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Patterns and Contexts of Anti-COVID-19 Vaccination in Romanian Local Communities

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Abstract

Background: *Are local communities relevant units for the analysis of anti-COVID 19 vaccination? This is the question we are addressing here for the case of Romania as an Eastern European society.*

Methods: *To answer the question we used multiple regression models to predict cumulative rates of vaccination in rural communes and cities or towns of the country. The same relations among vaccination rates and several predictors were analysed not only in all the localities of the country but also in historical regions and urban versus rural areas.*

Results: *Infection rates, the average age of the local population, population density and local human development proved to be rather stable predictors. Communities with higher vaccination rates are mostly urban, higher developed, with an older population, and also with higher rates of COVID-19 infections. Once local communities are placed in their regional context, significant differences emerge.*

Conclusions: *Some variables are efficient discriminators of the vaccination behaviour irrespective of individual or aggregated level of the data. This is the case of age. If one considers only aggregated data at the community level in Romania, one can add infection rates and local development levels as invariant predictors acting beyond context.*

Keywords: Anti-COVID-19, Vaccination, Romanian, Local Communities

The COVID-19 (C19) vaccination data analyzed at the aggregate level of the local community is a very special case. On the one hand, we already know that the 'ecological error' of extending conclusions from the aggregate level to subunits, possibly individuals, must be avoided. On the other hand, however, vaccination in general, against C19 in particular, is highly dependent on the community-regional offer of vaccination. From this point of view, it is useful to combine individual analyses with those at the community-regional level. Multilevel analysis [1], with measurement variables at different levels, is the solution of principle. Difficult to apply, however, for those who opt for in the sense of quantitative approaches. Why? For the simple reason that there are only rarely, very rarely, individual surveys with a selection of representative sub-samples at the local level. There are, at most, surveys on the subject of infection-vaccination that outside the data at the individual level collect or allow the association of regional/country variables.

Contextualizations are practices of integrating particular analyses into the whole to which they refer, either through complementary/mixed methods [2] or through the adoption of specific analytical perspectives or frameworks [3]. In the present case, the community analysis of the anti-C19 vaccination phenomenon at the level of Romania, using official data, is contextualized by reference to analyses that appeal to the characteristics of the regions or networks of localities that include local communities, to survey data for Romania, compared to survey data from the new versus the old Member States of the European Union. In addition, analyses at the local community level also appeal to proxy variables that allow estimation of cultural models of collective accountability.

The present case is that of the analysis of local communities in Romania in terms of vaccination models. The predictors of these local vaccination patterns are essential characteristics of local communities. How can the understanding of the phenomenon be enriched by relating to integrative contexts of direct or indirect influence? This is what we will try to describe in the next methodological section and apply in the analysis itself, in the hope that the solutions given can be useful in other analyses as well.

The focus will be on identifying relevant relationships in understanding group behaviours, at the territorial level, in the process of anti-C19 vaccination. The option is justified by the fact that the interconnection measurements, more than the level ones, are more relevant for possible public vaccination policies, under conditions similar to those of the pandemic period to which we refer. In addition, whether it is infections with the new coronavirus or vaccinations against this virus, percentage measurements (how much per cent of..) tend to be relatively incomplete, and

unstable. Relation measures are expected to be more stable than those referring to the intensity of reference phenomena.

The contextual approach will allow for multiple comparisons between Romania and other countries of the European Union, between local communities from different cultural areas or historical regions of Romania, from rural and urban areas. In this way, the space in which we frame the C19 infections and the vaccinations against them is no longer a "container" one, as in the methodological nationalism approaches, but a matrix one, as in the approaches of methodological transnationalism [4]. Community-regional Romania resembles, in many respects, Italy [5], marked by strong differences between the different component regions.

Methodology

In constructing the theoretical model for explaining inter-community variations in anti-C19 vaccination rates, we turn to an adapted variant of the theory of planned behaviour and its preceding form, relating to reasoned behaviour [6, 7]. The intention to vaccinate, from the perspective of the planned behaviour, depends directly on the attitude, the pressure of others in making the decision and the degree of control that the subject can have over the desired behaviour. As we are talking about aggregated vaccination data, however, at the locality level, we do not have measurements of the intention to vaccinate or estimates of the perception of the degree of control over the target behaviours. Consequently, in community-level approaches, we will abandon the intention to vaccinate by considering it a latent variable, not directly measured, and the perception of opportunities to control target behaviour. In contrast, C-19 vaccination rates can be considered as aggregated estimates of individual vaccinations.

