CESifo WORKING PAPERS

8816
2021

January 2021

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CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
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Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
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· from the RePEc website: www.RePEc.org
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CESifo *Working Paper No. 8816*

Communities and Testing for Covid-19

Abstract

Between November 18th and 25th, 2020, 348,810 out of 500,607 (69.7 percent) eligible residents of the South Tyrol region of Italy volunteered to take a Covid-19 rapid antigen test. We examine the community characteristics that are associated with higher testing rates. Our findings point to a number of key community determinants of people's willingness to volunteer. Convenience was an important factor. Beyond that, socioeconomic status and religiosity were also both positively related to greater testing.

JEL-Codes: I120, I180.

Keywords: Covid-19, testing, volunteer, religion.

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December 2020
We would like to thank Alexia Lochmann for helpful research assistantship.
Conflicts of interest: none.

1. Introduction

During the Covid-19 pandemic, people are asked to take action to protect themselves and others from infection. Wearing masks, for instance, can provide protection to the wearers, as well as reduce outward transmission by infected individuals, therefore providing protection for others (Asadi et al., 2020; Prather et al., 2020). The same will be true regarding vaccination, as the benefits to individuals are combined with benefits to others through community (herd) immunity. Despite the dramatic consequences of Covid-19, however, it cannot be taken for granted that people are keen to undertake these beneficial actions[1].

In this article, we look at participation in a voluntary mass testing scheme implemented in the Italian region of South-Tyrol between November 18th and 25th, 2020, where 348,810 out of 500,607 (69.7 percent) eligible residents were administered a Covid-19 rapid antigen test. 3,448 tested positive. Testing delivers great benefits to others, in particular for the population of asymptomatic that we consider here, and we examine the community characteristics that are associated with higher testing rates. The willingness to contribute to such public goods is indeed related not only to individual characteristics, but also to social factors. The concept of social capital is often used to capture these factors (Ostrom, 2009; Putnam, 2001) and there have been several investigations about the social determinants of behavior in the pandemic, usually focusing on social distancing (Jay et al., 2020; Kapitány-Fövény and Sulyok, 2020; Bargain and Aminjonov, 2020; Barrios et al., 2021; Brodeur et al., 2020; Durante et al., 2020).

Population-scale testing has been proposed as an effective measure to control the pandemic (Taipale et al., 2020) and has already been implemented in several contexts, for instance in the Chinese regions of Wuhan and Qingdao and in Slovakia (Holt, 2020). Slovakia, in particular, tested over 3.6 million people — out of a population of almost 5.5 million —and, similarly to South-Tyrol, found that over 1% of them were positive[2]. Differently from the case studied here, however, non-participants were required to quarantine for ten days, thus providing a strong incentive to participate. While similar incentives could be used also for

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[1] See on mask-wearing: https://news.gallup.com/poll/315590/americans-face-mask-usage-varies-greatly-demographics.aspx and on vaccination: https://news.gallup.com/poll/325208/americans-willing-Covid-vaccine.aspx

[2] https://www.nature.com/articles/d41587-020-00021-z

vaccination, they may prove controversial, and it is therefore of great interest to study a context where participation was fully voluntary.

Previous work has found that parochialism, i.e., a preference for favoring the members of one's ethnic, racial or language group, is an important factor behind altruistic behavior (Bernhard et al., 2006). From this point of view, an interesting feature of South-Tyrol is the presence of different linguistic groups: German (around 69% of the population), Italian (around 26%), and Ladin (around 5%)[3], with a conflictual relationship solved by granting special autonomy to the territory in the early 1970s (Niezing, 2017). For this reason, we explore the role of linguistic diversity, as well as of other characteristics that have been identified in the literature as relevant for contributions to public goods, like gender and education, as well as proxies for social capital and religiosity, and other relevant variables like age, household size, employment, and past prevalence of the infection. In the discussion section, we highlight how our findings relate to the existing literature.

2. The Mass Test in South Tyrol

The population of South Tyrol was invited to take part in a mass screening using antigen rapid tests, involving a nasal and throat swab. To enable this, authorities set up around 300 testing centers, with each municipality having at least one, where professional health care workers carried out the tests, with the support of volunteers from the civil protection agency, the voluntary fire services and other organizations for handling the logistics and the administration. All residents were invited to participate, with the exception of children below the age of five, people with Covid-19 symptoms, those on sick leave, those who had tested positive and isolated in the last three months, and those who had recently tested positive or were in quarantine or self-isolating. People with a prior appointment for a PCR test, those regularly tested for work reasons, and individuals in social care were also not tested.

