.[28–32]

78   Thus, we examined how perceived NSC is associated with individuals' intentions to obtain COVID-19 booster and seasonal

79   influenza vaccines in the fall/winter of 2023 among a large, nationally representative US adult sample. These vaccination intentions

80   were examined independently and jointly. We believe this is the first study to examine three dimensions of NSC (trust, relational, and

81   value-based) to better understand the complex dynamics between NSC and intentions to receive vaccines. Also, to our knowledge, no

82   studies have considered unobserved factors influencing vaccination intentions by jointly modeling vaccination intentions for influenza

83   and COVID-19. We hypothesize that perceived NSC will be positively associated with intentions to obtain an influenza and COVID-

84   19 vaccine across all three dimensions of NSC, controlling for sociodemographic and health-status covariates, and several exploratory

85   variables: healthcare access, risk perceptions of COVID-19 or flu infection, loneliness, and trust in doctors. We hypothesize that these

86   associations will remain robust when jointly estimating both vaccination intentions.

87

88   2. Methods

89   2.1. Data

90   The global market research firm, Ipsos, conducted a cross-sectional, representative survey (N=2,189) of US adults aged 18-75

91   using its Global Omnibus panel from May 24-26th, 2023. Due to a lack of consent for some questions used in analysis (N=25), the

92   final study sample was reduced (N=2,164). The survey period was marked by the end of the US public health emergency, a decrease

93   in COVID-19 infections, hospitalizations, and deaths, and wide availability of COVID-19 vaccines. Our survey was designed to

94   examine health-related behaviors and their determinants as the pandemic wanes, including NSC, intentions to receive vaccines

95   (COVID-19 and influenza), healthcare access, risk perceptions of COVID-19 or flu infection, loneliness, and trust in doctors.

96   Participants were recruited until quotas for age, gender, region, and working status were met. Additional surveys were sent to specific

97   respondent quota groups to meet sample requirements. Respondents' demographic information (e.g. gender) was supplied by Ipsos.

98   Study participants completed the web-based survey using their preferred method (e.g., mobile device). To create a representative

99   sample of US adults, sampling quotas were set on age, gender, region, and working status. To account for the offline US population

100   excluded from participation in the survey, Ipsos supplied survey weights based on gender within age groups, working status,

101   household income, and region. The study protocol was approved by the [REDACTED] Institutional Review Board.

102   2.2. Measures

103   The primary dependent variables were intentions to receive the COVID-19 and influenza vaccines. The primary explanatory

104   variable was perceived NSC. Additional explanatory variables included healthcare access, perceived risk of COVID-19 or flu

105   infection, loneliness, and trust in doctors. Controls included gender, race, rurality, age, ethnicity, presence of children, marital status,

106   work status, US region, household income, and self-reported mental and physical health status (Table 1).

107   *2.2.1 Vaccination intentions*

108   Participants were asked: *How likely or unlikely would you personally be to get the following vaccines in the fall/winter of*

109   *2023?*

110   *1.COVID-19 booster (if recommended for annual seasonal boosters)*

111   *2.Seasonal flu (influenza)*

112   Participants responded on a 4-point Likert Scale ('very likely' to 'not at all likely', 'don't know', or 'prefer not to say'); responses

113   were combined to create binary variables ('not very'/'not at all likely' versus 'very'/'fairly likely'. 'Don't know' and 'prefer not to

114   say' responses were dropped from models after confirming lack of sample selection bias using the inverse mills ratio method.[33]

115   *2.2.2. Perceived NSC*

116   Participants responded to the following about their neighborhood: 1.*This is a close-knit neighborhood 2.People around here*

117   *are willing to help their neighbors. 3.People in this neighborhood generally don't get along with each other. 4.People in this*

118   *neighborhood do not share the same values. 5.People in this neighborhood can be trusted.* Responses were on a 4-point Likert scale

119   from 'strongly disagree' to 'strongly agree'. This question is from the National Institutes of Health (NIH) Rapid Acceleration of

120   Diagnostics for Underserved Populations (RADx-UP), common data elements (CDEs):[34] Questions 1-3 were classified as relational, 4

121   as value-based, and 5 as trust-related NSC. Questions 3 and 4 were reverse coded. The scale as a whole demonstrated good internal

122   consistency (Cronbach α=0.83),[35] and construct validity (i.e., strong association with informal social control; r=0.80, $P<0.001$).[36]

123   *2.2.3 Additional explanatory variables*

124   For healthcare access, participants were asked: *Do you have a doctor or nurse who you usually see if you need a check-up,*

125   *want advice about a health problem, or get sick or hurt?* Responses included 1-'yes', 2-'no', or 3-'prefer not to say'. Second,

126   participants were asked: *What is your primary kind of health insurance or health care plan now?* Responses were 0-'I do not have

127   health insurance', 1-'private (purchased directly or through employment)', 2-'public (Medicare, Medicaid, Tricare)', 3-'don't know',

128   or 4-'prefer not to say'. These were CDEs drawn from the National Heart, Lung, and Blood Institute and the NIH RADx-UP,

129   respectively.[34] For risk perceptions of infection (COVID-19 and influenza), participants were asked the following for each virus: *What*

130   *would you say the risk is of you personally becoming infected with the following types of illness in the next 12 months?* Participants

131   responded on a scale from 0-'no risk' to 100-'extreme risk', 'don't know', or 'not applicable', similar to previous literature assessing

132   lung cancer risk.[37] For loneliness, participants were asked the following from the revised University of California Los Angeles

133   Loneliness Scale: 1.*How often do you feel that you lack companionship? 2.How often do you feel left out? 3.How often do you feel*

134 *isolated from others?* Responses were 'hardly ever,' 'some of the time,' and 'often'.[38] For trust in doctors, participants were asked: *Do*

135 *you trust your doctor to take care of people's problems?*, a CDE derived from the NIH Phenotypes for Exposures Toolkit.[34] Responses

136 were 'a lot,' 'most of the time,' 'not very much,' or 'don't know'.

