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Territorial Disparities in COVID-19 Vaccination in Romania

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Abstract

This paper explores relationships between vaccination coverage and indicators at the level of local administrative units for the case of rural localities of Romania. Positive correlations have been identified in relation to fiscal capacity, coverage of the population with general practitioners, COVID-19 incidence rate and absence of a marginalized community within the locality. Regional differences are again highlighted in the analysis. This means that there is at least partially an overlap of the disadvantaged rural areas with the ones registering low vaccination uptakes against COVID-19. Further on, it means that these territorial areas accumulate a series of structural disadvantages that can prove to increase the discrepancies between them and other rural or large urban areas. The paper contributes to enlarging the perspective on vaccination coverage by adding both conceptual and practical insights. From the point of view of practitioners, the results of the study can be used to tailor intervention in communities with similar characteristics, to underscore public health inequalities across territories. Points for practitioners are relevant for a wide range of stakeholders from public health, public management, and social protection fields, placed in both local and central level decision-making positions.

Keywords:

vaccination coverage; localities; COVID-19; Romania; local governments; marginalized areas; rural areas

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1. Introduction

This paper explores factors associated with disparities in COVID-19 vaccination coverage in the rural localities of Romania. Vaccination has been advocated as one of the strategies to control the current COVID-19 pandemic. The topic is highly relevant in the context of Romania, which still registers one of the lowest vaccination uptakes against COVID-19 in the EU (ECDC), with rural areas registering lower vaccination coverage than urban areas (as of 5 January 2022, vaccination uptake in rural areas is 36.77%, compared to 41.26% in urban areas) (National Institute of Public Health).² Although four types of vaccines have been made available in Romania throughout the past year (Pfizer-BioNtech, Moderna, AstraZeneca, and Johnson&Johnson), the supply outpaced the demand. The topic is also relevant for the upcoming potential challenges to be faced in 2022, with increased infection rates and substantial socioeconomic challenges posed by the pandemic.

Previous studies have been mostly focused on examining vaccination coverage at national levels, in different time sets (Lindholt et al., 2021; Liu et al., 2021; Zaprutko et al., 2022) or individual level factors for explaining vaccination hesitancy, usually based on survey data (Karabela et al., 2021; Cristea et al., 2021; Achimescu et al., 2021; Stănescu & Dumitru, 2021). This study introduces a different analysis layer, that of community-level variables in relation to vaccination uptake, based on publicly available granular data on vaccination uptake, for all local administrative units in Romania. Disaggregation of data at this level is of particular importance in examining territorial disparities, which have been signaled especially in relation to the functioning of public health systems in post-communist countries (Stănculescu & Neculau, 2014). In particular, rural areas accumulate multiple disadvantages regarding several social and economic indicators, including employment, access to basic services (including general practitioners, emergency or hospital services, but also water, sewerage, paved roads, etc.) (Cucu et al., 2021; Rusu et al., 2022). Eastern Europe in particular is considered to be signaling a consistent difference in the impact of the COVID-19 pandemic when compared to Western and Northern Europe. Eastern Europe (to which Romania is also affiliated) registered the lowest number of tests, and therefore the least number of cases per million, but also the worst situation in terms of number of deaths per million (Alrasheedi, 2023).

The paper starts with two sections introducing the research background, detailing previous studies on vaccine hesitancy and briefly introducing pre-pandemic territorial inequalities in Romania, with an outline of the structure of the local public administration in Romania. The third section presents data sources and methods. The last two sections cover results, discussion and conclusive remarks.

² <https://vaccinare-covid.gov.ro/situatia-vaccinarii-in-romania>.

2. Research background: previous research on vaccine hesitancy

The concept of vaccine hesitancy has been developed in relation to delays in the acceptance or refusal of vaccines despite the availability of vaccine services (WHO, 2014). It is noteworthy that this does not refer to low vaccine uptake due to lack of vaccine stock, large travel distances, or a general lack of available services. The present quantitative analysis highlights structural, community-level variables as predictors of low vaccination coverage at the level of territorial administrative units.

The key lines of demarcation in the models previously developed for studying vaccine hesitancy correspond to individual factors versus social processes or to groups of contextual influences, individual and group influences, and vaccine/vaccination-specific issues. In this respect, the SAGE Working Group Determinants of Vaccine Hesitancy Matrix identifies the following: (i) contextual influences – such as: (1) communication and media environment, (2) influential leaders, immunization program gatekeepers and anti- or pro-vaccination lobbies, (3) historical influences, (4) religion/culture/gender/socioeconomics, (5) politics/policies, (6) geographic barriers and (7) perception of the pharmaceutical industry; (ii) individual and group influences – (1) personal, family and/or community members' experience with vaccination, including pain; (2) beliefs, attitudes about health and prevention; (3) knowledge/awareness; (4) health system and providers-trust and personal experience; (5) risk/benefit; (6) immunization as a social norm vs. not needed/harmful, and (iii) vaccine/vaccination specific issues – (1) risk/benefit (epidemiological and scientific evidence), (2) new vaccine or a new formulation/recommendation for an existing vaccine, (3) mode of administration, (4) design of vaccination program or mode of delivery, (5) reliability and/or source of supply of vaccine, (6) vaccination schedule, (7) costs and (8) the strength of the recommendation and/or knowledge base and/or attitude of healthcare professionals (WHO, 2014). Further, on the concept of vaccine hesitancy, determinants grouped around the 3Cs model have been developed. These refer to complacency, convenience and confidence. They combine perceived risk of disease (complacency as a low perceived risk of disease), different forms of trust (confidence in the effectiveness and safety of the vaccine) and various types of factors related to availability and affordability – convenience (WHO, 2014). Moreover, the matrix of 3Cs has also been completed with two more factors – risk calculation and collective responsibility (Wiysonge et al., 2021). They, however, resemble the previously cited items on risk/benefit and immunization as a social norm.

