Regional inequalities, support for anti-establishment candidates, and COVID-19 vaccination uptake in Poland

Abstract

This article aims to explain the regional differences in COVID-19 vaccination rates in Poland, taking into account living conditions and quality of life in municipalities, political conditions, and socio-economic spatial processes. The study used publicly available data on: the percentage of vaccinated residents in 2,477 Polish municipalities as of 20 March 2022, characteristics of municipalities representing their level of socio-economic development, and the level of support for anti-establishment candidates in the 2020 presidential election. The analysis was conducted using the Spatial Durbin Error Model (SDEM). The results indicate that lower vaccination rates occurred in municipalities with characteristics typical of less developed areas with poorer living conditions and characterized by support for anti-establishment politicians. We identified the existence of significant spillover effects, indicating the diffusion of pro- and anti-vaccination attitudes between neighbouring municipalities. Our study contributes to the literature on the determinants of vaccination coverage by combining the perspectives of public health, regional economics and political geography.

Introduction

COVID-19 vaccinations during the pandemic have become one of the key tools for protecting public health, but their acceptance has proven to be highly diverse across different social and geographical groups. Previous studies show that vaccination decisions are shaped by complex psychological and institutional mechanisms (MacDonald, 2015; Betsch et al., 2018). However, there is still little research in the literature analysing vaccination hesitancy and taking into account the territorial context, in particular the "geography of discontent" and the role of regional inequalities (McCann, 2020; Dijkstra et al., 2020; Rodríguez-Pose, 2018).

In this context, Poland is a particularly interesting case study. First, compared to other countries, the level of acceptance of at least one dose of the vaccine was among the lowest, which increases the importance of identifying the barriers and mechanisms explaining this phenomenon (Lazarus et al., 2023). Secondly, during the COVID-19 pandemic, Poland was characterized by an unusual inverse relationship between support for the government and attitude towards vaccination, which suggests the important role of local socio-political conditions in explaining vaccination hesitancy. Third, Poland is characterized by fairly strong regional diversity, which allows for testing a wide spectrum of dimensions and indicators of quality of life and similar aspects of socio-economic development. Fourth, the Polish government organized a series of competitions aimed at municipalities to encourage residents to get vaccinated against COVID-19.

The vaccination rate in Polish municipalities as of March 20, 2022, varied greatly across the country. For example, out of 2,477 municipalities, the highest percentage of vaccinated people was recorded in the municipality of Wronki in the Wielkopolskie Voivodeship (79.5%), while the lowest was in the municipality of Czarny Dunajec in the Małopolskie Voivodeship (22.0%). In this study, we attempt to explain the regional differences in vaccination rates among residents of Polish municipalities, taking into account both local conditions and spatial interactions between municipalities.

We set the following research questions:

1) Which dimensions and indicators of quality of life in Polish municipalities correlate with COVID-19 vaccination rates?
2) Are there significant spillover effects in vaccination behavior in Poland determined by the quality of life in municipalities?
3) Is the level of support for populist/anti-system candidates in Polish municipalities a significant determinant of COVID-19 vaccination rates?
4) Are there significant spillover effects in vaccination behavior in Poland determined by support for populist/anti-system candidates?

Data

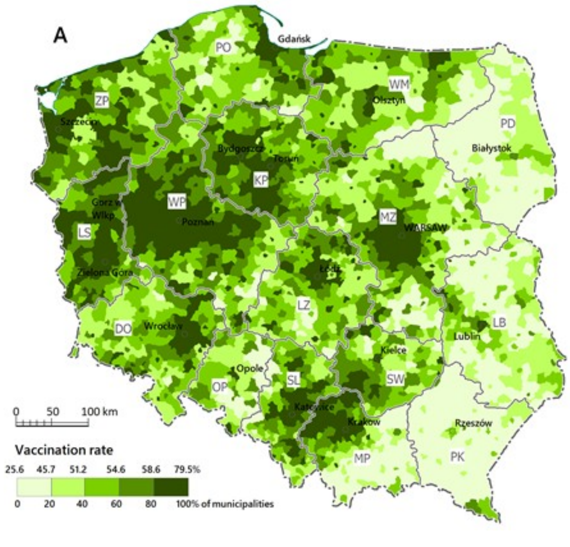
As shown in the introduction, the example of Poland may be interesting for examining vaccination rates for several reasons (low vaccination rates, strong political polarisation, and an inverse relationship between trust in the authorities and vaccination, large differences between regions providing good statistical material in terms of, for example, significance indicators).