137 2.3. Empirical specification

138 Our empirical strategy assumes intentions to receive COVID-19 and influenza vaccines are dependent on several observable

139 and unobservable factors. Let ψ_i stand for intentions to obtain COVID-19 and influenza vaccines in the fall/winter of 2023 with ($_i$)

140 denoting specification at the individual level. Our main interest is the effects of perceived NSC (ρ_i) as a vector of five questions

141 pertaining to NSC on likelihood to obtain a COVID-19 or influenza vaccine (ψ_i). Models include a set of controls (λ_i) (gender, race,

142 rurality, age, ethnicity, presence of children, marital status, work status, US region, household income, and self-reported mental and

143 physical health status), a vector of healthcare access to include access to a healthcare provider and insurance status (v_i), a vector of risk

144 perceptions of illness (COVID-19 or influenza specific to vaccine type) (ρ_i), a vector of three questions pertaining to loneliness (χ_i),

145 and one item regarding trust in doctors (Ω_i). The error term (ε_v) accounts for unspecified, unobserved variables. The full estimation is:

146 $$\psi_i = \beta_0 + \rho_i\beta_1 + \lambda_i\beta_{2+} v_i\beta_{3+} \rho_i\beta_4 + \chi_i\beta_5 + \Omega_i\beta_6 + \varepsilon_{vi}$$

147 The error term has the subscript ($_{vi}$) to denote variations at the individual level and according to each vaccination intention (ψ_i)

148 specification. Estimation was performed for each vaccination type separately; however, COVID-19 and influenza vaccination

149 intentions demonstrated moderate to high pairwise correlation (0.593, $p<0.001$). Therefore, we estimated vaccination intentions jointly

150 assuming each specifications' error terms (ε_v) were correlated.

151 2.4. Analysis

152 Survey sample weights were used to estimate means for model variables. In multivariate analysis, we ran hierarchical, ordinary

153 least squares (OLS) regressions for each vaccine type. Then, we ran bivariate probits to estimate vaccination intentions jointly and

154 allow for explanatory variables specific to each vaccine type (risk perceptions of COVID-19 vs. influenza). All models used

155   bootstrapped standard errors and 200 iterations to allow for within sample correlation. Missing values were removed when running

156   regressions.

157   Model goodness of fit was assessed using Wald chi-square values, adjusted R^2, and variance inflation factors to test for

158   multicollinearity using OLS models, and rho value and its likelihood ratio test to ensure appropriateness of bivariate probit estimation.

159   We report hierarchical regressions adding explanatory variables to demonstrate parameter stability (Tables 2 & 3). Coefficient and

160   bootstrapped standard errors are presented for all models (Tables 2-4 & 2A). A p-value of 0.05 determined statistical significance. All

161   analyses were conducted in STATA 17.0.

162

163   3. Results

164   3.1. Study sample characteristics

165   The study sample varied by age (mean=45.6, range=18-75 years), gender (women-50.8%, men-48.5%, other-0.30%), and

166   marital status (e.g., married-50.5%, never married-27.8%, divorced/separated-9.50%). Most participants were White (79.1%), urban

167   residents (88.1%), non-Hispanic (85.9%), had no children (66.1%), were working (63.9%), and reported positive perceptions of their

168   mental and physical health; participants reported good (35.6%; 46.7%) or very good (34.0%; 26.9%) mental or physical health,

169   respectively (Table 1A). Most reported intentions to obtain the COVID-19 (59.1%) and influenza (64.5%) vaccines in the fall/winter

170   of 2023 (Table 1). Overall, perceived NSC was high; most believed that people are willing to help their neighbors (82.8%), get along

171   with each other (77.7%), and are trustworthy (77.7%); however, beliefs about living in a close-knit neighborhood (agree/strongly

172   agree-55.5%), and neighbors sharing the same values (agree/strongly agree-55.3%) were split. Most had access to a medical provider

173   (77.7%) and had public (38.9%) or private (50.1%) insurance, compared to no insurance (6.5%). On average, perceived risk of

174   COVID-19 (39.5/100) and influenza infections (41.8/100) were moderate, and about half felt lonely 'some of the time' or 'often' –

175   lack companionship (51.1%), felt left out (50.7%), and felt isolated from others (50.7%). Last, most trusted doctors to take care of

176   people's problems (most of the time-59.1%; a lot-28.1%).

177   3.2. Perceived NSC and vaccination intentions

178   The roles of perceived NSC in vaccination intentions varied by vaccine type and NSC dimension (Tables 2 & 3, columns 4).

179   Trust in people in their neighborhood (trust dimension) was positively associated (b=0.06, $P<0.05$) with influenza, while perceiving

180   their neighborhood to be close-knit (relational dimension) was positively associated (b=0.06, $P<0.05$) with COVID-19 vaccination

181   intentions. Also, perceptions that neighbors share the same values (value-based dimension) was negatively associated (b=-0.07,

182     $P<0.01$) with COVID-19 vaccination intentions. Relational and value-based NSC were not associated with influenza while trust-based

183   NSC was not associated with COVID-19 vaccination intentions.

184   Other explanatory variables had consistent results across both vaccine types. For healthcare access, not having a doctor (vs.