Testing centers generally operated from 8am till 6pm from Friday, 20 November to Sunday, 22 November. During this period, people could show up at any of the centers throughout South Tyrol. In some municipalities it was possible to register online and some municipalities published suggested centers and time slots based on the address of residence. It was also

[3] Notice that everyone is classified within these three linguistic groups, despite the growing presence of migrants who do not necessarily belong to neither and of bilingual people.

possible to be tested in some pharmacies and at some GPs in the period 18 to 25 November. People only needed a valid ID and a European Health Insurance card. They filled in a form with an email address, where they would receive, generally within a day, an encrypted file with the outcome, and a mobile number, where they would receive an SMS with the code to open the file.

In case of a negative result, people were advised to continue following prevention measures like social distancing and mask wearing. In case of a positive result, people had to isolate for 10 days if asymptomatic and contact their doctor if they developed symptoms.

Participation in the mass testing was voluntary and encouraged by a massive communication campaign, providing information (with material available also in Albania, Arabic, English, French and Urdu, as well as in simple language for kids), as well as endorsements by public figures. The headline of the campaign was "Together against coronavirus", using appeals like "Let's break the infection wave together and pave the way towards a gradual return to normality!", thus underlining the importance of common action.

3. Data and Methodology

Data about testing come from the Health Authority[4], while data about municipality characteristics come from the Provincial Statistical Office, ASTAT[5], or the National Statistical Office, ISTAT[6].

Tested individuals are matched by the authorities to their municipality of residence based on their tax identification number and the total number of residents in each municipality is measured using official registration data.[7] We define the population eligible for testing as all residents of a municipality age five or higher that are not currently in quarantine either because they have recently tested positive for Covid-19 or have been in close contact with someone that has. The testing rate is then measured as the number of residents of a municipality who volunteered to be tested between November 18th and 25th divided by the population eligible for testing in that municipality. The past Covid positive rate is similarly

[4] https://coronatest.asdaa.it/it/muni (Italian) or https://coronatest.asdaa.it/de/muni (German)
[5] https://astat.provincia.bz.it/it/banche-dati-comunali.asp
[6] http://asc.istat.it/ASC/
[7] In Italy, all individuals are legally required to register in their municipality of residency and local services, such as education and health care, are only available to those that are registered.

calculated as the number of residents in a municipality who previously tested positive but are not currently positive divided by the total number of residents.

Age, gender, employment, immigration status and household size are measured in administrative data and made available at the municipality level. We can also calculate the standard deviation of age within a municipality using the available data. The proportion of individuals with secondary education and higher, and the proportion speaking the three official languages of the region and of volunteers at non-profits are measured using the 2011 Census.

For education and language spoken, we calculate the within municipality variation using the Herfindahl-Hirschman index (HHI) which is calculated as: $HHI_j = \sum_{n=1}^{k} S_{nj}^2$ where S_{nj} is the share of individuals living in municipality j who have characteristic $n=1, 2, \ldots, k$. In this case, the share of individuals who speak i) German; ii) Italian; and iii) Ladin; and the share with i) no education; ii) an intermediate degree; iii) a secondary degree; and iv) an university degree. Finally, we measure, as a proxy for religiosity, the proportion of religious weddings over total weddings celebrated in a given municipality between 1995 and 2019.

In our analysis, we run an OLS regression model of the form:

$$Y_j = \alpha + \beta X_j + \varepsilon_j$$

where Y_j is the testing rate in municipality j, X_j is a vector of municipality characteristics and ε_j is a mean zero error term. In all our models, we calculate robust standard errors that allow for heteroscedasticity. Since the outcome variable is a rate bounded between zero and one, our estimated β coefficients can be interpreted as the percentage point impact on the testing rate of a one unit differences in the corresponding covariate.

We estimate two specifications where we vary how we control for the language distribution in the municipality. First, we control for the percentage of residents speaking each of the official languages. Second, we control for the spoken language diversity in the municipality as measured by the HHI.

We also estimate three versions of each specification. In the first one, each municipality is given equal weight and hence given an equal importance in estimating the relationship between X and Y. In the second one, the model is estimated using weighted-GLS and the importance of each municipality is determined by its registered population. Here, more populated municipalities are more important in determining the relationship between X and Y. The final specification is similar to the second one, but we drop the five municipalities with population above 15,000, thus having a more homogeneous sample.