Variables retained in the analysis from the perspective of this approach are included in the graph in Figure 1. The social norm, as the pressure of others on those who are going to decide to vaccinate, we have estimated through an indicator taken from the field of electoral behaviours. From the data of the Permanent Electoral Authority, we know what the local participation rate was in the 2020 parliamentary elections. The measurement hypothesis adopted here argues that that indicator is relevant to the local propensity to adopt behaviours that are significant to the local public interest. More specifically, we have assumed that where there have been high electoral participation rates, there is a better structured local culture of empowering citizens concerning community interests. Implicitly, in such communities we expect, caeteris paribus, that the pro-vaccination pressure against C19 will be higher in localities with high voter turnout rates. If that indicator remains significant in different variants of predicting the community rates of anti-C19 vaccination then we can consider the aforementioned hypothesis as validated

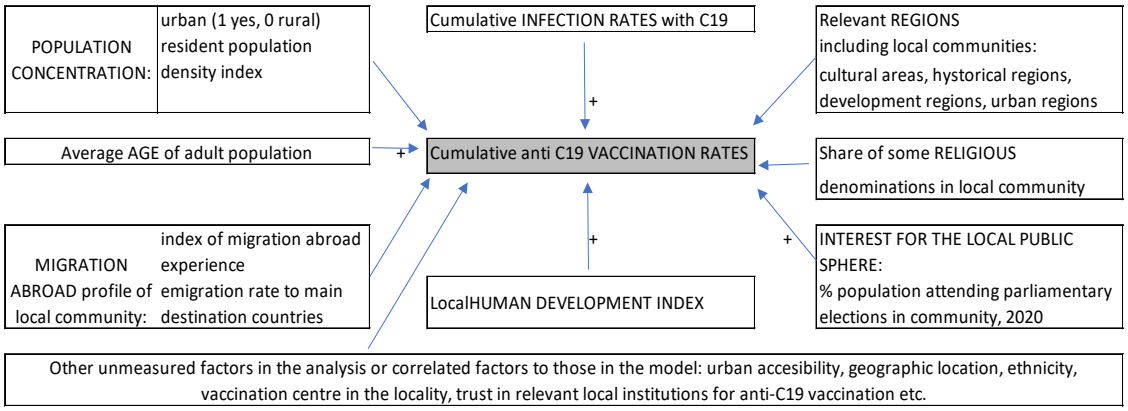

Figure 1: The theoretical model of predicting vaccination against C19 at the community level in Romania

The rest of the variables in the model are proximate variables, for indirect measurement, of the attitude towards vaccination against C19. Cumulative rates of SARS CoV 2 infection can be interpreted as significant for vaccination-friendly attitudes. Even the uninfected, living in the same community with several infected people, it is to be assumed that they were able to know, directly, more people sick with the new covid. In this way, the probability of its anti- C19 vaccination increased. Similarly, a higher share of elderly people in the locality could directly contribute to the adoption of anti-C19 vaccination behaviours, due to the increased risk of disease associated with age.

From previous analyses, also carried out at the level of local communities in Romania, we know that increased probabilities of illness with the new coronavirus were recorded in localities with increased shares of emigrants in other countries or with intra-Community social interactions, accentuated by local or regional development [8]. As a result, we have assumed that in such communities it is likely that increased vaccination rates will be recorded as a result of heightened concerns of illnesses with the new coronavirus. Similarly, we introduced the prediction model of local vaccinations and qualitative variables for which we had previously recorded increased risks of SARS CoV 2 infection. These are variables such as the cultural area to which the locality belongs or the share of religious minorities.

The dependent variable in the basic model of multiple regression was the cumulative vaccination rate in early February 2022 (data source at Romanian Government - https://bit.ly/3jMUQKo, consulted June 2022). It was measured as the percentage of people who have done at least one anti-C19 vaccine out of the local population of 16+ years old. The variable rate of infection with the new coronavirus was also measured as a cumulative rate but for the period February 2020 to April 2021. The average age of the local population, the community experience of migrating abroad, and the level of local development or religious affilia-

tion were measured in pre-pandemic times. In this way, the risk of having circularity or endogenous effects in the model disappeared.

The use here of multiple regression analysis by including territorial units is similar to the procedure used in Australia to identify, at the level of the postal code area, the factors favourable or unfavourable to the vaccination rates for five-year-olds [9].