Additionally, an emphasis on the social processes over the individual factors can bring an enhanced standpoint on the structural disparities in vaccination rates. From this perspective, the two potential pathways previously explored might prove to be useful. They refer to neoliberal logic and social exclusion (Wiysonge et al., 2021). The neoliberal logic underscores individual choices and accountability on both health-related risks and outcomes and has been opposed to the position advocated in the

vaccination campaign to view vaccination as a public health and collective responsibility. In addition, experiencing social exclusion can prove to be a factor accounting for vaccine hesitancy. The same source relates it to distrustful government-citizen relations, which can result in distrusting vaccination, resisting vaccination as a form of agency or avoiding vaccination for reasons of time and opportunity. Therefore, social exclusion and neoliberal logic have been viewed as complementary to the core psychological constructs highlighted in the framework of the 5Cs (*ibid.*).

Furthermore, particular factors identified in relation to COVID-19 vaccine hesitancy seem to be again related to the model of the 3Cs/5Cs. They embrace dimensions related to lack of trust, risk of contracting COVID-19 and sociodemographic variables, among others. First, lack of trust has been related in particular to a large set of issues, which can be summed up to lack of confidence in the vaccine as a result of safety and effectiveness problems, including lack of trust in public (health) authorities (Wiysonge et al., 2021; Tahir et al., 2021; Viswanath et al., 2021; Kalam et al., 2021), effects of the infodemic³ (Karabela et al., 2021), the perception of whether the government is handling the pandemic well in a cross-country study (de Figueiredo & Larson, 2021), low levels of trust in relation to where it is made, effective protection, how long the protection lasts (Kreps & Kriner, 2021), or being against vaccines in general, concerns about safety/provenience/ thinking that a vaccine produced in a rush is too dangerous, belief to be already immunized, belief in natural immunity (Pavić et al., 2022; Troiano & Nardi, 2021), the emotional risk perception, with higher risk perceptions for acceptors of the vaccine (İkişik et al., 2021), trust in the national health authorities and scientists and personal health concerns (Lindholt et al., 2021), or experiences of government and other forms of authority (Cooper et al., 2021). Second, complacency regarding the individual risk of getting infected with COVID-19, lack of time to go and get a vaccine (Wiysonge et al., 2021), perceived risk of getting COVID-19 and severity of the disease and other behavioral determinants to differentiate Acceptors from Non-Acceptors (Kalam et al., 2021), use of protective measures alongside lower perceived severity of COVID-19 if infected (Schwarzinger et al., 2021).⁴ Third, sociodemographic variables associate the decision of COVID-19 refusal with key variables like age, gender, education, income, vaccination history, and other variables – examples include being a female, age with an inverted U-shaped relationship, lower educational level, poorer compliance with recommended vaccinations in the past, no report of a chronic condition (Schwarzinger et al., 2021), in addition to race/ethnicity, vaccine safety and effectiveness, influenza vaccination history, and self-protection from COVID-19 (Al Shurman et al., 2021), or being non-

3 The term infodemic used as an excess of information, some correct and some not, which arises during a disease outbreak (Karabela et al., 2021).

4 Similar factors, like fear of side effects, digital divide reasons – lack of access to the online vaccine registration platform, lack of trust in government, belief in conspiracy theories, low or no monthly income and depending on someone else to reach a decision about vaccination, have been identified in another study conducted in South Africa (Katoto et al., 2022).

academics, and people who did not vaccinate against influenza in the previous season (Shmueli, 2021), monthly family income, education level, self-diagnosis of COVID-19 or a friend, family member, or colleague significantly influence the acceptance of COVID-19 vaccination, whereas the dogma of being naturally immune to COVID-19 is among key reasons for the refusal of the vaccine (Tahir et al., 2021). Older adults have less concerns and/or being more accepting of COVID-19 vaccination as well as higher levels of education being associated with increased vaccine hesitancy (Cooper et al., 2021).⁵

Previous research showed lower vaccination uptake among ethnic minority groups and deprived communities in England (Razai et al., 2021). Some of the cons against the COVID-19 vaccine add to the low rates of trust in governmental authorities, especially at the central level, in accordance with factors earlier identified (Razai et al., 2021). Hence, there is a plea in favor of the development of more inclusive policies and frameworks in SARS-CoV-2 vaccine allocation for disadvantaged groups such as incarcerated people, homeless people, asylum seekers and undocumented migrants (Farina & Lavazza, 2021). Again, age and level of education are factors associated with the perception of official protective measures and vaccination intent (Gilles et al., 2022). Similar findings on higher vaccination hesitancy among members of minority groups have been reported in other studies as well – Black Americans compared to White Americans, underlining the “wait-and-see” approach, vaccine side effects and efficacy, alongside other perceptions related to access and medical mistrust, against the background of systemic racism (Dong et al., 2022). The same structural discriminatory attitudes, together with transport and language barriers, are highlighted in Butler et al. (2022). A better focus on specific disadvantaged groups has been emphasized – for instance, in relation to patients with mental illness (Payberah et al., 2022), people living with HIV/AIDS (Yao et al., 2022) or robust disaggregated data on vaccine hesitancy among ethnic minorities (Hussain et al., 2022).

Furthermore, another qualitative study placed the concept of vaccine hesitancy in a different perspective. The developed typology refers to attitudes towards vaccination even after the vaccination uptake. The analysis brings out four types of COVID-19 vaccine attitudes – active acceptance, passive acceptance, passive decline and active decline. The category of passive acceptance includes respondents who had one or two doses of the vaccine, but still had doubts about its efficacy or safety. Declination of vaccine or passive acceptance has been identified more likely among ethnic minority communities and female healthcare workers (Gogoi et al., 2022).

In a different research line on the same topic, big data analysis of Youtube comments revealed another set of factors present in the online ecology of vaccine hesitancy – (i) polarization of views, skewed in favor of anti-vaccine; (ii) concerns about safety, side-effects, lack of trust in government and pharmaceutical companies;

⁵ Older age and having a chronic disease history were reported to be positively associated with COVID-19 vaccine hesitancy in Chinese people living with HIV/ AIDS (Yao et al., 2022).

