The Effect of Public Tolerance towards Corruptive Behaviour on Healthcare Efficiency and Equity – The Case of the UK's COVID-19 Vaccination Programme

Franziska Sohns, Stefano Ghinoi, Magdalena Langosch

PII: S0277-9536(24)00633-6

DOI: https://doi.org/10.1016/j.socscimed.2024.117180

Reference: SSM 117180

To appear in: *Social Science & Medicine*

Received Date: 17 August 2023

Revised Date: 18 July 2024

Accepted Date: 2 August 2024

Please cite this article as: Sohns, F., Ghinoi, S., Langosch, M., The Effect of Public Tolerance towards Corruptive Behaviour on Healthcare Efficiency and Equity – The Case of the UK's COVID-19 Vaccination Programme, *Social Science & Medicine*, https://doi.org/10.1016/j.socscimed.2024.117180.

The Effect of Public Tolerance towards Corruptive Behaviour on Healthcare Efficiency and Equity – The Case of the UK's COVID-19 Vaccination Programme

Dr. Franziska Sohns, Associate Professor in Economic Geography, Anglia Ruskin University, Cambridge, UK

Dr. Stefano Ghinoi, Associate Professor in Applied Economics, Università degli Studi di Modena e Reggio Emilia, Modena, Italy

Dr. Magdalena Langosch, Visiting Lecturer, Imperial College Business School, London, UK

Abstract

Over the past four years, the COVID-19 pandemic has caused significant uncertainty, suffering, and economic disruption worldwide. Consequently, governments have faced pressure to ensure fair vaccine access while achieving vaccination targets quickly. Such challenging circumstances can create opportunities for nepotism and bribery, increasing attention to corruption risks associated with the pandemic response. This study investigates the relationship between public attitudes towards corruptive behaviour and the efficiency and equity of the UK's COVID-19 vaccination programme. It combines primary data on public tolerance towards corruptive behaviour with secondary data on the efficiency of the vaccination program at the local authority level in England and Scottland. We employ a survival analysis approach, estimating Cox Proportional Hazards Models, which examine the time taken to reach vaccination targets. Our findings suggest moderate tolerance towards nepotism/favouritism and bribery among the British public, with 28% of survey participants considering monetary bribery and 34% considering nepotism/favouritism as acceptable means to secure early vaccination access. Moreover, while public tolerance towards corruptive behaviour generally had a negative impact on the efficiency of the vaccination programme, it appears to have expedited the vaccination rollout in politically aligned local authorities governed by the Conservative and Unionist Party. However, this positive effect on efficiency appears to have come at the expense of reduced equity in vaccine distribution. These findings underscore the trade-off between efficiency and equity in vaccine distribution during public health crises, emphasising the need for health policies that balance efficiency with equity to ensure fair and effective distribution of vaccines in the future.

Keywords: corruptive behaviour, healthcare, Covid-19, political alignment, United Kingdom

The Effect of Public Tolerance towards Corruptive Behaviour on Healthcare Efficiency and Equity – The Case of the UK's COVID-19 Vaccination Programme

1. Introduction

Since the 'coronavirus disease 2019' (COVID-19) outbreak was first detected in Wuhan in December 2019, it has spread to almost every corner of the globe. As a highly transmissible respiratory illness that can cause severe complications, COVID-19 was soon perceived as a major public health risk by national governments across the world, threatening to overwhelm their national healthcare systems. Consequently, significant efforts were put into the swift development and administration of effective vaccines in many countries, including the UK.

The UK's COVID-19 vaccination programme, which began on the 8th of December 2020, has been acknowledged for its efficiency (Neville & Warrell, 2021), particularly in its early stages. By April 2021, the UK's National Health Service (NHS) had administered at least one dose to 50% of its population, significantly surpassing rates seen in Germany (20%), France (19%), and Ireland (19%) at that time (Mathieu et al., 2022).

This early success has been attributed to strategic decisions, including swift negotiations of large-scale contracts with Oxford-AstraZeneca and Pfizer-BioNTech, early emergency approval of COVID-19 vaccines, and the timely formation of mass vaccination sites and mobile vaccination units (Baraniuk, 2021). The UK Government also defined clear eligibility criteria, prioritising care home residents, healthcare workers, the elderly, and clinically extremely vulnerable until April 2021, following World Health Organization (WHO) guidance (Public Health England, 2021).