In order to answer the above research questions, we use the Spatial Durbin Error Model (SDEM), which allows for the simultaneous estimation of direct and indirect effects (spillovers), interpreted in terms of the local diffusion of vaccination attitudes (LeSage & Pace, 2009; Elhorst, 2010; LeSage, 2014). To estimate the model, we use publicly available data on the percentage of vaccinated residents in 2,477 Polish municipalities as of March 20, 2022, characteristics of these municipalities reflecting quality of life and other socio-economic development features, and the level of support for anti-establishment candidates in the 2020 presidential election (this year's elections in Poland are the closest to the outbreak of the pandemic and the related vaccinations).

A vaccinated person is defined as someone who has received two doses of a two-dose vaccine or one dose of a single-dose vaccine. The vaccination rate is defined according to formula (1):

$$vaccinated = \frac{\#\ of\ vaccinated\ people}{total\ population\ of\ municipality} * 100\% \quad (1)$$

Figure 1. Vaccination rate values as of 20 March 2022

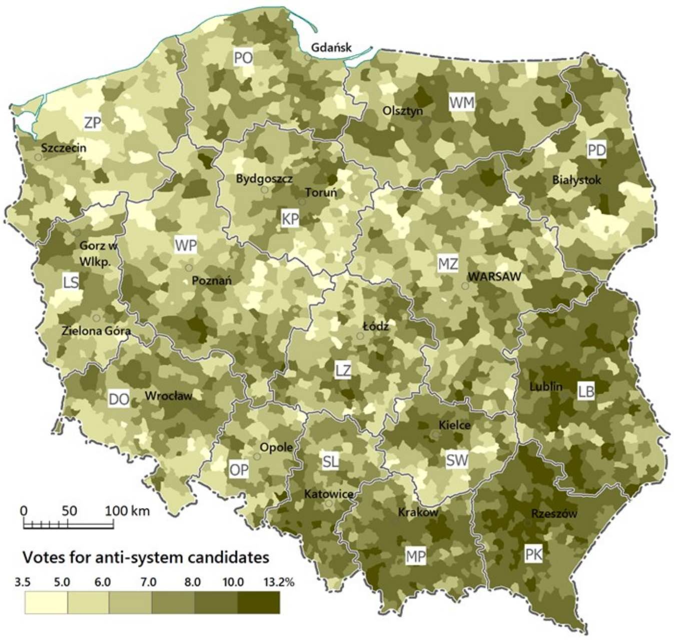


Source: Own elaboration.

Note: The voivodeships' abbreviations (consistent throughout all maps): DO – Dolnośląskie, LB – Lubelskie, LS – Lubuskie, LZ – Łódzkie, MP – Małopolskie, MZ – Mazowieckie, OP – Opolskie, PK – Podkarpackie, PD – Podlaskie, PO – Pomorskie, SL – Śląskie, SW – Świętokrzyskie, WM – Warmińsko-mazurskie, WP – Wielkopolskie, ZP – Zachodniopomorskie.

In our study, we analyse the spatial correlation between the COVID-19 vaccination rate and the level of living conditions and quality of life. We identify this level through 12 socio-economic variables in 2,477 municipalities. These variables are components of the synthetic quality of life index developed by Śleszyński (2021). Furthermore, in our study, we consider the level of support for populist (anti-establishment) candidates in the first round (28 June 2020) of last general election before the date from which our vaccination coverage data originate (variable *presidential2020*) as a determinant of vaccination coverage in a municipality. We used only data from the first round of the elections in order to be able to include a broader list of candidates who can be described as populist or anti-establishment. We obtained the data from the GeoElections Poland 1.0 dataset (Śleszyński & Kowalski, 2025) compiled on the basis of data from the Polish National Electoral Commission.

Figure 2. Support for populist/anti-establishment candidates in the first round of the Polish presidential election on 28 June 2020



Source: based on National Electoral Commission in Poland data.

Methodology and results

The specification of our model is based on the Spatial Durbin Error Model (SDEM) structure:

$$Y = \beta_0 + X\beta + WX\theta + u, \quad (2)$$

where:

$$u = \lambda Wu + \varepsilon, \ (3)$$

This model structure was chosen based on both econometric and theoretical considerations.

We examine three specifications that allow us to capture the impact of higher education and school education individually (equations 4-5, given as Model 1 and Model 2, respectively, in Table 2) and jointly (equation 6, given as Model 3 in Table 2):

$$X = \{higher\ educ + other\ factors\} \qquad (4)$$
$$X = \{school\ educ + other\ factors\} \qquad (5)$$
$$X = \{higher\ educ + school\ educ + other\ factors\} \qquad (6)$$

The lambda coefficient is significant and positive, which indicates a strong spatial dependence and the existence of unobservable factors affecting the dependent variable. The model estimates are presented in Table 1 below.