(iii) preferences associated with affiliations to political parties (Teng et al., 2022). Additional qualitative studies revealed several other incongruences in the perceptions expressed by participants – between the information from official sources and the information from social media, between the aims and implementation at the national level and realities and needs at the local level, alongside a sense of low trust level in government or following examples of vaccination “heroes” (Chan et al., 2022).

To sum up, a systematic review on the identified factors for worldwide COVID-19 vaccine hesitancy identified as the most common vaccine efficacy, vaccine side effects, mistrust in healthcare, religious beliefs, and trust in information sources, alongside demographic factors – health inequalities or socioeconomic disadvantages, systemic racism, or exposure to online misinformation (Biswas et al., 2021). The importance of misinformation alongside structural inequities in ethnic minority groups has been outlined in Hussain et al. (2022) as well as in Moscardino et al. (2022). It is noteworthy that the setting of the study matters.

The importance of the national level context has been revealed in a study using discrete choice experiments showing that, for instance, the most important attributes are associated by respondents from the United States with the greatest importance to the efficacy of COVID-19 vaccines, the cost of vaccination, whereas for those from China the cost of vaccination was the most important attribute and efficacy the second most important attribute (Liu et al., 2021).

A literature review performed on studies related to vaccine hesitancy in Eastern Europe grouped the identified factors into the following ones: (i) differences related to vaccine brand, with the Messenger ribonucleic acid (mRNA) vaccines holding top places in preferences; (ii) confidence in trials evaluating COVID-19 vaccines and in resulting clinical evidence (still Romania reporting no confidence in these studies, given the short time frame – in Manolescu et al., 2021); (iii) confidence dynamics in time: comparisons before and after vaccine initiation or social popularization; (iv) associations with spirituality and religion, however with inconclusive results; (v) conspiracy beliefs, also signaled in Romania’s context (Maftai & Holman, 2021; Achimescu et al., 2021); (vi) the misinformation phenomenon, related to the influence of using the Internet as an information source (Mogoș et al., 2022) or (vii) the influence of the community in shaping personal opinions (in correlation with the subjects’ perception that their primary group accepts vaccination, in Cristea et al., 2021; Popa et al., 2022). Additional examined factors from the same literature review report on trust in institutions, including health institutions, vaccine literacy in the general population, attitudes toward vaccination in health workers or students or more complex vaccine hesitancy models (like the 5Cs model, the health belief model, etc.). Nonetheless, there is no explicit statement about the limitations of the reviewed studies. Interpretation of data from convenience samples (with no men included) in a Romanian study (Maftai & Holman, 2021) or an international study conducted in Poland, Lithuania, and Ukraine (Zaprutko et al., 2022) should be carefully examined. The same potential bias in samples selection, together with rather diverse ways of

defining vaccine acceptance, have been signaled in an extensive (in terms of countries coverage) literature review on COVID-19 vaccination acceptance, targeting available survey data (Sallam et al., 2022).

In particular relevant for the purpose of this article, previous research investigated statistical analysis of associations between municipalities' deprivation quintiles and incidence of confirmed COVID-19 cases, mortality rates and vaccination coverage. The conclusion set in the study is that, despite a successful vaccination campaign, the territorial disparity gap has not been closed, in particular in relation to the highest mortality rates during the third wave (Oroszi et al., 2022). The relationship with the locality's deprivation index is stated to be mediated through the educational level, with on the one hand education as one of the important determinants in the deprivation index and, simultaneously, having a positive effect on willingness to accept vaccination (ibid.).

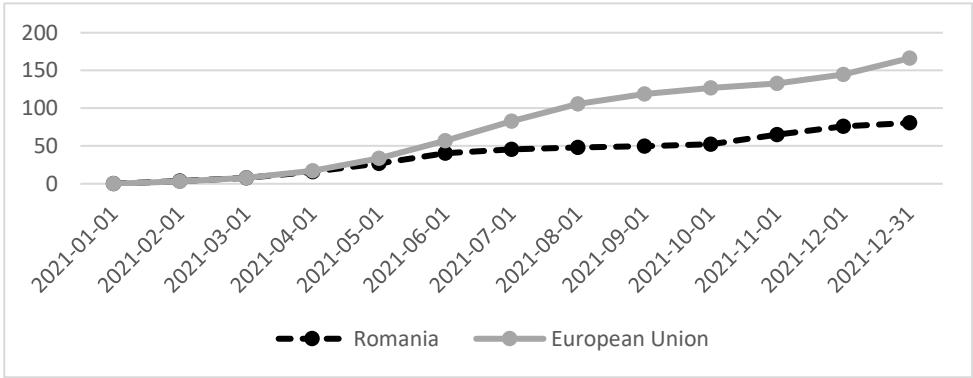
Other comparisons between vaccination rates registered in post-communist countries, like Lithuania and Poland, discuss the importance of enforcing strict regulations in relation to the COVID-19 certificates – in Lithuania's case also in relation to access to restaurants, sports facilities, indoor events, in addition to international travel (as was the case of Poland, used as a control group, which relied mostly on public health campaigns for an increased vaccination rate in the analyzed period from 31 July to 30 September 2021). Authors conclude that the enactment of this certificate in Lithuania has contributed to an increased gap in the vaccination uptake between the two countries (Walkowiak et al., 2021).