Although we have avoided the transfer of relationships found at the community level to relationships at the individual level, for contextualization we also resorted to the analysis of a file with survey data, at the individual level. We have therefore made a contextualization of the intercommunal variations of anti-C19 vaccination in Romania using, succinctly, an analysis with individual-level survey data, generated by the Flash Eurobarometer 494, with data collected in May 2021 [10]. The same survey allowed us to contextualize the community analyses with aggregated data by comparing the relationships that involved the anti-C19 vaccination in Romania to the vaccinations in the new EU Member States, but without Romania, and with the old Member States of the Union.

We have achieved regional contextualizations of community behaviours through exploration by following the role of historical regions, cultural areas or development regions in differentiating community vaccination behaviours.

The next section is a brief descriptive analysis of vaccination behaviours and their main predictors at the local community level in Romania. The next section of the material presents the results of multiple regression analyses on the inter-community variation of anti-C19 vaccination behaviours. The contextualization of these analyses is carried out in the section that introduces the results of the approaches at the individual level, for the interviewees from Romania compared to those from the New and Old Member States of the European Union. Naturally, context analyses follow those considered as the main ones, within this framework, dedicated to approaches at the local community level.

Intercommunity variability of the infection-vaccination phenomena

A simple synthetic picture of the intercommunal variations of infections through the new coronavirus and, associated, vaccinations against this virus, can be obtained by reference to the situation in four types of local communities. In identifying these types, we started from the premise that the phenomena of development and social interaction are strongly differentiated depending on the size of the cities and the proximity that the communes have as rural administrative units to the cities.

C19 infection rates have increased systematically from rural localities isolated from large cities to large cities (Table 1). Vaccination rates against C19 had a similar trend with an increase from small isolated rural communes to large cities.

The average level of human development in large settlements was much higher in cities than in rural areas. The major contrast is between large, highly developed cities and isolated municipalities with very low values of the local human development index [12]. From this simple calculation of the average values of the indicators used in Table 1, conclusions can be drawn on the relationships between vaccination rates and infection rates, migration abroad, and population density, for example.

In the same table, however, we also passed the coefficients of variation for the same indicators for the four categories of localities. We note, with these data, that the rates of anti-C19 vaccination have varied to a lesser degree than those of infection with the new coronavirus. The finding could be related to the fact that vaccination had a consistent determination not only by the intensity of infections but, also, by the way, the central, regional and local institutions organised the offices for anti-C19 vaccination. This institutional facet could contribute to reducing the variation of vaccination among local communities.

Table 1: Key descriptors in the analysis of four categories of localities

Statistics	Description indicators	*rural communes*		urban localities in 2018		Total
		far from large cities	*close to large cities*	*under 100 thou inhabitants*	*with more than 100 thou inhabitants*	
weighted averages per indicator and category of locality	*Cumulative vaccination rates, February 2022 (%)*	25.5	30.9	37.4	45.7	35.1
	C19 infections rates (‰) , April 2021	26.0	36.9	47.5	72.3	47.2
	Population density per km2, 2021	67.6	135.6	460.5	3715.9	1321.6
	Local human development index 2018	45.9	52.7	62.5	71.0	58.8
	Index of migration abroad experience, 2011	50.0	55.3	71.5	92.0	69.6
weighted coefficients of variation per indicator and category of locality (%)	*Cumulative vaccination rates, February 2022 (%)*	34.6	38.7	21.6	13.0	34.3
	C19 infections rates (‰) , April 2021	72.8	75.3	43.8	20.2	57.4
	Population density per km2, 2021	199.9	118.4	111.5	73.0	170.0
	Local human development index 2018	27.3	28.5	13.6	8.0	24.8
	Index of migration abroad experience, 2011	25.3	22.9	16.9	7.3	29.6

Primary data sources: National Institute of Public Health (NIPH) and National Institute of Statistics (NIS). All the figures are computed by the weighting function of the local population in 2018, by permanent domicile. The coefficient of variation indicates the value of the standard deviation as a per cent from the average. The usually resident population was not computed at the local level for the reference period. The communes are considered to be close to large cities of more than 100 thou. if their index of urban accessibility is in the fifth quintile (Heroiu et al., 2013). For example, the cumulative vaccination rate (in %) was 37.4% in cities of less than 100 thou. inhabitants, in February 2022.