Table 1. SDEM estimation results

		Model 1			Model 2			Model 3		
		Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
	Presidential elections	-0.1973***	-0.187***	-0.3461***	-0.2086***	-0.1446***	-0.3532***	-0.1969***	-0.14925***	-0.34615***
	Urban classification	0.1531***	0.1057	0.2588***	0.28069***	0.1394**	0.42006***	0.15365***	0.10836	0.26202***
	Functional classification	-0.0502	-0.0189	-0.0692	0.0361	0.1229	0.159*	-0.04968	-0.01471	-0.06439
	Unemployment	-0.0003	-0.0158	-0.0161	0.0124	0	0.01246	0.00143	-0.01864	-0.01721
	Energy exclusion	-0.0623***	0.1267***	0.0638*	-0.13428***	0.1388***	0.00451	-0.06061***	0.12245***	0.06184
	Transportation exclusion	0.009709	-0.0231	-0.0134	-0.01229	-0.0051	-0.0174	0.00982	-0.02324	-0.01342
	Internet access	0.0671***	0.02147	0.0885**	0.08426***	0.00177	0.08603**	0.06687***	0.0221	0.08897**
	Higher education	0.3583***	-0.0129	0.3454***				0.35274***	-0.00618	0.34656***
	School education				0.07374***	0.0317	0.10545***	0.01965	-0.02889	-0.00924
	No bathroom	-0.0829***	-0.0736**	-0.1564***	-0.1494***	-0.00167	-0.15104***	-0.08139***	-0.07412**	-0.15551***
	Useful floor area per capita	-0.076***	0.1084***	0.0324	0.00825	0.1333***	0.1415***	-0.07528***	0.10509***	0.02981
	Average income per capita	0.0196*	0.0074	0.027	0.03562***	0.01458	0.0502	0.01852*	0.00927	0.02779
	Hidden drain	-0.1117***	-0.24368***	-0.3554***	-0.1156***	-0.2594***	-0.3749***	-0.11161***	-0.24532***	-0.35693***
	Income poverty	0.0112	-0.0669**	-0.0557	-0.00037	-0.0654**	-0.0657*	0.01212	-0.06621**	-0.05409
	Population debt	0.1363***	0.2087***	0.345***	0.106***	0.214***	0.3201***	0.13774***	0.20301***	0.34075***
	Number of observations	2477								
SDEM	**Lambda**	0.711***			0.702***			0.711***		
	AIC	3,106			3,377			3,106		
	BIC	3,286			3,557			3,298		
	Spatial autocorrelation in residuals	No								
	Reduced to SEM?	No								
	Reduced to SLX?	No								

Source: own calculations

Note: 10% - *, 5% - **, 1% - ***

Significant negative estimates of the effects of the *presidential2020* variable indicate that support for an anti-establishment presidential candidate in a given municipality and neighbouring municipalities reduces the vaccination rate – thus, we have no grounds to reject research questions 3 and 4.

As regards the variables describing quality of life, significant and negative effects (including spillovers) occur with the variables *no_bathroom* and *hidden_drain* – residents of "left-behind" areas are less likely to be vaccinated. Significant positive effects (both direct and indirect) occur with the variables *urban_class* and *debt* – richer and more urbanized municipalities are characterized by higher vaccination rates. Depending on the specification, there are also significant positive direct effects for the variables *average_income*, *internet_access* and *education* – municipalities with a higher standard of living are more willing to vaccinate.

Summary

In this article, we examined how living conditions and quality of life in Poland, as well as the political preferences of the population, are related to the level of COVID-19 vaccination coverage, and whether these relationships are spatial in nature. The results of our empirical study indicate that lower vaccination coverage was concentrated in municipalities with characteristics typical of 'left behind' areas and less developed regions: lower levels of urbanisation, income and education, poorer housing conditions and weaker internet access, which is consistent with the geography of discontent approach (Rodríguez-Pose, 2018; Dijkstra et al., 2020; McCann, 2020). We also identified a significant negative correlation between support for anti-establishment candidates and COVID-19 vaccination rates, which can be interpreted in the light of the literature on medical populism, anti-expert attitudes and the role of disinformation during the pandemic.

A key contribution of the study is to show that a significant part of the mechanisms is spatial in nature: both quality of life factors and support for anti-establishment candidates generate local spillover effects, suggesting processes of diffusion and 'contagion' of attitudes in neighbouring municipalities (Bourdin et al., 2023; Mare et al., 2024). The level of vaccination in a given municipality was not only a function of its own socio-economic characteristics, but also of the situation in neighbouring municipalities. These effects were particularly evident in relation to variables describing diffusion and acculturation mechanisms within local spatial systems. Furthermore, we showed that support for anti-establishment candidates also generates significant negative spillover effects. Our results confirm the validity of combining the concept of geography of discontent with theories of innovation diffusion and the 'contagion' of social attitudes.

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