For the case of Romania, direct social interaction with people from extra-local communities, considered among the conditions favoring COVID-19 infections (Sandu, 2022), is also relevant for vaccine hesitancy. Moreover, factors related to socio-human capital, regional capital, size of the locality, location of the community around a large city, being part of a high modernity area or being part of a high emigration abroad community have been examined (Sandu, 2022). Previous analyses conducted at the locality level for the case of Romania revealed, as predictors of vaccination coverage (data for August 2021), the infection rate with COVID-19, the local human development index, the average age of the local population in 2018, the area of residence (urban/rural), the index of urban connectedness, the permanent resident population and the index of migration experience, together with cultural areas as clusters of neighboring counties (Sandu, 2021). Compared to the evolution of vaccination coverage in the EU, Romania shows a substantial gap, which increased significantly during the critical period of 2021, especially starting with July 2021 (Graph 1). For instance, in October 2021, the vaccination coverage was 52.37 vaccinations per hundred in Romania, and in the EU 126.9 vaccinations per hundred people (Mathieu et al., 2021). For the same time frame⁶, in other post-communist

⁶ Data for 1 October 2021, chosen as an example also in relation to the availability of granular data at LAU 2 level, analyzed in this paper.

countries, Poland registered a value of 98.02, and Czechia a value of 113.05, while Bulgaria had an even lower value than Romania, with 37.55 vaccinations per hundred people.

Figure 1:
Total vaccinations per hundred, in Romania and EU, 2021



Source: Mathieu et al. (2021); <https://ourworldindata.org/covid-vaccinations>⁷

Vaccine hesitancy associated with individual-level characteristics has been highlighted in previous Eurofound studies, based on survey data at the EU level. They also point out an East-West divide, with the Nordic and Mediterranean countries at higher rates of vaccine intention, whereas the Eastern countries belong to a group with significantly lower rates – in Romania about 59% and Bulgaria 33%. By sociodemographic variables, those who seem to be more hesitant at the EU level are more likely to be men, in the age group of 35–49 years, unemployed people, people with a long-term illness or disability or full-time homemakers or persons who use social media as their primary source of news (Ahrendt et al., 2021).

This study questions a different set of predictors of vaccination uptake at the locality level than the ones previously tested for Romania’s case. They are represented by structural factors related to population composition, and various indexes at the locality level.

3. Research background: pre-pandemic territorial inequalities in Romania

This section briefly introduces the structure of the local public administration in Romania, while outlining key territorial disparities concerning general development,

⁷ Data source cited for Romania – Government of Romania via datelazi.ro.

but also health inequalities, as captured by the latest data available before the pandemic outburst in 2020.

The Romanian system of public administration consists of a two-tier local government structure including 3,181 municipalities (3,180 municipalities plus the municipality of Bucharest, capital city) and 41 county councils. The set of 3,181 municipalities includes 2,861 rural municipalities, 217 towns and 103 cities.⁸ Both the local and county councils are elected. The local council consists of between 9 and 31 members, while the county council consists of between 31 and 37 members. Both local and county councils usually meet once a month in ordinary meetings, if necessary. The members of the local council are elected by secret ballot and by direct suffrage.

While there are no subordination relationships between the county and the local councils, the legal provisions in the Romanian Constitution state that the county council is the public administration authority to coordinate the activities of the municipalities (commune, town and municipal councils) in order to provide services at the county level (Article 122). The executive bodies of the local and county councils are represented by the mayor or, respectively, the President of the County Council.

In terms of size, there is a large number of municipalities under or equal to 5,000 inhabitants (Table 1). Together they account for more than one third of the population of the total number of 3,180 municipalities (excluding the capital city, the municipality of Bucharest). These include a total number of 29 urban municipalities (out of the total number of 2,491 municipalities under or equal to 5,000 inhabitants). Towns, cities, municipalities and counties can decide on matters of general interest, in areas under their jurisdiction, in accordance with the law.

Table 1:

Breakdown of municipalities according to the size of the population

Number of inhabitants	Number of municipalities	Out of which, urban municipalities:	Percentage of total population
Under 2,000	752	1	6.08
2,001–5,000	1739	28	30.57
5,001–10,000	479	105	17.33
10,001–20,000	115	91	8.18
20,001–100,000	76	75	17.19
Over 100,001	19	19	20.65
Total	3180	319	100

Note: the municipality of Bucharest is not included in the analysis (municipality over 100,001 inhabitants)

Source: Author's own calculations based on data from Population Census of 2011.

⁸ Annex to Law no. 290/2018, Statistical situation documentary on administrative organization of Romania's territory. The Baneasa municipality from Constanta county was considered a city until 2019, when it was reclassified as a commune. The current analysis on rural localities does not include it.

There are substantial territorial inequalities between territorial administrative-units. In the rural area, communes with low fiscal capacity come, to a significantly higher extent, from the development regions of North East, South Muntenia and South West, as outlined in Table 2.

Table 2:

Fiscal capacity by development region, rural localities in Romania (%)

		Fiscal capacity				
Development Region		Lower quartile	Medium-low quartile	Medium-upper quartile	Upper quartile	Total
	North East	42.7	26.3	18.2	12.8	100
	South East	17.2	21.4	31.3	30.1	100
	South Muntenia	21.0	27.6	25.8	25.6	100
	South West	44.9	29.2	15.7	10.3	100
	West	14.2	21.4	29.5	34.9	100
	North West	17.1	27.5	30.0	25.3	100
	Center	10.1	19.3	29.7	40.9	100
	Bucharest	*	*	*	68.8	100
	Total (N)	715	714	717	715	2861
	Total (%)	25	25	25	25	100

Note: Colored cells indicate significantly higher values (adjusted residuals). * Lower than 5 cases. Fiscal capacity is measured as shares of own revenues with the sums deducted from personal income tax, in total expenditures, average values for the last three years.

Source: Author’s own calculations based on the public information data on local budgets execution for all communes in Romania, 2023.

Relevant health inequalities regard, besides the consistent distance between Romania and EU concerning key health outcome indicators, also the territorial discrepancies between, on the one hand, the urban and rural areas, and between rural localities, from the standpoint of this paper.

Romania spends among the lowest financial resources in the EU on health. Additional characteristics of the health system resources before the spread of COVID-19 in 2020 include (i) a focus on spending on hospitals, coupled with policy priorities directed to strengthening primary care; (ii) a lower number of doctors and nurses than the largest part of EU countries, compounded by the migration of health professionals; and (iii) overuse of hospitals over outpatient care (OECD/EU, 2019, pp. 9–12). Several policy measures intended to be implemented before the pandemic outlined the need to rationalize the network of hospitals in Romania (Government of Romania, 2011, 2014) and transform it into outpatient care, yet there was no visible change in terms of fund allocation by type of expenditure. In 2019, the financial resources for the health system recorded an increase in total allocations, yet still counted as one of the lowest values among EU countries (5, compared to 8 percent of GDP at the European level).