Although all UK regions were tasked with implementing the COVID-19 vaccination programme uniformly, significant regional disparities emerged, with rural areas such as South West England achieving the highest and urban areas such as London the lowest vaccination rates by the end of 2021 (Sasse & Hodgkin, 2022). These regional differences in vaccination rates have been attributed to varying levels of vaccine hesitancy

(ONS, 2021), with the highest rates amongst young adults and ethnic minorities (Badr et al., 2021; Razai et al., 2021), who are more likely to live in urban areas (Defra, 2022).

While some communities hesitated to get vaccinated, others sought vaccination before they were eligible (Kashyap & Wurth, 2021), creating fertile grounds for corruptive behaviour. The United Nations Office on Drugs and Crime (UNODC) recognised this corruption risk already during the early stages of the COVID-19 pandemic, emphasising its potential to undermine the fairness and effectiveness of vaccination efforts (UNODC, 2020).

Interest in the impact of corruptive behaviour on healthcare access and outcomes had been present even before the onset of the COVID-19 outbreak (e.g., Rose, 2006; Vian, 2008; Hunt, 2010), suggesting that corruptive behaviour can harm citizens' health and welfare by undermining healthcare systems' effectiveness and increasing health inequalities. Over the last years, an increasing number of empirical studies started analysing the effects of corruptive behaviour in the distribution of the COVID-19 vaccines (e.g., Farzanegan & Hofmann, 2021; Spreco et al., 2022; Usman et al., 2022). While these studies provide valuable insights into factors leading to corruptive behaviour (Usman et al., 2022) and its impact on vaccination coverage (Farzanegan & Hofmann, 2021; Spreco et al., 2022) at the national level, research that investigates public attitudes towards corruptive behaviour at the individual and subnational level remains scarce.

Notable exceptions include Lamot and Kirbiš (2024) who analysed individuals across 26 European countries, revealing significant interactions between individual-level predictors, including satisfaction with the healthcare system, trust in political institutions, and conspiracy beliefs, and country-level predictors, including perceived corruption, on individuals' intention to get vaccinated against COVID-19. Moreover, Duch et al. (2021) investigated attitudes towards the marketisation of COVID-19 vaccine allocations in adults across 13 countries including the UK; an attitude more prevalent in countries with high levels of perceived corruption (Duch et al., 2022). Likewise, Horodnic et al. (2021) analysed informal payments made by patients during the COVID-19 pandemic in Central and Eastern Europe, discovering higher acceptance in countries with weaker institutions and widespread tolerance towards corruption.

While these studies offer valuable insights into individual attitudes, such as vaccination intentions, preferences for private provision of COVID-19 vaccines, and tolerance towards informal payments (a form of corruptive behaviour), they use the national level as the unit of comparison. In doing so, they overlook potential regional variations within countries, as highlighted by Bauhr and Oscarsson (2011).

Moreover, despite the critical role of multi-level governance in implementing vaccination programmes (Allain-Dupré et al., 2021), research on how sub-national governance quality affects vaccination outcomes is lacking. Considering that the UK's vaccination rollout was primarily managed by local authorities (LAs) (Local Government Association, 2021), we believe it is essential to investigate how inter-regional differences impacted the efficiency and equity of vaccination efforts at the local level.

By investigating whether disparities in the efficiency and equity of the COVID-19 vaccination rollout among LAs in England and Scotland can be attributed to local variations in public tolerance towards corruptive behaviour and governance quality, we seek to contribute to the existing literature within the field of public health policy and governance studies, providing a more nuanced spatial perspective.