We will see, in the next section, what was the net, specific effect of each of the factors mentioned, using the estimates obtained by the multiple regression analysis.

Sources of intercommunity differentiation of anti-C vaccination rates19

As expected, anti-C19 vaccination rates were higher in localities that recorded higher infection rates, keeping under control the effect of other predictors of the analysis. Similarly, localities with higher shares of the elderly recorded increased anti-C vaccination rates19 (Table 2). In such situations, pro-vaccination orientation has been structured more strongly, as a result of natural processes of concern about the possible negative consequences of the pandemic. Pro-vaccination attitudes appear to have been significantly favoured by the higher proportions of the elderly, and people infected with SARS CoV 2. In other words, the socio-demographic profile of the locality mattered a lot in structuring the attitudes towards vaccination.

Vaccination against C19 was more intense in urban than in rural areas and is higher than in lower population density areas (Table 2). The positive correlation between housing density and vaccination rates can also be found in the case of analyses at the level of 387 sub-regions in Poland [7]. Why were vaccination rates higher in localities with higher housing density (Table 2)? It is possible that in such localities there was not only a greater awareness of the risks of disease, as a result of high-level infections. Under certain conditions of density and high-level social interaction, C19 infections seem to have been more frequent but also opportunities to prevent better diseases.

Developed localities, urban or rural, have seen increased vaccination rates. However, we do not know where these behaviours come from. It is likely that in such localities, not only subjective factors such as attitudes towards vaccination have acted, but also public space conditionings regarding increased vaccination opportunities, given that the sanitary organization of vaccination was, at least in the first period of the pandemic, very likely better in the developed localities. It is a facet that is not measured by aggregated data on the perception of vaccination opportunities at the level of different localities.

Migration experience at the locality level had a contradictory effect on the intensity of the anti-C19 vaccination. On the one hand, more people abroad from a locality favoured lower rates of vaccination. Unclear why. Having more people abroad favoured a higher pressure to circulate across borders even without vaccination?

Why has the higher share of emigration from the locality to Germany and Italy significantly disadvantaged the anti-C19 vaccination? Why, instead, were the increased rates of emigration to Spain specific to communities of origin with increased rates of anti-C19 vaccination? Similarly, the effect of increased proportions of Adventists and Pentecostals in the locality as deterrents to anti-C19 vaccinations should be elucidated through specific analyses. For migration factors, the effects recorded through regression analyses may be also associated with unknown changes in the migration configuration between the pandemic period and the date of the 2011 census when the migration data were collected. Hope that regional analysis of the same regression approach would bring, in another section of this study, more information.

Table 2: Predicting local community rates of anti-C19 vaccinations in Romania

Predictors		Model 1		Model 2	
		Coefficient	P>t	Coefficient	P>t
COVID-19 infection rates February 2020-April 2021		0.150	0.000	0.164	0.000
Population concentration	urban (1 yes, 0 rural)	1.624	0.000	0.591	0.167
	resident population 2021 (ln transformation)	0.099	0.722	-0.061	0.821
	density index 2021 (ln)	1.267	0.000	1.286	0.000
average age 18+ years old 2018		0.139	0.000	0.132	0.000
local human development index 2018		0.315	0.000	0.304	0.000
Migration profile of community 2011	index of migration abroad experience 2002, 2011	-0.048	0.000	0.000	0.977
	emigration rate to Spain 2011 (ln)	1.138	0.000	0.474	0.000
	emigration rate to Italy 2011 (ln)	-0.711	0.000	-0.278	0.038
	emigration rate to Germany 2011 (ln)	-0.706	0.001	-0.599	0.003
Religious minorities	% Adventist in population 2011 (ln)	-0.713	0.007	-0.479	0.059
	% Penticostals in population 2011 (ln)	-2.063	0.000	-1.841	0.000
% population attending parliamentary elect. 2020		0.026	0.024	0.001	0.913
Cultural area including reference community. Acronymes for component counties (Reference category Maramures)	*AB AD CS HD*			-1.515	0.020
	SJ BN			0.927	0.226
	CV HG MS BH			-2.200	0.001
	BV SB CJ TM			-1.739	0.012
	Oltenia de Nord			2.339	0.001
	Oltenia de Sud			2.023	0.010
	Muntenia de Nord			0.187	0.785
	Muntenia de Nord Est			-2.302	0.003
	Muntenia de Sud			0.345	0.645
	SV IS			-4.205	0.000
	BT VS			-1.056	0.128
	NT BC VR GL			-5.067	0.000
	Dobrogea			3.777	0.000
	Bucuresti Ilfov			-4.670	0.000
	constant	-2.584	0.222	-1.386	0.506
	R2	0.589		0.641	
	N	2845		2845	