4. Results

Figure 1 shows the variation in testing rates across the 116 municipalities of the South Tyrol, while Table 1 shows the distribution across the municipalities. Testing rates varied between 54.2 and 85.9% with the interquartile range 67.5 to 74.5%. Around 71% of eligible individuals volunteered to be tested in the median municipality. While we are interested in how community characteristics relate to testing rates, there is a large variation in the population of different municipalities (from 200 in the smallest to 108,606 in the largest), hence we also examine how testing rates vary when we weight municipalities by their population. While the most populated municipalities have relatively low testing rates, our weighted estimates look fairly similar with a median testing rate of 68.9% and an interquartile range of 67.0 to 72.2%. We also present weighted estimates where we drop five municipalities that have a population greater than 15,000.[8] The weighted distribution of test rates is nearly identical in this sample to the unweighted distribution across all municipalities.

Table 2 presents the mean and standard deviation for all municipality characteristics that we consider in our analysis. On average, municipalities have 4,630 residents and the average population density is 125 inhabitants per KMs^2. On average, there were three testing centers per municipality, and previously 1.2 percent of population had tested positive for Covid-19. On average, residents are aged 42, gender balanced, living in a household with 2.5 members. 53% of residents are employed, 41% have secondary education or higher, 6.8% are immigrants, and 83.7% speak German, 9.5% speak Italian and 6.9% speak Ladin as their principal language. On average, 48% of weddings performed recently in each municipality were religious ceremonies and 48% of the population volunteered at a non-profit organization. We also examine the importance of heterogeneity within municipalities on three dimensions, age, education and language spoken. The standard deviation of age within communities, is

[8] This drops the four 'cities' of the South Tyrol, i.e. Bolzano-Bozen, Merano-Meran, Brixen-Bressanone and Bruneck-Brunico, and what can be considered the largest suburb of Bolzano, Laives-Leifers.

23.5 on average, while the HHI for education is 0.31 and for language spoken 0.86, on average.

Weighting for population size, the average municipality is much larger with 30,230 residents, a density of 657 inhabitants per KMs^2, with fifteen testing centers. Perhaps surprisingly, most other characteristics of the residents are fairly similar. The main exceptions are that residents of larger areas are more educated, more likely to be immigrants, and more likely to be Italian speakers. In these areas, weddings are less likely to be religious and the primary language is more diverse (between Italian, German and Ladin). When the larger municipalities are dropped, the characteristics of the weighted sample are nearly identical to those of the unweighted sample in all dimensions.

Table 3 presents our main results. We will focus our discussion on the characteristics of municipalities that are associated with the community testing rate at a minimum 10 percent significance threshold, but also mention some other interesting relationships. We first discuss the results treating all municipalities with equal weighting. Controlling for population density and the number of testing centers, testing rates are lower in more populated municipalities, but the effect size is fairly small with an additional 1,000 people associated with 0.6-0.7 percentage point (pp) lower testing rates. On the other hand, having more testing centers is correlated with higher testing rates, with each additional center associated with 0.7-1.0 pp higher testing rates.

Testing rates are higher in municipalities with an older population, less age variation, more women, larger households and a more educated population. Testing rates are also higher in municipalities with a higher proportion of religious weddings, with communities with a 10 pp higher proportion of religious weddings having 1.1-1.4 pp higher testing rate. Finally, municipalities with a larger share of individuals speaking the two minority languages in the region (Italian and Ladin) or those with more diversity in language spoken have higher testing rates. One interesting, albeit not statistically significant, finding is that testing rates are lower in municipalities with higher previous positive Covid-19 rates.

Our main results are remarkably similar if we weight each municipality by its population. The only substantive differences we find are for the population variables. Now, both the negative relationship between population and testing rates and the positive relationship between number of testing centers and testing rates are both about half their size as in the unweighted estimates. The same is true if we exclude the larger municipalities, now neither population nor number of testing centers is statistically significantly associated with testing rates, but population density has a positive association with municipalities with an additional 100 people per KMs^2 having 1.8-1.9 pp higher testing rates.

5. Discussion

Our findings point to a number of key community determinants of people's willingness to volunteer for the Covid mass testing program in the South Tyrol.

First, it is clear that convenience was an important factor; after controlling for population and population density, individuals were more likely to get tested in communities where there were more centers.

Second, communities where the population is older, more educated and living in larger households had higher testing rates, consistent with a positive relationship between socioeconomic status and willingness to contribute to public goods. The finding on age could also be related to the increased risk of hospitalization or deaths associated with age[9]. Similarly, the finding for household size could occur because large households have increased social contacts and hence are at higher risk[10].