Nonetheless, the value is higher than the financial resources available for health in 2019 in Bulgaria, Poland, Cyprus, Latvia and Ireland.⁹ The value of expenditures for hospital services is almost equal to the EU level in 2019 – 2.9 percent in GDP in Romania and 3 percent of GDP in the EU. Romania spends the highest share among EU countries for inpatient care – 44 percent of total spending in 2019 (OECD/EU 2021, p. 10). Although on an increasing trend, the supply of medical doctors for the population is still far from the EU level. In 2019, the value registered at the national level was 318.67, whereas the European value was 390.58 medical doctors per hundred thousand inhabitants. Only two development regions from Romania registered higher levels than the EU ones, namely, Bucharest-Ilfov (617.92) and West (416.35). The lowest number of medical doctors was registered in the South Muntenia region (159.76 in 2019).¹⁰

Life expectancy at birth differs substantially between counties and residence areas. The latest available data (for 2020) show that life expectancy at birth was 77.44 years in 2020 in the urban area, and 74.41 years in the rural area. Except for two counties¹¹, in all other counties, life expectancy is higher in the urban area, compared to the rural area. The smallest differences between residence areas are registered in the counties of Suceava (0.96 years), Caras-Severin, Maramures and Ilfov (1.22 years). On the opposite, the largest differences are registered in Vaslui (5.09 years), Bacău (4.89 years), Dolj (4.57 years) and Galați (4.33 years) (Cucu et al., 2021, p. 22).

4. Data and methods

This study is based on a quantitative analysis performed by aggregating publicly available data, all of them at the locality level, meaning at the level of a single administrative-territorial unit (LAU 2 unit).¹² The author aggregated several publicly available indicators based on the unique statistical identification code for each locality. Nevertheless, this effort has not been without obstacles. The rate of COVID-19 vaccination coverage and the rate of COVID-19 infections have been publicly displayed without the unique identification number (statistical code) corresponding to each locality in Romania (SIRSUP). This simple fact significantly hinders the analyses conducted by independent researchers and is not the only case where improved and meaningful data transparency is needed in Romania. To complete this analysis, the researcher manually introduced this code (more than three thousand localities) for each locality. Rates of vaccine coverage from August and October were processed and analyzed, as published by the Romanian Government.¹³ Other variables are posted on

9 Eurostat database, General government expenditure by function (COFOG) [GOV_10A_EXP]

10 Eurostat database, Health personnel by NUTS 2 regions [HLTH_RS_PRSRG]

11 Valcea and Hunedoara.

12 The correspondence between LAU 2 units level in Romania and other EU countries – Eurostat

13 <https://vaccinare-covid.gov.ro/wp-content/uploads/2021/10/AV-pe-uat->

a website created by the Ministry of Public Works, Development and Administration and the World Bank in a common EU-funded project. Notably, the entire quantitative analysis uses only publicly available data that can be replicated by any interested researcher. The analysis has been focused only on rural areas of Romania for two key reasons: (i) there is a greater homogeneity in rural areas, on the topic of opinions on vaccination against COVID-19 (as compared to urban areas); (ii) the vaccination coverage has been lower in rural areas, again, compared to localities from the urban areas. The complete list of variables used in the study is presented in the Annex.

The key variable for the analysis, financial capacity, has been computed in two key methods. Under each method, two lines of calculating own revenues have been used. The first one is according to the standard legislation on local public finances in Romania and includes sums deducted from personal income tax. Still, in order to better consider the local financial autonomy, an additional procedure has been used, one in which “local own revenues” do not include the sums deducted from personal income tax allocated in order to achieve local budgets equalization. In this latter method, own revenues mirror in a rather improved way the local budget’s own effort. The formula used by this study for computing local fiscal capacity is represented by the average value for the last three years, 2018–2020, as shares of own revenues in the total revenues. This variable can also be considered an indication of the local financial autonomy. Nonetheless, in the case of a locality with a low size of the budget, there is a high likelihood that it will stand in a good position, even though the absolute size of the own revenues or total revenues is small, at the national level.¹⁴

There is a high heterogeneity between the values of each commune under all four methods of computing fiscal capacity. Table 3 presents descriptive statistics for each of the four indicators previously explained. Even in the upper quartile, which will be considered the best values for fiscal capacity, the range of values differs from 139 euro/inhabitant or 190 euro/inhabitant (if considering the sums deducted from the personal income tax) to maximum values of more than 2,000 euro/inhabitant, for both indicators computed using this measurement unit. As shares of own revenues in the total revenues, the range of values in the upper interval is from 30 percent (or 42 percent with the sums deducted from the personal income tax) to more than 90

5.10.2021.pdf?fbclid=IwAR2zW_CdCKcjNOhjbWVzaI5iOjSRgCQ1LM6kDo6vyW3G_9DhmjZTKH9_BJA

14 In order to test whether there are differences when using other computing methods for the variable on fiscal capacity, diverse computation methods have been employed. Namely, as average of own revenues per inhabitant, for the last three years, namely 2018, 2019, 2020. In order to better reflect the local financial autonomy, the sums deducted from the personal income tax have been excluded from the total sum of own revenues. The analysis uses publicly available data on the local budgets’ execution in Romania, published by the Ministry of Development, Public Works and Administration. Data for the population refer to census data (2011). It is most likely that census data which are currently collected (in 2022) will better reflect the size of the population. In fact, data on population can be considered a limitation throughout the tested variables, as the vaccination coverage has also relied on the currently available set of data from the National Institute of Statistics, which can only partially reflect the present circumstances.

percent, as maximum values, under these two methods of computation.¹⁵

Table 3:

Descriptive statistics for the fiscal capacity of the rural localities in Romania

		Own revenues, excluding SDIVG, average value for 2018, 2019 and 2020, % in total revenues
Mean		25.59
Median		22.42
Mode		3.50 ^a
Std. Deviation		13.18
Minimum		3.50
Maximum		94.19
Percentiles	25	17.074
	50	22.429
	75	30.290
Total number of valid cases		2861

Note: a. Multiple modes exist. The smallest value is shown.