185   having a doctor) (b=-0.11, $P<.001$) for influenza (b=-0.07, $P<0.05$ for COVID-19) was negatively associated, and having private

186   (b=0.12, $P<0.05$; b=0.13, $P<0.01$) or public (b=0.11, $P<0.05$; b=0.09, $P<0.05$) insurance (vs. no insurance) were positively associated

187   with influenza and COVID-19 vaccination intentions. Perceived risk of influenza (b=0.00, $P<.001$) and COVID-19 (b=0.00, $P<0.001$)

188   infection were positively associated with intentions to become vaccinated against that virus. Lacking companionship 'some of the

189   time' or 'often' (vs. 'hardly ever') was positively associated (b=0.05, $P<0.05$) with COVID-19 vaccination intentions while feeling

190   left out or isolated was not associated with COVID-19 vaccination intentions. All three items pertaining to loneliness were not

191   associated with influenza vaccination intentions. Lastly, trusting in doctors 'most of the time' (b=0.25, $P<.001$; b=0.18, $P<.001$) or 'a

192   lot' (b=0.41, $P<.001$; b=0.39, $P<.001$) (vs. 'not very much') were positively associated with influenza and COVID-19 vaccination

193   intentions. Overall, trust in doctors had the largest effect size regarding the association with individuals' vaccination intentions.

194   The bivariate probit specification (Tables 4 & 2A) demonstrated overall robustness of these findings and a positive association

195   between unobservable factors for intentions to receive both vaccines (ρ(s.e.) 0.74, 0.03). NSC demonstrated a stronger association with

196   COVID-19 vaccination intentions; more components of NSC (3 of 5 – relational, value-based, and trust dimensions) were significantly

197   associated with COVID-19 vaccination intentions than when analyzed separately (2 of 5 – relational, value-based). Further, perceived

198   risk of influenza (b=0.01, $P<.001$) and COVID-19 (b=0.01, $P<.001$) infection remained positively associated with intentions to

199 become vaccinated against that virus. In terms of healthcare access, not having a doctor (vs. having a doctor) (b=-0.32, $P<0.01$)

200 remained negatively associated with influenza vaccination intentions only, while having private (b=0.51, $P<0.01$) or public (b=0.40,

201 $P<0.05$) insurance (vs. no insurance) remained positively associated with COVID-19 vaccination intentions only. Loneliness and

202 COVID-19 vaccination intentions became non-significant.

203 4. Discussion

204   This study employed a nationally representative survey of US adults to examine associations between three dimensions of

205 perceived NSC and COVID-19 and influenza vaccination intentions as severity of the COVID-19 pandemic waned. While most US

206 residents had high trust-related NSC, value-based and relational NSC varied. Most intended to receive the COVID-19 and influenza

207 vaccines in the fall/winter of 2023.

208   When both vaccination intentions were estimated jointly, higher perceived risk of COVID-19 and influenza, and greater trust

209 in doctors were associated with greater intentions to become vaccinated against COVID-19 and influenza. Having a doctor was

210 associated with influenza vaccination intentions, while having public or private insurance was associated with COVID-19 vaccination

211 intentions only. Only the trust dimension of NSC was associated with influenza vaccination intentions, while items from all three

212 dimensions of NSC (trust, relational, and value-based) were associated with COVID-19 vaccination intentions. Thus, NSC may play a

213 greater role in COVID-19 vaccination intentions than in influenza. Specifically, greater trust in neighbors was associated with greater

214 COVID-19 and influenza vaccination intentions. However, perceiving one's neighborhood to be close-knit (relational) was associated

215 with *greater* intentions, but perceiving neighbors to share the same values (value-based) was associated with *fewer* intentions to

216 vaccinate against COVID-19, perhaps due to polarization of communities across political and religious lines.[39] Thus, an individual's

217 decision to become vaccinated against COVID-19 may depend on appraised beliefs and values of the surrounding community and on

218 whether these values are shared.

219   Similar to our findings, previous research has found greater perceived NSC was associated with greater uptake and acceptance

220 of COVID-19 vaccines,[12,25] and greater likelihood of obtaining influenza vaccines.[13] These studies examined Australian,[12] older

221 Chinese,[25] and older American adults during the pandemic, post-pandemic, and pre-pandemic, respectively.[13] While this study

222 examined individual aspects of NSC, previous studies measured NSC as a single composite score derived from

223 multidimensional/multi-item scales with similar (trust-related) and different (neighborhood attractiveness) items. Other studies found

224 individual values, social capital, political polarization, barriers to reliable vaccine information, risk perceptions, and health-protective

225 behaviors to be associated with COVID-19 vaccination intentions.[26,28–32]

226   Unobserved factors related to COVID-19 and influenza vaccination intentions were strongly associated, suggesting that

227 individuals' intentions to become vaccinated against COVID-19 and influenza are due to similar underlying reasons. Previous

228 research found increasing NSC to be associated with greater preventive healthcare use, including higher likelihood to obtain influenza

229 vaccinations, but did not explore how different types of preventive healthcare use might be jointly related by unobserved factors.[13]

230   Greater healthcare access (having a doctor for influenza and insurance coverage for COVID-19 vaccination intentions), higher

231 risk perceptions of illness, and trust in doctors were associated with greater intentions to become vaccinated against both illnesses.