Data sources: National Institute for Public Health for COVID-19 and National Institute of Statistics for the other data. Own computations. Ordinary least square regressions in STATA, robust standard errors. Dependent variable – local community rates of anti-COVID-19 vaccinations cumulated up to February 05. 2022. No colinearity: VIF for predictors is not larger than 4. Shadow for regression coefficients that are significant for p=0.05 or less. See the map of cultural areas in Sandu 2022b.

In the series of regularities obtained, it would also be worth noting the role of the community culture associated or not with the solidarity and responsibility through the adoption of vaccination. We have already mentioned in the methodological section of the analysis that in the set of predictors we have also included an indirect measure of that culture. It is about the share of those who participated in the European Parliament elections in the locality, in 2020. Once included in the multiple regression analysis in Table 2, that predictor has proven to be effective. Caeteris paribus, the communities with increased participation rates in the 2020 European Parliament elections, also recorded increased vaccination rates during the pandemic. Of course, there is no direct link between the 2020 vote and vaccination rates during the pandemic. The assumption from which we started, however, was that a high level of voter turnout can be significant for a community-oriented civic culture, in the sense of self-engagement through behaviours that can be useful to others. For now, with the aggregated data we have worked with, the hypothesis is not disproved. We note it as such, noting, however, that further research is necessary to validate it. An argument for questioning the respective hypothesis of indirect measurement of the local civic spirit through voter turnout is given by the fact that the predictor in question is no more significant in the second model from Table 2.

We have not yet explicitly addressed the role of regional and residential environmental factors in structuring C-C19 vaccination practices. If we keep under control the characteristics of age, infection, migration, religious affiliation, etc., does the regional belonging of the localities still matter? But do prediction relationships remain the same for urban and rural? These questions we will try to answer in the section that follows.

Regional and residential environment

The cultural areas of the country are subregions of the historical regions, characterized by the socio-cultural homogeneity of the counties that compose them [11]. The cultural area effect in the prediction of vaccination at the local level is consistent. The explanatory power of model 2 in Table 2 is five percentage points higher than for model 1. Cultural areas in Transylvania, Muntenia and Moldova tend to register lower vaccination rates. The trend is consistent with that of infection by SARS CoV 2. The latter tends to have large variations between cultural areas [8]. The highest negative impact on anti-C19 vaccination rates was recorded for localities from Bucharest-Ilfov, South-East Moldova, and Suceava-Iasi counties from the West Moldova region.

There is another kind of contextualization through which we track not the variations in level but the differences in relationships. To what extent, for example, do the effects of external migration on the anti-C19 vaccination remain negative as in the case of the national model? If we run model 1 from Table 2 on seven of the eight historical regions (see appendix), we find out the answer.

Only in the Moldova historical region, the model coincides with the national one, in the sense of negative effects. It is only in this region that higher migration abroad, and especially in Italy, had negative effects on the intensity of anti-C19 vaccination. In Muntenia's historical region higher emigration rates bring positive effects on the intensity of vaccination rates against C19. For the other regions, migration abroad and the intensity of anti-C19 vaccinations are non-significant from the statistical point of view.

The contextualization of residential environments (Table 3), however, indicates a strong dependence of relationships on the prediction of anti-C19 vaccination in the residential environment. If comparisons are made only within the same residential environment we will find that context dependencies are higher in urban than in rural areas.

Localities with higher C19 infection rates are those that have also seen increased vaccination rates in urban and rural areas.

Similarly, a higher level of development, the increased average age in the locality, and lower migration abroad experience favour higher vaccination rates in rural and urban areas.

Only in rural areas, for example, increased emigration rates to Italy and Germany are accompanied by low-level anti-C19 vaccination. In smaller, inter-knowledge communities (Mendras, 2002), such as rural ones, migration destinations abroad seem to have a stronger echo. Mere inter-knowledge may be an important conditioning factor in this process.

Also at the level of the communes, there is a significant positive effect of the situations in which the culture of solidarity and community responsibility, estimated by increased voting rates in the 2020 parliamentary elections, appears as a favouring factor of vaccination against C19. For urban communities, there is no similar significant relationship.