Source: Author's own calculations based on the public information data on local budgets execution for all communes in Romania, 2023.

Additionally, the relevance of data relies on the quality of the available data used in the secondary quantitative analysis. Moreover, study limitations include the dependance on the availability of data at the national level for all rural localities. If other types of relevant quantitative information are available, alternative explanation models can be conducted. However, the analyses presented are constructed on an extensive number of cases, with almost 3,000 cases, which provides the ground for pertinent findings for the rural localities of Romania. Subject to available data, the study can also be replicated in different country contexts, in particular in post-communist countries.

Alongside the role of fiscal capacity, the study also tests relationships between vaccination coverage and other variables like development region, general practitioners' offices by 1,000 inhabitants, incidence rate in September 2021, presence of a marginalized community and the share of older persons in the total population.

15 In general, there is a good consistency between the methods of computing local fiscal capacity, both concerning the measurement units expressed as euro/inhabitant, and as share of own revenues in total revenues. However, there are also some cases of territorial administrative units for which the share of sums deducted from the personal income tax can bring an important added value on the indicators. This means that, for instance, more than 43 localities can be placed in the lower quartiles when excluding these funds used for local budgets equalization and, simultaneously, move up to the upper quartile when considering these funds. At the same time, there is a consistent difference between the placement of certain localities, if we compare the positions placed in the medium-low and medium-upper quartile, for both indicators.

Except for the variable regarding marginalized communities¹⁶, the hypothesized relationships with the vaccination coverage represent positive correlations with the vaccination coverage. Older adults and persons with underlying health conditions have been identified among the vulnerable groups (WHO, 2020; UN, 2020).¹⁷ A high incidence rate can be regarded to be in relation to the perceived risk of disease (complacency as a low perceived risk of disease) (WHO, 2014) but also in relation to risk calculation (Wiysonge et al., 2021). The number of general practitioners' offices by 1,000 inhabitants can also be an indicator of various types of factors related to availability and affordability – convenience (WHO, 2014). The relationship with marginalized communities is hypothesized to be in an indirect relationship due to the structural characteristics of these rural communities, as underlined by previous research (Teşliuc et al., 2016). “By definition, these rural areas are severely deprived census sectors in which most of the population have completed only lower secondary education at most, make a living in the informal sector (especially agriculture), and live in precarious dwellings even by the usual low standard for rural areas (in other words, they live in overcrowded houses and/or have no access to running water or electricity)” (Teşliuc et al., 2016, p. 28). In line with earlier studies on the rate of vaccination uptake and disadvantaged communities (Razai et al., 2021), the assumed direction between these two variables, in the Romanian context, is of an indirect relationship.

5. Results

The results section presents the findings concerning factors associated with differences in vaccination coverage in the rural localities of Romania. Additionally, variances in vaccination rates registered between August and October 2021 are presented.

Vaccination coverage has increased substantially only for a limited number of communes in Romania, based on the available data for August and October 2021. As shown in Table 4, only 23 communes succeeded in increasing the vaccination coverage by more than 5 percent in this timeframe. The largest part of the examined set of localities increased the vaccination coverage with at most two percent, whereas 41.2% increased it with shares varying between 2 and 5 percent. It is noteworthy that localities that succeeded in increasing the vaccination coverage by more than 5 percent are to a significantly greater extent from the medium-upper quartile of fiscal capacity, while those that increased it between 2 and 5 percent are from the upper quartile of the indicator on own revenues – without sums for equalization purposes, euro/inhabitant.

16 And the one concerning affiliation to a specific development region, in which the hypothesized relationships differ between localities.

17 <https://www.who.int/europe/news/item/03-04-2020-statement-older-people-are-at-highest-risk-from-covid-19-but-all-must-act-to-prevent-community-spread>

Table 4:

Differences in vaccination coverage between October and August 2021, rural localities

	Number of cases	Percent
No difference	5	0.2
Up to 1%	297	10.4
Between 1 and 2%	1358	47.5
Between 2 and 5%	1178	41.2
More than 5%	23	0.8
Total	2861	100

Source: Author's own calculations based on the public information data on vaccination coverage at locality level, published by the Government of Romania, 2023

The moment of registering vaccination coverage in October 2021 is of particular relevance. The next analyses use data from vaccination uptake in October 2021. From the point of view of the research context, it is worth mentioning that in the period of October-November, Romania registered a peak of the 14-day death notification rate (per 1,000,000 population) (European Centre for Disease Prevention and Control).¹⁸ As shown in previous research, the fatality rate can have an impact on vaccination uptake at the local level. Still, at a general level, the increase from August until October 2021 has not proved to be substantial.

The results of the statistical analysis indicate several significant correlations between different locality level factors and vaccination uptake. Firstly, there is a significant positive correlation between the level of fiscal capacity and vaccination coverage in the rural localities of Romania, irrespective of the method of calculation. Table 5 presents the results of the analysis for the fiscal capacity computed as the mean value for the last three years of the share of own revenues¹⁹ in the total revenues. It shows that localities with a higher vaccination coverage are to a significantly higher extent from the communes with a good level of fiscal capacity (upper quartile). Table 5 presents the results for the local own revenues computed as euro per inhabitant, without considering the sums deducted from the personal income tax. However, significant associations between the two key variables under study are to be found in all the cases, with all other three methods for computing fiscal capacity. Table 5 presents several variables analyzed – in relation to territorial affiliation (development region), health – general practitioners; demographic (share of older people); economic and social (presence of marginalized community which is an aggregate index built from indicators related to the population's educational level – lower secondary education at most, employment structure – make a living in the informal sector

¹⁸ <https://covid19-country-overviews.ecdc.europa.eu/countries/Romania.html>

¹⁹ Without including the sums deducted from the personal income tax.