232 Prior research has demonstrated similar findings regarding perceived risk of COVID-19 infection and vaccination acceptance and

233 intentions [18–20] as well as strong trust in doctors and increased uptake of both vaccines.[22–24]

234 4.1. Limitations

235   First, cross-sectional data limit our ability to make causal inferences and observe changes in NSC and vaccine intentions over

236 time. Second, vaccination intentions do not equate to actual vaccination behaviors, thus additional information (e.g., vaccination

237 history from medical records) is needed to determine whether greater perceived NSC is also associated with vaccination uptake. Third,

238 lack of sample size and data prevented better understanding of how politically and religiously shared values influence vaccination

239 decisions. Also, greater theoretical and psychometric testing is needed to further develop and validate the unique dimensions of NSC.

240 Last, social desirability bias may have influenced participants' vaccination intentions despite survey administration efforts to minimize

241 bias (e.g., ensure anonymity).

242   While the models presented do not incorporate all factors associated with vaccination intentions following the pandemic and

243 were limited to survey questions, rigorous empirical strategy ensured robustness of results. Other parameters like perceived vaccine

244 effectiveness and previous vaccination could strengthen model specifications. Although the effects of perceived NSC on individuals'

245 vaccination intentions were modest (e.g., 19.1% increase in COVID-19 vaccination intentions associated with 1-unit increase in

246 relational NSC; Table 4), the population-level impact could be substantial (19,100 out of 100,000 people more willing to receive

247 COVID-19 vaccines).

248

249 5. Conclusion

250   Understanding how NSC can mitigate the negative, long-term impacts of the pandemic is particularly valuable, given that the

251 pandemic exacerbated existing health disparities for many communities. We believe this study is the first to examine multiple

252 dimensions of NSC to better understand the complex dynamics between NSC and vaccination intentions and to consider unobserved

253 factors influencing vaccination intentions by jointly modeling vaccination intentions for influenza and COVID-19. Our findings

254 suggest that efforts to promote vaccination intentions, should go beyond addressing individual beliefs and hesitancy and address

255 factors that build neighborhood-level cohesion, address healthcare barriers, and reduce provider mistrust. Future studies should further

256 explore mechanisms (e.g., values, norms, etc.) underpinning the relationship between NSC and vaccination intentions. Furthermore,

257 longitudinal interventions are needed to verify the causal effects of NSC on and determine aspects of NSC most effective for driving

258 vaccination behavior.

259

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Table 1.

Weighted descriptive statistics of US adults aged 18-75 (N=2,189) from the Ipsos Online Omnibus panel – surveyed on intentions to vaccinate and perceived neighborhood social cohesion, post COVID-19 pandemic (May 24th-26th, 2023)

Dependent variables	n	Mean	Linearized SE
How likely or unlikely would you personally be to get the following vaccines in the fall/winter 2023?			
COVID-19 booster (if recommended for annual seasonal boosters)			
Not at all likely/not very likely	818	0.36	0.01
Very likely/fairly likely	1240	0.59	0.01
Don't know	77	0.03	0.00
Prefer not to say	29	0.01	0.00
Seasonal flu (influenza)			
Not at all likely/not very likely	742	0.32	0.01
Very likely/fairly likely	1345	0.65	0.01
Don't know	58	0.02	0.00
Prefer not to say	19	0.01	0.00
Exploratory variables	n	Mean	Linearized SE
Neighborhood social cohesion			
Please answer the following questions pertaining to your neighborhood:			
This is a close-knit neighborhood			
Strongly disagree/disagree	1022	0.45	0.01
Strongly agree/agree	1167	0.56	0.01
People around here are willing to help their neighbors			
Strongly disagree/disagree	427	0.17	0.01
Strongly agree/agree	1762	0.83	0.01
People in this neighborhood generally don't get along with each other			
Strongly disagree/disagree	1691	0.78	0.01
Strongly agree/agree	498	0.22	0.01
People in this neighborhood do not share the same values			

Strongly disagree/disagree	1181	0.55	0.01
Strongly agree/agree	1008	0.45	0.01
People in this neighborhood can be trusted			
Strongly disagree/disagree	560	0.22	0.01
Strongly agree/agree	1629	0.78	0.01

Healthcare access

Do you have a doctor or nurse who you usually see if you need a check-up, want advice about a health problem, or get sick or hurt?

Yes	1661	0.78	0.01
No	464	0.20	0.01
Prefer not to say	39	0.02	0.00

What is your primary kind of health insurance or health care plan you have now?

I do not have health insurance	163	0.07	0.01
Private (purchased directly or through employment)	946	0.50	0.01
Public (Medicare, Medicaid, Tricare)	962	0.39	0.01
Don't know	51	0.02	0.00
Prefer not to say	42	0.02	0.00

Risk perception of infection

What would you say the risk is of you personally becoming infected with the following types of illness in the next 12 months? (0-100)

COVID-19	1929	39.5	0.70
Don't know	235	-	-
Seasonal Flu (Influenza)	1951	41.8	0.67
Don't know	213	-	-

Loneliness

How often do you feel that you lack companionship?

Hardly ever	1017	0.49	0.01
Some of the time/ Often	1172	0.51	0.01

How often do you feel left out?