Third, we find higher testing rates in communities with a higher female share, consistent with a vast literature showing gender differences in preferences, including altruism (Croson and Gneezy, 2009; Falk and Hermle, 2018).

Fourth, we find that more religious communities – proxied by share of religious weddings – have higher testing rates consistent with the literature showing religious rituals being associated with higher degrees of cooperation (Ruffle and Sosis, 2007) and, more generally, showing the link between religiosity and civic responsibility (Monsma, 2007).

Fifth, we find some weak evidence that social cohesion is related to testing rates, with communities with higher dispersion in terms of age having lower testing rates. However, we

[9] https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.html

[10] Supporting this, we also find higher testing rates in communities with more employed people, but this is not usually statistically significant.

do not find a significant relationship between educational diversity, immigration share or volunteering rates, which are arguably other proxies of social cohesion, and testing rates.

Finally, we find higher testing rates in municipalities with a higher share of speakers of Italian and Ladin. Given their status as languages spoken by a minority of the population at the provincial level, these localities also have more linguistic diversity, and therefore a lower HH index. Higher linguistic diversity is thus associated with increased participation. This result may be related to the fact that, among Italian regions, South-Tyrol has by far the lowest vaccination coverage[11], an issue mostly related to the German speaking population (Kreidl and Morosetti, 2003) and this diffidence may spillover towards the tests. The minority populations might have preferences more aligned with the rest of Italy or have worried about negative spillovers from potential lower testing rates among the German-speaking majority.

Interesting, we found an insignificant relationship between the past Covid positive rates in a community and the current testing rates. One could have expected a positive effect of higher previous contagion, on the contrary the insignificant coefficient is consistently negative.

While we focus on a mass testing campaign, we suspect that similar patterns would reveal themselves for vaccination uptake. Hence, these results can be useful for helping guide policies designed to increase vaccine uptake, for example, by making it more convenient, encouraging people to think about the importance of protecting other people and focusing extra resources on lower socioeconomic status communities.

However, an important limitation of our study is that we can only measure the role of community characteristics and it is possible that this hides important heterogeneity across individuals. Beyond this, because individuals typically sort into communities with people with similar characteristics, the correlation between community characteristics and the measured outcome might be stronger at the community than individual level. Furthermore, we can only measure a subset of community characteristics that are related to testing rates and hence we might have not accounted for important unobservable characteristics that could bias the relationships that we currently estimate.

[11] https://www.epicentro.iss.it/vaccini/dati_Ita. South Tyrol is also the region with the lowest usage of antibiotics (Osservatorio Nazionale sull'impiego dei Medicinali, 2019).

This notwithstanding, our results can be helpful in identifying communities particularly at risk of not adhering to voluntary programs to fight the pandemic, in our case mass tests, but in prospect also vaccination campaigns.

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Figure 1: Covid-19 Testing Rates across Municipalities in the South Tyrol