(especially agriculture), and standard of living – live in precarious dwellings even by the usual low standard for rural areas.

Table 5:

Disparities in COVID-19 vaccination coverage for the rural localities of Romania

		Vaccination coverage				Total
		Lower quartile	Medium-low quartile	Medium-upper quartile	Upper quartile	
Fiscal capacity	Lower quartile	41.0	27.4	21.4	10.2	100
	Medium-low quartile	32.2	29.0	24.1	14.7	100
	Medium-upper quartile	21.6	29.6	28.7	20.1	100
	Upper quartile	15.1	22.0	27.4	35.5	100
Development region	North East	59.5	25.3	11.9	3.4	100
	South East	36.6	31.8	21.7	9.9	100
	South Muntenia	16.4	29.3	30.1	24.3	100
	South West	16.9	31.6	30.9	20.6	100
	West	13.2	28.1	37.4	21.4	100
	North West	15.4	21.1	29.0	34.5	100
	Center	28.6	23.5	23.0	24.9	100
	Bucharest-Ilfov	0	*	*	81.3	100
General practitioners' offices by 1,000 inhabitants	Lower quartile	36.8	25.6	21.6	16.0	100
	Medium-low quartile	30.3	26.3	23.9	19.6	100
	Medium-upper quartile	24.5	27.0	26.3	22.2	100
	Upper quartile	18.3	29.1	29.9	22.8	100
Incidence rate in September 2021	Lower quartile	36.6	27.1	21.7	14.5	100
	Medium-low quartile	28.7	30.1	25.2	16.1	100
	Medium-upper quartile	24.2	27.9	29.1	18.9	100
	Upper quartile	20.4	22.8	25.7	31.0	100
Presence of a marginalized community	No	17.1	26.1	29.5	27.2	100
	Yes	46.9	28.6	17.7	6.8	100
Share of older persons in total population	Lower quartile	37.5	23.8	19.6	19.2	100
	Medium-low quartile	28.1	28.8	24.7	18.4	100
	Medium-upper quartile	23.6	29.0	27.7	19.7	100
	Upper quartile	20.7	26.4	29.7	23.2	100
	Total (%)	27.5	27.0	25.4	20.1	100
	Total (N)	786	772	727	576	2861

Note: Colored cells indicate significantly higher values (adjusted residuals).

* Lower than 5 cases.

Source: Author's own, 2023.

Further on, communes with a good COVID-19 vaccination coverage are to a significantly higher extent from communes with a good coverage of the population with general practitioners (medium-upper and upper quartiles of the indicator on general practitioners' offices by 1,000 inhabitants), a high COVID-19 incidence rate in September 2021, a higher share of older persons in the total population²⁰ and without a marginalized community. They are also more likely to come from the development regions of North West, South Muntenia, Center and Bucharest. It is noteworthy that parts of these regions also represent the development regions with the highest GDP per capita in 2020.²¹ On the opposite side, rural localities placed in the lowest quartile concerning vaccination uptake are more likely to come from communes with low fiscal capacity, placed in the North Eastern and South Eastern regions, with a rather low number of general practitioners' offices per 1,000 inhabitants, with a lower share of older persons in the total population and including a marginalized community in the population. Notwithstanding, older persons have been considered more vulnerable in times of the pandemic, also in relation to a higher prevalence of chronic diseases in this age-group (WHO, 2020; UN, 2020; Centers for Disease Control and Prevention, 2023). Another potentially vulnerable group is represented by the population living in marginalized communities.

6. Discussion

The results of research put structural factors of vaccination uptake under the spotlight. Additionally, the increases in vaccination uptake between August and October 2021 reports on complacency, which relates to the perceived low risks of vaccine-preventable diseases, in line with previous studies (Kalam et al., 2021; Pavić et al., 2022; Schwarzingner et al., 2021; Wiysonge et al., 2021). Consequently, this brings up the problem of risk calculation as a comparison of the risks of infection and vaccination for reaching a decision (in relation to the incidence rate variable). However, the direct cause of the lack of confidence and risk calculation can be represented by another structural problem, like population characteristics, such as their low density, low formal employment rate, and poor connections with densely populated urban areas. Furthermore, it is possible that more accurate data from the current census will provide a better picture of this topic – both regarding population, ethnic minorities and inner locality area. In addition, a high share of the rural population works as self-employed in agricultural activities in Romania, with few or no formal relations/physical contacts with densely populated urban areas. Hence, the introduction of formal access restrictions – such as digital certificates for access in public institutions – is again decoupled from the motivations of the population living in rural remote and scarcely dense localities.

²⁰ Data for 2020.

²¹ Eurostat database, Gross domestic product (GDP) at current market prices by NUTS 2 regions [NAMA_10R_2GDP], Euro per inhabitant.

Furthermore, in relation to the marginalized communities, several indicators differ substantially when compared to the general population. The structure of the population in rural marginalized communities is different. “At the national level, 6.2 percent of the rural population, 5.3 percent of all households, and 5.2 percent of all dwellings are located in rural marginalized areas. Older people account for 13 percent in these areas (the average share for rural nonmarginalized areas is 19 percent for people aged 65 or older), while one in every four households in rural marginalized areas has five members or more (with only 15 percent in nonmarginalized areas)” (Teşliuc et al., 2016, p. 28). Moreover, the negative correlation between the share of the marginalized population and vaccination coverage can be attributed to a long relationship of distrust in both governmental and public health authorities.²²

This contextualized research for the case of Romania further deepens our understanding of territorial disparities on vaccination coverage and adds to the growing body of worldwide knowledge on vaccine hesitancy against the COVID-19 vaccine. In particular for the underserved areas, new intervention models like the socio-ecological models have been proposed in order to address systemic barriers for engagement in public health programs (Caperon et al., 2022).