Hardly ever	1034	0.49	0.01

	n	Mean	Linearized SE
Some of the time/ Often	1155	0.51	0.01
How often do you feel isolated from others?			
Hardly ever	1033	0.49	0.01
Some of the time/ Often	1156	0.51	0.01
<u>Trust in doctors</u>			
Do you trust doctors to take care of people's problems?			
A lot	584	0.28	0.01
Most of the time	1290	0.59	0.01
Not very much	269	0.11	0.01
Don't know	46	0.02	0.00
Controls	**n**	**Mean**	**Linearized SE**
<u>Gender</u>			
Male	1057	0.49	0.01
Female	1117	0.51	0.01
Other	7	0.00	0.00
Prefer not to say	8	0.00	0.00
<u>Race</u>			
White	1683	0.79	0.01
Black/African American	247	0.10	0.01
Native American/Alaska Native	40	0.02	0.00
Asian	102	0.05	0.01
Pacific Islander	19	0.01	0.00
Other	71	0.03	0.00
Prefer not to answer	26	0.01	0.00
No consent	1	0.00	0.00
<u>Rurality</u>			
Urban	1901	0.88	0.01
Rural	288	0.12	0.01
Age	2189	45.6	0.38

Ethnicity

Are you of Hispanic, Latino or of Spanish origin?

Hispanic	302	0.13	0.01
non-Hispanic	1863	0.86	0.01
Prefer not to say	23	0.01	0.00
No consent	1	0.00	0.00

Has children

No	1525	0.66	0.01
Yes	664	0.34	0.01

Marital status

Single, never married	714	0.28	0.01
Living with partner	205	0.09	0.01
Married	931	0.51	0.01
Widowed	78	0.03	0.00
Divorced or separated	261	0.10	0.01

Working

No	857	0.36	0.01
Yes	1332	0.64	0.01

US region

New England	102	0.05	0.01
Middle Atlantic	280	0.13	0.01
East North Central	313	0.14	0.01
West North Central	140	0.06	0.01
South Atlantic	443	0.20	0.01
East South Central	128	0.06	0.01
West South Central	268	0.12	0.01
Mountain	166	0.08	0.01
Pacific	349	0.17	0.01

Household income

<$5,000-$24,999	468	0.11	0.01
$25,000-$49,999	473	0.17	0.01
$50,000-$74,999	430	0.16	0.01
$75,000-$99,999	309	0.23	0.01
$100,000-$250,000+	409	0.29	0.01
Prefer not to say	100	0.04	0.00

<u>Self-reported health status</u>

How is your mental health in general (e.g., anxiety, depression, stress, eating disorders)? How would you say it is now?

Very poor	62	0.03	0.00
Poor	175	0.07	0.01
Fair	466	0.20	0.01
Good	755	0.36	0.01
Very Good	681	0.34	0.01
Don't know	15	0.01	0.00
Prefer not to say	10	0.00	0.00

How is your physical health (e.g., pain, disease) in general? How would you say it is now?

Very poor	31	0.01	0.00
Poor	115	0.04	0.00
Fair	503	0.20	0.01
Good	967	0.47	0.01
Very Good	534	0.27	0.01
Don't know	7	0.00	0.00
Prefer not to say	7	0.00	0.00

Note. SE = linearized standard error.
Due to lack of consent, data were missing (n=25) for COVID-19 and influenza vaccination intentions, risk perception of COVID-19 and influenza infection, healthcare access to a doctor or nurse, primary healthcare insurance, and self-reported mental and physical health status. Survey weights, provided by Ipsos, were used to account for the sampling design and calculate the mean and linearized standard errors. The mean represents the proportion of participants for all categorical variables.

Table 2.
Associations between perceived neighborhood social cohesion and intentions to receive the influenza (flu) vaccine among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24th-26th, 2023) as part of the Ipsos Online Omnibus panel – Hierarchical regression results

Influenza (flu) vaccine	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[d]	
	Coef. 1 (SE)	z	Coef. 2 (SE)	z	Coef. 3 (SE)	z	Coef. 4 (SE)	z
Neighborhood social cohesion								
This is a close-knit neighborhood								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.03 (0.03)	1.57	0.01 (0.02)	0.55	0.01 (0.02)	0.65	-0.00 (0.02)	-0.07
People around here are willing to help their neighbors								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.01 (0.03)	0.23	0.00 (0.03)	-0.01	0.00 (0.03)	0.05	-0.00 (0.03)	-0.06
People in this neighborhood generally don't get along with each other								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.08 (0.03)	-2.95**	-0.04 (0.03)	-1.66	-0.04 (0.03)	-1.28	-0.04 (0.03)	-1.41
People in this neighborhood do not share the same values								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.03 (0.02)	-1.22	-0.02 (0.02)	-0.93	-0.02 (0.02)	-0.87	-0.03 (0.03)	-1.27
People in this neighborhood can be trusted								
Strongly disagree/disagree vs.								