Table 3: Predicting local community rates of anti-C19 vaccinations in Romania by rural and urban areas

Predictors		Rural		Urban	
		Coefficient	P>t	Coefficien	P>t
COVID-19 infection rates February 2020-April 2021		0.154	0.000	0.127	0.000
Population concentration	resident population 2021 (ln transformation)	0.180	0.598	0.807	0.155
	density index 2021 (ln)	1.461	0.000	0.564	0.252
average age 18+ years old 2018		0.144	0.000	0.182	0.000
local human development index 2018		0.308	0.000	0.357	0.000
Migration profile of community 2011	index of migration abroad experience 2002, 2011	-0.040	0.002	-0.096	0.003
	emigration rate to Spain 2011 (ln)	1.149	0.000	1.080	0.012
	emigration rate to Italy 2011 (ln)	-0.754	0.000	-0.405	0.272
	emigration rate to Germany 2011 (ln)	-0.688	0.002	-0.753	0.183
Religious minorities	% Adventist in population 2011 (ln)	-0.784	0.004	-0.290	0.784
	% Penticostals in population 2011 (ln)	-2.092	0.000	-1.622	0.000
% population attending parliamentary elect. 2020		0.028	0.018	0.028	0.580
constant		-4.394	0.107	-5.200	0.261
R2		0.533		0.645	
N		2528		3.17	

Data sources: National Institute for Public Health for COVID-19 and National Institute of Statistics for the other data. Own computations. Ordinary least square regressions in STATA, robust standard errors. Dependent variable – local community rates of anti-COVID-19 vaccinations cumulated up to February 05. 2022. No colinearity: VIF for predictors is not larger than 4. Shadow for regression coefficients that are significant for p=0.05 or less.

After estimating the regional and residential environment context of the anti-C19 vaccination at the community level, we will try, in the next section, to complete the analytical picture by referring to the persons interviewed in a Eurobarometer survey in Romania in 2021.

Individual comparisons

Even though at the community level we have operated with aggregated data and by representative survey at The Romanian level we have direct measurement data, most of the results from the two approaches are consistent. Older people, for example, are, according to survey data, those who have been vaccinated to a greater extent. Similarly, interviewees from urban areas were vaccinated against C19 in a higher proportion than those in rural areas (see Table 4, model 1, compared to Table 2).

All the data from the community analysis of the vaccine claimed that it was likely that the pro-vaccination attitude was stronger in communities where there were higher rates of C19 infection (Table 2). Of course, with the aggregated data on infection with the new covid, we could not prove that these are valid measures of attitudes towards vaccination. With the non-aggregated data from the survey, we find, however, that the pro-vaccination attitude directly stimulates, at the individual level, the effective anti-C19 vaccination (Table 4, model 1). The finding is in full consistency with the basic formulations of the theory of motivated action/the theory of planned behaviour.

All the data from the Eurobarometer 494 survey allow an approach to the causal model of vaccination at the individual level in Romania, compared to the new European Union states (NSM) but without Romania, and with the old Member States of the Union (OMS). For this analysis, we highlight a specific feature of Romania in the European context. Having been vaccinated as an adult, regardless of the disease targeted for prevention, is a favourable prerequisite for the adoption of the anti-C19 vaccine in the NMS and the OMS. Not for Romania (compare models 1 with models 2 and 3 from Table 4). Why? A return to the survey data clarifies the question. The share of those who were vaccinated as adults, regardless of the disease envisaged as the risk of avoidance, was 74% in OMS and 63% in NMS. For Romania, however, this share was much lower, at only 41%. The overwhelming share of the lack of a culture of vaccination as an adult to avoid illnesses is the one that explains, to a large extent, Romania's situation as a country of social controversy in terms of anti-C19 vaccination [10]. With this context specification, we can better understand the anti-C19 vaccination behaviour in Romania.