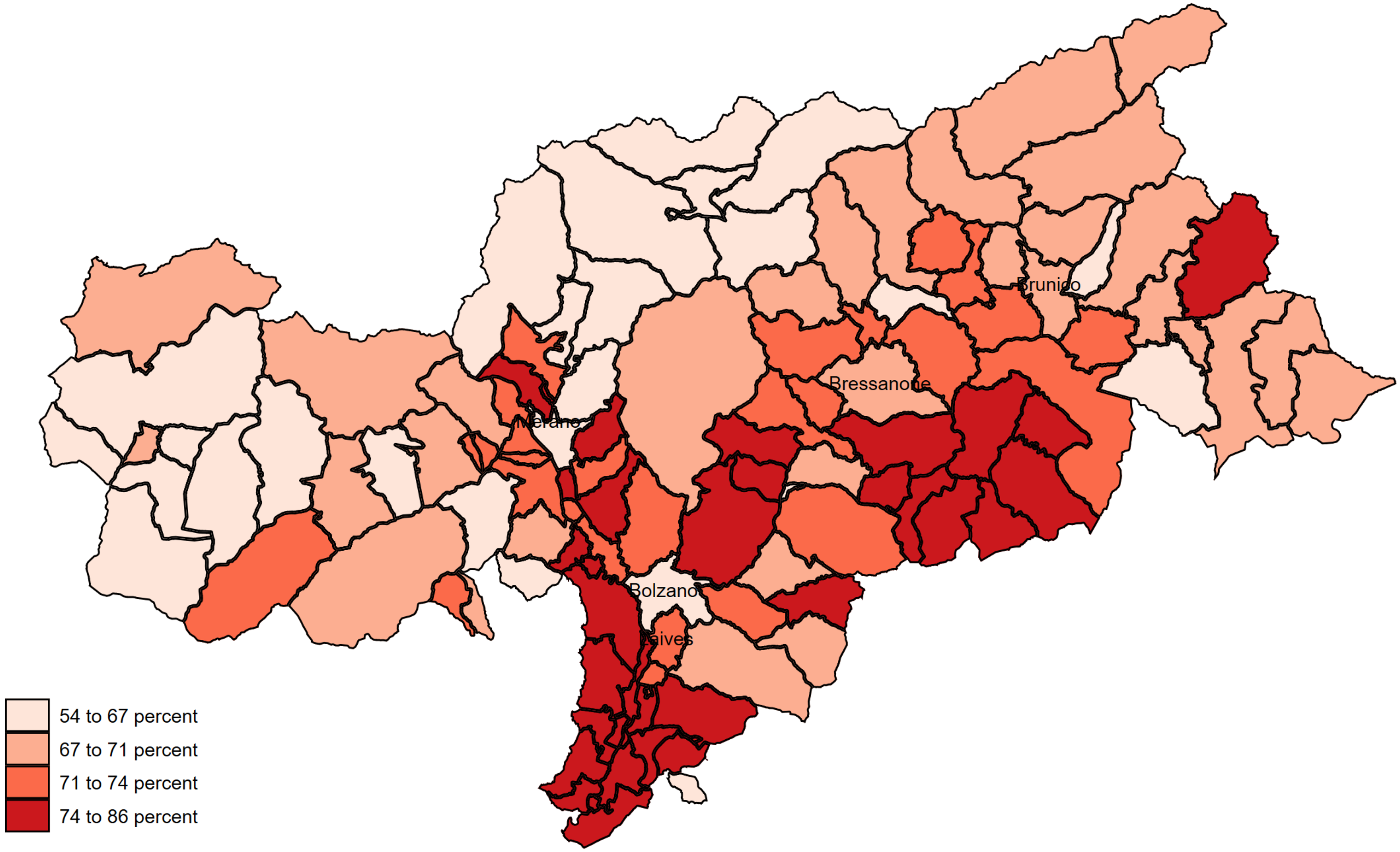

Table 1: Testing Rates Across Municipalities

	Unweighted	Weighted by Total Population	Weighted by Population - Dropping Municipalities >15K Population
Mean	0,711	0,697	0,711
Standard Deviation	0,059	0,045	0,051
1st Percentile	0,552	0,621	0,576
5th Percentile	0,621	0,637	0,633
10th Percentile	0,638	0,651	0,638
25th Percentile	0,675	0,670	0,677
50th Percentile	0,712	0,689	0,715
75th Percentile	0,745	0,722	0,745
90th Percentile	0,782	0,757	0,775
95th Percentile	0,816	0,781	0,793
99th Percentile	0,847	0,826	0,840
Municipalities	116	116	111

Testing rates are the share population excluding those currently positive or in quarantine.

Table 2: Summary of Municipality Characteristics

	Unweighted	Weighted by Population	Weighted by Population - Dropping Municipalities >15K
Population/1000	4,63	30,23	4,72
	(10,9)	(41,1)	(3,4)
Population Density (1000 per KM^2)	0,125	0,657	0,106
	(0,254)	(0,825)	(0,097)
Number of Testing Centers	3,0	15,1	2,7
	(5,3)	(21,5)	(1,0)
Past COVID Positive Rate	0,012	0,013	0,011
	(0,009)	(0,006)	(0,007)
Mean Age	41,6	42,5	41,5
	(1,3)	(1,6)	(1,1)
Standard Deviation Age	23,5	23,7	23,5
	(0,4)	(0,4)	(0,4)
Share Female	0,495	0,505	0,498
	(0,015)	(0,012)	(0,010)
Mean Household Size	2,46	2,34	2,44
	(0,16)	(0,18)	(0,14)
Employment Rate	0,533	0,536	0,539
	(0,055)	(0,040)	(0,049)
Share Higher Education	0,407	0,440	0,412
	(0,058)	(0,054)	(0,051)
HHI - Education	0,306	0,293	0,303
	(0,013)	(0,015)	(0,010)
Share Immigrant	0,068	0,097	0,071
	(0,041)	(0,045)	(0,033)
Share Speaking German	0,837	0,680	0,854
	(0,265)	(0,315)	(0,239)
Share Speaking Italian	0,094	0,277	0,082
	(0,149)	(0,292)	(0,113)
Share Speaking Ladin	0,069	0,042	0,064
	(0,233)	(0,175)	(0,221)
HHI - Language Spoken	0,859	0,755	0,858
	(0,137)	(0,166)	(0,124)
Share Religious Weddings	0,480	0,404	0,474
	(0,135)	(0,128)	(0,112)
Share Volunteering	0,477	0,441	0,420
	(0,227)	(0,184)	(0,166)
Municipalities	116	116	111