The paper explores factors associated with vaccination coverage in rural Romania. The perspective used by this study is therefore centered around structural factors, rather than on individual level factors. It examines correlations between local financial development of public administration and vaccination coverage, alongside meaningful differentiations based on other relevant locality level variables. The study is based on a secondary analysis of public official data on vaccination coverage at the local level and local budget execution in Romania. For the financial capacity, a mean value of the past three years was used, in order to decrease the potential variations within the last years affected by the pandemic. The results of the statistical analysis indicate a significant positive correlation between the level of fiscal capacity and vaccination coverage in the rural localities of Romania, irrespective of the method of calculation. Rural localities of Romania with a higher vaccination coverage are to a significantly higher extent from the communes with a good level of fiscal capacity. The paper contributes to enlarging the perspective on vaccination hesitancy by adding both conceptual and practical insights. Future studies could focus specially on the vaccination coverage of vulnerable groups, against the background highlighted by this study on the significant territorial discrepancies.

7. Conclusions and recommendations

Findings of the study can be used by central and local public health authorities, alongside municipalities’ representatives, especially from the side of the social services,

²² In total, there are 992 communes with marginalized communities (approximately 35% in the total number of rural localities in Romania).

in order to develop context-specific public health plans of actions. Data in this study capture a key moment in time, when Romania faced increased mortality rates associated with COVID-19, and still underwent a low vaccination uptake. The analysis stresses the structural determinants and inequalities in the rural areas of Romania, placed at disadvantage on several health, economic and social locality level indicators. It adds to the knowledge on the pandemic context in Central and Eastern Europe, in line with previously identified research needs (Nemec et al., 2020).

The study revealed significant associations between the COVID-19 vaccination coverage and locality level variables. Positive correlations have been identified in relation to fiscal capacity, coverage of the population with general practitioners, the COVID-19 incidence rate and the absence of a marginalized community within the locality. Regional differences are again highlighted in the analysis.

From the policy point of view, the study shows that there is at least a partial overlap of the disadvantaged rural areas with the ones registering low vaccination uptakes against COVID-19. Further on, it means that these territorial areas accumulate a series of structural disadvantages that can prove to increase the discrepancies between them and other rural or large urban areas. Territorial analyses are particularly important to provide an explicit and coherent understanding of the drivers of disparities in vaccination coverage, in order to formulate nuanced and evidence-based policy responses.

From the point of view of practitioners relevant for the community level, the results of the study can be used to tailor intervention in communities with similar characteristics. Although the study is conducted in Romania, the findings can prove to be relevant for other study settings as well, especially in Eastern European countries. Access costs continue to represent a structural barrier for the disadvantaged population in rural communities of Romania. In order to address social and economic determinants of public health inequalities, the experience of integrated teams in which a social worker closely cooperates with professionals from the health (community health nurse) and education sectors (school counselor) can prove to be a good example to be extended at a larger scale, in particular for the case of localities including rural marginalized communities.²³

At the organizational level, organization efforts transcending public sector levels (first and second tier of public administration and deconcentrated institutions²⁴, like the Public Health Directorate) can be replicated in similar challenges for rural communities. Future studies could update the statistical analysis model on the latest vaccination data with supplementary information and focus the empirical analysis on

23 Large scale EU funded project on integrated community teams, implemented in cooperation in Romania by the Ministries of Labour and Social Solidarity, Education and Health – Creating and implementing integrated community services for fighting poverty and social exclusion, Human Capital Operational Program, POCU/375/4/22/122607, <https://serviciicomunitare.ro>.

24 Like Public Health Directorates, subordinated to the Ministry of Health.

the vaccination coverage of vulnerable groups, like persons with disabilities or persons with chronic diseases.

The present study highlights that structural determinants of vaccine hesitancy are not likely to be overcome just by using coercive measures. An intersectoral approach that considers factors in an integrated approach is more likely to yield positive results in the future, in relation to other public health issues/campaigns conducted at the national level.

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Appendix - Tables

Table 1. List of variables

Variable name	Variable description	Measurement unit	Data Source	Reference date/year	Source for data access
Number of general practitioners' offices (per thousand inhabitants)	Number of general practitioners' offices (per thousand inhabitants)	Number	National Institute of Statistics	2017	Citadini.ro
Fiscal capacity	Average share of own revenues (without the sums deducted from the personal income tax), for the last three years – 2018, 2019 and 2020. Own computations.	Euro/inhabitant	MDLPA Annex 24 Local budgets execution	2018, 2019, 2020	Situation of revenues and expenditure of territorial administrative units, in the period of 1999–2019, http://www.dpfb1.mdrap.ro/sit_ven_si_chelt_uat.html
Incidence rate by locality, 30 September	14 days incidence by locality, as of 30 September	Score	Ministry of Health	30 September 2021	https://data.gov.ro/data-set/transparenta-covid/resource/092bacbf-9060-4568-ae51-b86981f282f7
Population vaccination coverage, as of August 2021/5 October 2021	Vaccination coverage	Score	Romanian Government	August 2021 and 5 October 2021	https://vaccinare-covid.gov.ro/wp-content/uploads/2021/10/AV-pe-uat-5.10.2021.pdf?fbclid=IwAR2zW_CdCKcjNOhjbWVzaI5iOjSRgCQ1LM6kDo6vyW3G_9DhmjZTKH9_BJA
Presence of a marginalized community at locality level	Binary variable, based on <i>The Atlas of Rural Marginalized Areas and of Local Human Development in Romania</i>	Binary variable (1=yes, 0=no)	Teşliuc et al. (2016)	2011	Teşliuc et al. (2016). https://documents1.worldbank.org/curated/en/847151467202306122/pdf/106653-WP-P159257-PUBLIC.pdf
Share of older population in the total population	Computations based on the data from the National Institute of Statistics	Percentage	National Institute of Statistics	2020	Tempo online database
Development region (NUTS 2)	Affiliation of each locality to statistical development region	-	National Institute of Statistics	-	National Statistical Yearbook