Strongly agree/agree	0.08	2.38*	0.09	2.97**	0.09	3.38**	0.06	2.24*
	(0.03)		(0.03)		(0.03)		(0.03)	
Have a doctor								
Yes vs.								
No	-0.19	-6.54***	-0.17	-5.99***	-0.17	-5.84***	-0.11	-3.88***
	(0.03)		(0.03)		(0.03)		(0.03)	
Primary health insurance								
I do not have health insurance vs.								
Private	0.14	3.23**	0.15	3.27**	0.15	3.29**	0.12	2.54*
	(0.05)		(0.04)		(0.05)		(0.05)	
Public	0.13	3.13**	0.15	3.13**	0.15	3.19**	0.11	2.36*
	(0.04)		(0.04)		(0.05)		(0.05)	
Risk of influenza infection			0.00	11.23***	0.00	9.85***	0.00	10.05***
			(0.00)		(0.00)		(0.00)	
Loneliness								
Lack companionship								
Hardly ever vs.								
Some of the time/ Often					0.05	1.66	0.05	1.95
					(0.03)		(0.03)	
Feel left out								
Hardly ever vs.								
Some of the time/ Often					0.03	0.96	0.03	1.08
					(0.03)		(0.03)	
Feel isolated								
Hardly ever vs.								
Some of the time/ Often					0.00	-0.02	0.00	0.01
					(0.03)		(0.03)	
Trust in doctors								
Not very much vs.								
Most of the time							0.25	7.23***
							(0.03)	
A lot							0.41	10.9***
							(0.04)	

Model statistics	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
Observations (N)	2087	1900	1900	1900
Replications	200	197	195	197
Adjusted R^2	0.08	0.14	0.14	0.20
Wald Chi^2	471.63	569.79	576.24	953.66
Significance	p<0.001	p<0.001	p<0.001	p<0.001

*p<.05. **p<.01. ***p<.001

Note. SE=bootstrapped standard error

[a] Model 1 includes social cohesion and healthcare access

[b] Model 2 adds risk of seasonal influenza (flu) infection

[c] Model 3 adds loneliness

[d] Model 4 (final model) adds trust in doctors

Table 2 shows the results for the ordinary least squares regressions with bootstrapped standard errors. All models (1-4) control for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status. Variance inflation factor is less than 10 for all models and 5.40 for Model 4.

Table 3.
Associations between perceived neighborhood social cohesion and intentions to receive the COVID-19 booster vaccine among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24th-26th, 2023) as part of the Ipsos Online Omnibus panel - Hierarchical regression results

COVID-19 booster vaccine	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[d]	
	Coef. 1 (SE)	z	Coef. 2 (SE)	z	Coef. 3 (SE)	z	Coef. 4 (SE)	z
Neighborhood social cohesion								
This is a close-knit neighborhood								
Strongly disagree/disagree vs.								
Strongly agree/agree	0.07 (0.02)	3.11**	0.07 (0.02)	2.64**	0.07 (0.02)	3.05**	0.06 (0.03)	2.53*
People around here are willing to help their neighbors								
Strongly disagree/disagree vs.								
Strongly agree/agree	-0.01 (0.03)	-0.24	-0.01 (0.03)	-0.29	-0.01 (0.03)	-0.21	-0.01 (0.04)	-0.45
People in this neighborhood generally don't get along with each other								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.08 (0.02)	-2.58*	-0.03 (0.03)	-1.14	-0.02 (0.03)	-0.74	-0.02 (0.03)	-0.64
People in this neighborhood do not share the same values								
Strongly agree/agree vs.								
Strongly disagree/disagree	-0.07 (0.02)	-3.04**	-0.06 (0.02)	-2.72**	-0.06 (0.02)	-2.25*	-0.07 (0.02)	-2.87**
People in this neighborhood can be trusted								
Strongly disagree/disagree vs.								

Strongly agree/agree	0.09 (0.03)	2.99**	0.09 (0.03)	2.81**	0.09 (0.03)	2.61**	0.06 (0.03)	1.87
Have a doctor								
Yes vs.								
No	-0.22 (0.03)	-4.57***	-0.12 (0.03)	-3.96***	-0.12 (0.03)	-4.27***	-0.07 (0.03)	-2.20*
Primary health insurance								
I do not have health insurance vs.								
Private	0.17 (0.05)	3.93***	0.16 (0.05)	3.35**	0.16 (0.04)	3.35**	0.13 (0.05)	2.85**
Public	0.14 (0.04)	3.27**	0.13 (0.05)	2.88**	0.13 (0.05)	2.72**	0.09 (0.05)	2.08*
Risk of COVID-19 infection			0.00 (0.00)	12.3***	0.00 (0.00)	11.4***	0.00 (0.00)	11.0***
Loneliness								
Lack companionship								
Hardly ever vs.								
Some of the time/ Often					0.05 (0.03)	1.59	0.05 (0.03)	1.98*
Feel left out								
Hardly ever vs.								
Some of the time/ Often					0.04 (0.03)	1.23	0.03 (0.03)	1.01
Feel isolated								
Hardly ever vs.								
Some of the time/ Often					0.01 (0.04)	0.19	0.01 (0.03)	0.38
Trust in doctors								
Not very much vs.								
Most of the time							0.18 (0.03)	4.76***
A lot							0.39 (0.04)	9.47***

Model statistics	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
Observations (N)	2058	1854	1854	1854
Replications	198	198	197	198
Adjusted R^2	0.07	0.14	0.15	0.20
Wald Chi^2	324.45	715.03	627.37	1095.27
Significance	p<0.001	p<0.001	p<0.001	p<0.001

*p<.05. **p<.01. ***p<.001.

Note. *SE*=bootstrapped standard error

[a] Model 1 includes social cohesion and healthcare access

[b] Model 2 adds risk of COVID-19 infection

[c] Model 3 adds loneliness

[d] Model 4 (final model) adds trust in doctors

Table 3 shows the results for the ordinary least squares regressions with bootstrapped standard errors. All models (1-4) control for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status. Variance inflation factor is less than 10 for all models and 5.32 for Model 4.