Table 4: Predicting vaccination at the individual level. Romanians compared to members of New Member Stares (NMS) and Old Member States (OMS)

Predictors	Model 1.Romania		Model 2.NMS without Romania		Model 3.OMS	
	Odds ratio	P>z	Odds ratio	P>z	Odds ratio	P>z
Index of provaccination orientation IPVO	1.013	0.000	1.010	0.000	1.006	0.000
vaccinated as adult for other illnesses*	0.915	0.643	1.237	0.021	1.816	0.000
trust in institutions that are relevant for anti C19 policies	1.043	0.644	1.013	0.814	1.024	0.457
online trust	0.820	0.032	0.906	0.016	0.816	0.000
living in city*	1.601	0.011	0.841	0.054	0.889	0.087
age	1.035	0.000	1.037	0.000	1.066	0.000
man*	1.162	0.403	0.883	0.136	0.872	0.032
tertiarry education*	1.196	0.382	1.117	0.214	0.984	0.805
still studying*	2.111	0.053	1.196	0.219	1.100	0.535
employee*	2.288	0.000	1.412	0.000	1.205	0.011
family with children under 15 y.o	1.058	0.775	0.612	0.000	0.648	0.000
constant	0.072	0.000	0.101	0.000	0.014	0.000
Pseudo R2	0.262		0.210		0.254	
N	1007		11271		13828	

Data source: Flash Eurobarometer 494, data collected May 2021. Logistic regressions, robust standard errors.* Dummy variables with 1 for the presence of the attribute and 0 for its absence. Shadow for coefficients that are significant for $p<0.05$.

The propensity for anti-C19 vaccination was significantly higher in the major cities of Romania, compared to the situation in the medium / medium-sized cities or communes in Romania. The impact of this localization factor was stronger in Romania, compared to NSM and OMS. Where does this difference come from? Probably, although there is still room for argumentation, we are dealing with another effect of the fact that the difference in the standard of living between urban and rural is consistently higher in Romania compared to that in other countries in the NSM or the one in the OMS.

Conclusions And Discussion

Anti-C19 vaccination in Romania had a lower inter-community variation than that of infections with the new covid. Reconstituting the contexts relevant to the variation of vaccination patterns can be useful both for understanding the phenomena of vaccination and for good practices in the field. The main contexts that we have considered in understanding the inter-community variations of the anti-C19 vaccination are those of individual, regional, residential, country and continental macro-region status.

Age seems to be a kind of determinant relatively invariably impactful. Communities with higher shares of the elderly, rural or urban, tend to have a higher share of vaccinations. The perceived risks of the disease tend to be higher for the elderly and, as a result, the pro-vaccination attitudes of the elderly tend to be more strongly structured. Even if we change the way of analysis and we operate with age at the individual level, with survey data, the relationship remains unchanging: the elderly in Romania, as well as those in the New Membre of the European Union, like those in the Old Member States, tend to adopt the anti-C19 vaccination to a greater extent than adults and young people.

Community vaccination patterns have been largely dependent on those of C19 infection. The higher the infection rates, the higher the vaccination rates. The infection-vaccination relationship, however, was not of equal intensity. At the residential environment level, it was stronger in the rural than in the urban. The interpretation given for this differentiation is a matter of the medium of inter-knowledge. The communes and villages that compose them constitute, to a much greater extent than the cities, societies of inter-knowledge. In such rural environments of direct inter-knowledge, attitudes towards vaccination have a stronger structuring. Hence the fact that C19 infection rates have had a greater positive impact on vaccination rates in rural than in urban areas.

In connection with the experience of migration abroad, we only had aggregated data, at the local community level, for Romania, not in the European survey data. With such aggregated data, we have been able to see that there is a tendency for an increased emigration experience to contribute to a decrease in the community vaccination rate. Especially in the countryside, there seems to be an impact of the destination country on vaccination.

However, the relationship is not valid for all historical regions. We find it, in the version of the national model, only in Moldova's historical region. Further research is needed to understand these different ways of relating to migration experiences and vaccination rates.

The rural communities of origin for emigration to Spain appear to be more oriented towards the anti-C19 vaccination, and those with more departures to Italy and Germany seem to be of lower vaccination orientation. Why this is so, we do not know, within the limits of the data available for the present analysis.

It is also unclear why we have seen deterrent effects on vaccination for local communities where there are several people of Pentecostal or Adventist religions. Further research is also needed.

Regional factors seem to have had a consistent role in structuring vaccination models at the local level in Romania.

With Eurobarometer survey data and representative sub-samples at the country level, we were able to see what is the impact of a culture of vaccination as an adult, regardless of the disease targeted to be avoided by vaccination. In the old Member States of the European Union given and in the New ones, there is a tendency for those who have previously been vaccinated to be more inclined toward the anti-C19 vaccination as well. The previous vaccination culture does not act as a significant factor, however, for the anti-C19 vaccination in Romania as well. Why? The reason seems to be related to the fact that the share of those who have been vaccinated as adults, regardless of the disease targeted for avoidance, is much lower in Romania.