Standard deviations in parentheses. Share variables are as a proportion of the total or adult population in a municipality.

Table 3: The Relationship Between Community Characteristics and COVID-19 Testing Rates

	Unweighted		Weighted by Population		Weighted by Population - Dropping Municipalities >15K Population	
Population/1000	-0.00616**	-0.00680***	-0.00265**	-0.00349***	-0.00187	-0.00265
	(0.00252)	(0.00231)	(0.00120)	(0.00122)	(0.00229)	(0.00222)
Population Density	0.0655	0.0610	-0.0317*	-0.0201	0.181**	0.193**
(1000 per KM^2)	(0.0516)	(0.0480)	(0.0172)	(0.0179)	(0.0785)	(0.0773)
Number of Testing Centers	0.00726*	0.00955***	0.00410**	0.00613***	0.00468	0.00641
	(0.00390)	(0.00352)	(0.00182)	(0.00187)	(0.00608)	(0.00629)
Past COVID Positive Rate	-0.908	-1.052	-0.501	-0.658	-0.484	-0.651
	(0.692)	(0.702)	(0.567)	(0.581)	(0.506)	(0.515)
Mean Age	0.0162**	0.0194***	0.0171**	0.0208***	0.0237***	0.0261***
	(0.00688)	(0.00723)	(0.00691)	(0.00726)	(0.00688)	(0.00715)
Standard Deviation Age	-0.0336**	-0.0358**	-0.0162	-0.0218	-0.0228	-0.0250*
	(0.0152)	(0.0153)	(0.0146)	(0.0151)	(0.0140)	(0.0142)
Share Female	1.289***	1.473***	1.391***	1.618***	1.063**	1.276**
	(0.420)	(0.399)	(0.520)	(0.531)	(0.519)	(0.530)
Mean Household Size	0.175***	0.237***	0.129**	0.199***	0.230***	0.285***
	(0.0657)	(0.0661)	(0.0630)	(0.0654)	(0.0681)	(0.0672)
Employment Rate	0.135	0.0601	0.166*	0.0843	0.179*	0.0815
	(0.102)	(0.102)	(0.0970)	(0.101)	(0.0997)	(0.105)
Share Higher Education	0.381***	0.361***	0.389***	0.355***	0.281**	0.256**
	(0.0996)	(0.108)	(0.105)	(0.117)	(0.114)	(0.119)
HHI - Education	0.225	0.243	0.439	0.565	0.634	0.577
	(0.562)	(0.579)	(0.452)	(0.453)	(0.531)	(0.532)
Share Immigrant	0.147	0.0859	0.0850	0.0267	0.255	0.236
	(0.174)	(0.184)	(0.170)	(0.181)	(0.181)	(0.183)
Share Speaking Italian	0.101**		0.0802***		0.0653	
	(0.0449)		(0.0265)		(0.0563)	
Share Speaking Ladin	0.0680***		0.0640***		0.0625***	
	(0.0211)		(0.0213)		(0.0216)	
HHI - Language Spoken		-0.150***		-0.129***		-0.0819
		(0.0564)		(0.0463)		(0.0591)
Share Religious Weddings	0.109***	0.137***	0.127***	0.158***	0.125***	0.158***
	(0.0381)	(0.0382)	(0.0392)	(0.0386)	(0.0416)	(0.0398)
Share Volunteering	0.00154	-0.0164	-0.0267	-0.0407	-0.0245	-0.0321
	(0.0273)	(0.0252)	(0.0324)	(0.0303)	(0.0336)	(0.0331)
R-squared	0.505	0.478	0.555	0.531	0.516	0.484
Municipalities	116	116	116	116	111	111

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Share variables are as a proportion of the total or adult population in a municipality.