Table 4.
Associations between perceived neighborhood social cohesion and intentions to receive the COVID-19 booster and influenza (flu) vaccines among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24th-26th, 2023) as part of the Ipsos Online Omnibus panel - Bivariate probit regression results

	COVID-19 booster		Seasonal Influenza (flu)	
	Coef. (SE)	z	Coef. (SE)	z
Neighborhood social cohesion				
This is a close-knit neighborhood				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19 (0.08)	2.32*	-0.01 (0.07)	-0.09
People around here are willing to help their neighbors				
Strongly disagree/disagree vs.				
Strongly agree/agree	-0.06 (0.11)	-0.54	0.04 (0.11)	0.34
People in this neighborhood generally don't get along with each other				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.11 (0.10)	-1.13	-0.15 (0.10)	-1.62
People in this neighborhood do not share the same values				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.22 (0.09)	-2.65**	-0.14 (0.09)	-1.63
People in this neighborhood can be trusted				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19 (0.08)	1.99*	0.23 (0.10)	2.24*
Have a doctor (Yes vs.)				
No	-0.14 (0.10)	-1.51	-0.32 (0.09)	-3.39**
Prefer not to say	0.00 (0.05)	0.03	-0.04 (0.12)	-0.38

Primary health insurance (I do not have health insurance vs.)					362
Private	0.51 (0.14)	3.15**	0.31 (0.15)	1.75	
Public	0.40 (0.15)	2.30*	0.29 (0.16)	1.60	
Don't Know	0.01 (0.04)	0.24	0.08 (0.09)	0.86	
Prefer not to say	0.01 (0.05)	0.24	0.10 (0.10)	1.08	
Perceived risk of COVID-19/flu infection	0.01 (0.00)	8.79***	0.01 (0.00)	8.22***	
Loneliness					
Lack companionship (Hardly ever vs.)					
Some of the time/ Often	0.16 (0.10)	1.62	0.18 (0.10)	1.82	
Feel left out (Hardly ever vs.)					
Some of the time/ Often	0.10 (0.12)	0.89	0.08 (0.12)	0.84	
Feel isolated (Hardly ever vs.)					
Some of the time/ Often	0.06 (0.13)	0.53	0.02 (0.11)	0.15	
Trust in doctors (Not very much vs.)					
Most of the time	0.55 (0.12)	4.62***	0.74 (0.12)	6.14***	
A lot	1.27 (0.15)	9.60***	1.35 (0.15)	9.94***	
Don't know	0.08 (0.07)	1.18	-0.09 (0.10)	-0.90	
Model statistics					
Observations (N)				1790	
Replications				196	
Rho (SE)				0.74 (0.03)	
Wald test of rho (Chi2)				1403.43	
Significance				p<0.001	
Loglikelihood				-1705.11	

*p<.05. **p<.01. ***p<.001
Note. *SE*=bootstrapped standard error
The model controls for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status.

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Table 1A.
Weighted descriptive statistics of US adults aged 18-75 (N=2,189) from the Ipsos Online Omnibus panel – surveyed on intentions to vaccinate and perceived neighborhood social cohesion, post COVID-19 pandemic (May 24th-26th, 2023) – non-transformed dependent variables

Dependent variables	n	Mean	Linearized SE
How likely or unlikely would you personally be to get the following vaccines in the fall/winter 2023?			
COVID-19 booster (if recommended for annual seasonal boosters)			
Not at all likely	551	0.24	0.01
Not very likely	267	0.12	0.01
Fairly likely	383	0.19	0.01
Very likely	857	0.41	0.01
Don't know	77	0.03	0.00
Prefer not to say	29	0.01	0.00
Seasonal flu (influenza)			
Not at all likely	468	0.20	0.01
Not very likely	274	0.12	0.01
Fairly likely	384	0.18	0.01
Very likely	961	0.47	0.01
Don't know	58	0.02	0.00
Prefer not to say	19	0.01	0.00

Note. *SE* = linearized standard error.
Due to lack of consent, data were missing (n=25) for COVID-19 and influenza vaccination intentions. Survey weights, provided by Ipsos, were used to account for the sampling design and calculate the mean and linearized standard errors. The mean represents the proportion of participants.

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Table 2A.
Associations between perceived neighborhood social cohesion and intentions to receive the COVID-19 booster and influenza (flu) vaccines among US adults aged 18-75 (N=2,164), surveyed post COVID-19 pandemic (May 24ᵗʰ-26ᵗʰ, 2023) as part of the Ipsos Online Omnibus panel - Bivariate probit regression results

	COVID-19 booster		Seasonal Influenza (flu)	
	Coef. (SE)	z	Coef. (SE)	z
Neighborhood social cohesion				
This is a close-knit neighborhood				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19(0.08)	2.32*	-0.01 (0.07)	-0.09
People around here are willing to help their neighbors				
Strongly disagree/disagree vs.				
Strongly agree/agree	-0.06 (0.11)	-0.54	0.04 (0.11)	0.34
People in this neighborhood generally don't get along with each other				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.11 (0.10)	-1.13	-0.15 (0.10)	-1.62
People in this neighborhood do not share the same values				
Strongly agree/agree vs.				
Strongly disagree/disagree	-0.22 (0.09)	-2.65**	-0.14 (0.09)	-1.63
People in this neighborhood can be trusted				
Strongly disagree/disagree vs.				
Strongly agree/agree	0.19 (0.08)	1.99*	0.23 (0.10)	2.24*
Gender (male vs.)				
Female	0.00 (0.01)	0.06	-0.02 (0.02)	-0.77
Other	-0.04 (0.03)	-1.42	0.37 (0.13)	2.83**