From a methodological point of view, the analyses in this material could be greatly consolidated if we had multilevel, individual, community, regional, and national data. In their absence, however, the working version adopted here could be of use to other researchers. The different contextualizations we have resorted to having been able to facilitate nuances, the abandonment of universalist perspectives, and the completion of the general causal picture with new hypotheses that can be tested in other research. Different levels of approach can coexist within the same research even if they are not integrated as nested models, provided that the level of data aggregation is specified [13-18].

Appendix

Predicting local community rates of anti-C19 vaccinations in Romania by historical regions

Predictors		Moldova		Muntenia		Oltenia		Dobrogea		Transilvania		Crisana-Marmures		Banat	
		Coeff.	P>t	Coeff.	P>t	Coeff.	P>t	Coeff.	P>t	Coeff.	P>t	Coeff.	P>t	Coeff.	P>t
COVID-19 infection rates February 2020-April 2021		0.144	0.000	0.188	0.000	0.108	0.000	0.1911	0.005	0.167	0.000	0.1148	0	0.143	0.000
Population concentration	urban (1 yes, 0 rural)	0.510	0.505	0.918	0.309	-0.448	0.647	-0.543	0.827	-0.354	0.766	2.0013	0.041	3.013	0.132
	resident population 2021 (ln transformation)	-0.761	0.160	-0.509	0.369	0.851	0.171	0.9044	0.459	-0.131	0.843	-1.475	0.032	0.315	0.780
	density index 2021 (ln)	2.428	0.000	0.110	0.805	1.660	0.016	-0.537	0.629	2.218	0.000	1.9918	0.003	1.842	0.076
average age 18+ years old 2018		0.144	0.000	0.062	0.006	0.116	0.000	0.1707	0.020	0.226	0.000	0.0357	0.389	0.031	0.625
local human development index 2018		0.252	0.000	0.244	0.000	0.319	0.000	0.3439	0.000	0.346	0.000	0.4366	0	0.311	0.000
Migration profile of community 2011	index of migration abroad experience 2002, 2011	-0.078	0.003	0.116	0.000	-0.062	0.128	-0.091	0.206	0.012	0.724	0.046	0.307	-0.093	0.157
	emigration rate to Spain 2011 (ln)	0.620	0.035	0.559	0.037	0.042	0.895	0.3719	0.707	1.155	0.000	-0.268	0.512	-0.293	0.593
	emigration rate to Italy 2011 (ln)	-0.666	0.007	-0.842	0.004	0.817	0.012	-0.244	0.811	-0.616	0.038	-0.215	0.631	0.824	0.072
	emigration rate to Germany 2011 (ln)	-0.508	0.236	0.631	0.310	-0.060	0.928	1.9147	0.168	-1.406	0.000	0.6997	0.283	-0.618	0.338
Religious minorities	% Adventist in population 2011 (ln)	-0.644	0.225	-0.322	0.594	1.276	0.181	-0.438	0.797	-0.494	0.332	-0.635	0.277	-2.686	0.041
	% Penticostals in population 2011 (ln)	-1.410	0.000	-2.830	0.000	-1.273	0.080	-2.783	0.135	-0.778	0.011	-2.667	0	-2.981	0.000
% population attending parliamentary elect. 2020		-0.005	0.884	-0.010	0.705	-0.017	0.383	0.0396	0.683	0.008	0.804	0.1023	0.013	0.053	0.422
_cons		3.333	0.418	8.731	0.063	-4.982	0.268	-0.346	0.975	-14.80	0.002	0.3747	0.941	2.498	0.771
R2		0.544		0.548		0.539		0.660		0.602		0.608		0.713	
N		606		625		394		104		606		294		145	

Data sources: National Institute for Public Health for COVID-19 and National Institute of Statistics for the other data. Own computations. Ordinary least square regressions in STATA, robust standard errors. Dependent variable – local community rates of anti-COVID-19 vaccinations cumulated up to February 05. 2022. No colinearity: VIF for predictors is not larger than 4. Shadow for regression coefficients that are significant for p=0.05 or less. The number of cases for Bucuresti-Ilfov is lower than necessary, considering the number of predictors. This is the reason for not doing computations for this region.

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