Prefer not to say	0.12 (0.12)	1.05	0.24 (0.24)	0.98
Race (White vs.)				
Black/African American	0.01 (0.01)	0.82	0.05 (0.04)	1.35
Native American/Alaska Native	-0.00 (0.03)	-0.01	0.03 (0.09)	0.37
Asian	0.02 (0.02)	0.80	0.08 (0.04)	1.96*
Pacific Islander	0.02 (0.06)	0.37	0.11 (0.13)	0.87
Other	0.04 (0.04)	1.03	0.09 (0.06)	1.44
Prefer not to say	0.10 (0.08)	1.29	-0.20 (0.12)	-1.69
Urban (vs. rural)	0.00 (0.01)	0.00	0.07 (0.03)	2.20*
Age^2	0.00 (0.00)	1.12	0.00 (0.00)	2.50*
Ethnicity (Hispanic vs.)				
Non-Hispanic	0.00 (0.01)	0.31	-0.06 (0.03)	-1.78
Prefer not to say	-0.01 (0.05)	-0.13	0.09 (0.13)	0.66
Has Children (vs. no)	0.01 (0.01)	0.85	-0.06 (0.03)	-1.95
Working (vs. no)	0.01 (0.01)	0.60	-0.01 (0.03)	-0.25
Marital status (single, never married vs.)				
Living with partner	0.02 (0.02)	0.78	-0.05 (0.05)	-1.20
Married	-0.02 (0.01)	-1.27	0.02 (0.03)	0.73
Widowed	0.01 (0.03)	0.24	-0.01 (0.06)	-0.08
Divorced or separated	-0.01 (0.02)	-0.69	-0.04 (0.04)	-1.06
US Region (New England vs.)				
Middle Atlantic	0.01 (0.02)	0.53	-0.12 (0.06)	-2.16*
East North Central	-0.01 (0.02)	-0.42	-0.10 (0.05)	-1.87
West North Central	0.01 (0.02)	0.33	-0.06 (0.06)	-0.89
South Atlantic	0.00 (0.02)	0.23	-0.14 (0.05)	-2.66**
East South Central	0.02 (0.03)	0.59	-0.16 (0.06)	-2.63**
West South Central	0.03 (0.02)	1.27	-0.10 (0.05)	-1.85
Mountain	-0.01 (0.02)	-0.31	-0.14 (0.06)	-2.23*
Pacific	0.01 (0.02)	0.34	-0.07 (0.05)	-1.45

Household income (<$5,000-$24,999 vs.)				
$25,000-$49,999	0.01 (0.02)	0.39	-0.03 (0.04)	-0.77
$50,000-$74,999	0.01 (0.01)	0.41	-0.03 (0.04)	-0.75
$75,000-$99,999	-0.00 (0.01)	-0.41	0.02 (0.03)	0.48
$100,000-$250,000+	0.00 (0.01)	0.19	0.02 (0.03)	0.72
Prefer not to say	0.03 (0.03)	1.08	0.07 (0.06)	1.06
Mental health status (very poor/poor/fair vs.)				
Good/very good	-0.00 (0.01)	-0.06	-0.03 (0.03)	-0.92
Don't know/ Prefer not to say	0.07 (0.09)	0.83	-0.01 (0.17)	-0.04
Physical health status (very poor/poor/fair vs.)				
Good/very good	-0.00 (0.01)	-0.35	0.06 (0.03)	2.20*
Don't know/ Prefer not to say	0.08 (0.20)	0.40	0.23 (0.18)	1.29
Have a doctor (Yes vs.)				
No	-0.14 (0.10)	-1.51	-0.32 (0.09)	-3.39**
Prefer not to say	0.00 (0.05)	0.03	-0.04 (0.12)	-0.38
Primary health insurance (I do not have health insurance vs.)				
Private	0.51 (0.14)	3.15**	0.31 (0.15)	1.75
Public	0.40 (0.15)	2.30*	0.29 (0.16)	1.60
Don't Know	0.01 (0.04)	0.24	0.08 (0.09)	0.86
Prefer not to say	0.01 (0.05)	0.24	0.10 (0.10)	1.08
Perceived risk of COVID-19/flu infection	0.01 (0.00)	8.79***	0.01 (0.00)	8.22***
Loneliness				
Lack companionship (Hardly ever vs.)				
Some of the time/ Often	0.16 (0.10)	1.62	0.18 (0.10)	1.82
Feel left out (Hardly ever vs.)				
Some of the time/ Often	0.10 (0.12)	0.89	0.08 (0.12)	0.84
Feel isolated (Hardly ever vs.)				
Some of the time/ Often	0.06 (0.13)	0.53	0.02 (0.11)	0.15
Trust in doctors (Not very much vs.)				

Most of the time	0.55 (0.12)	4.62***	0.74 (0.12)	6.14***
A lot	1.27 (0.15)	9.60***	1.35 (0.15)	9.94***
Don't know	0.08 (0.07)	1.18	-0.09 (0.10)	-0.90

Model statistics
Observations (N)	1790
Replications	196
Rho (SE)	0.74 (0.03)
Wald test of rho (Chi2)	1403.43
Significance	p<0.001
Loglikelihood	-1705.11

*p<.05. **p<.01. ***p<.001
Note. *SE*=bootstrapped standard error
The model controls for gender, race, rurality, age, ethnicity, presence of children, marital status, working status, US region, household income, and self-reported mental and physical health status.

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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