2. Conceptual Considerations

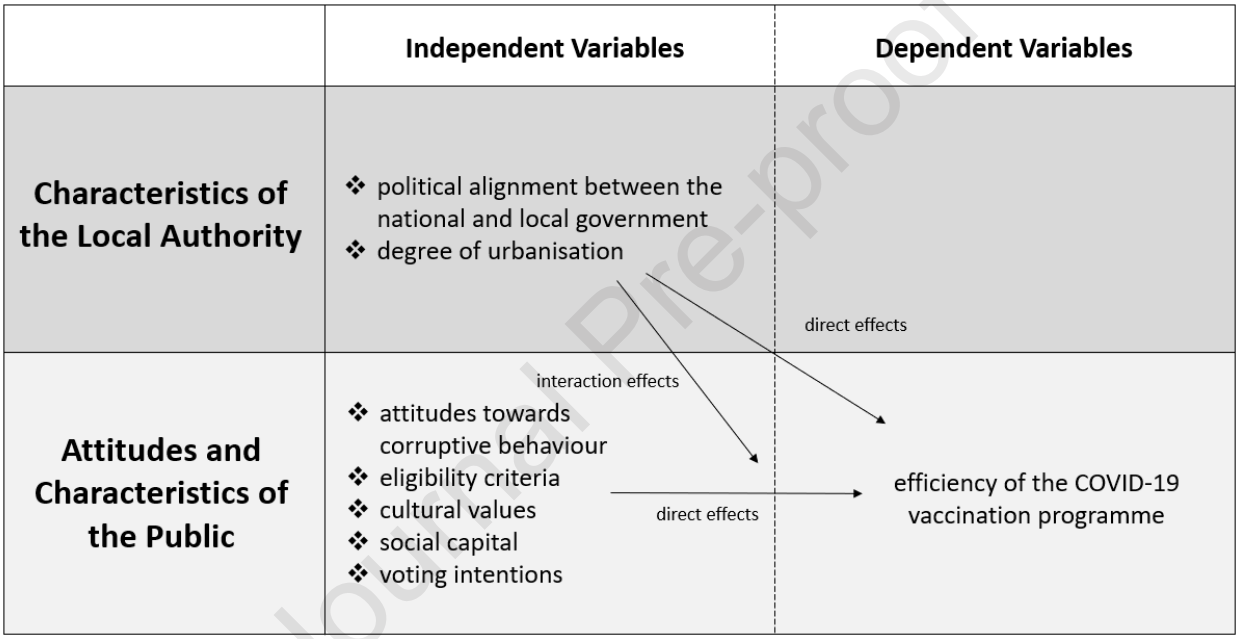
Previous research on corruptive behaviour has investigated country-specific factors associated with national corruption indices (e.g. Kapoor & Ravi, 2012; Montes & Paschoal, 2016), individual attitudes towards corruptive behaviour (e.g. Mancuso, 1995; Wroe et al., 2013), and economic impacts of corruption (e.g. Gupta et al., 2002; Brown & Shackman, 2007; Lučić et al., 2016). In the subsequent sub-chapters, we refer to this literature to develop a holistic conceptual framework (see Figure 1) for analysing how public tolerance towards corruptive behaviour affects the local efficiency and equality of the UK's COVID-19 vaccination rollout.

2.1. Conceptualising Corruption Behaviour

Friedrich (1966, p. 74) defines corruption as a situation in which "a powerholder who is charged with doing certain things (...) is, by monetary or other rewards not legally provided for, induced to take actions which favour whoever provides the rewards and thereby does damage to the public and its interests". Applying

this definition to our study, we define corruption as occurring whenever NHS staff members, charged with vaccinating the UK population according to UK government eligibility criteria (Public Health England, 2021), are, by monetary or other rewards, such as gifts and favours, not legally provided for, induced to administer a COVID-19 vaccination to non-eligible members of the public, thereby harming the public interest by failing to fulfil their obligation to prioritise those members of the public who were intended to be prioritised.

Figure 1: Conceptual Framework



Source: Own illustration.

Applying Ang's (2020) 'unbundling corruption' framework, we focus on corrupt transactions wherein individuals receive a COVID-19 vaccine before meeting eligibility criteria, representing a form of 'speed money'. Speed money is defined as small bribes aimed at expediting routine administrative processes or services within a bureaucratic context. While such payments are aimed at bypassing bureaucracy to secure preferential treatment, they are not intended to influence policy decisions. Following Bauhr and Oscarsson (2011), we also regard cases where NHS staff vaccinate family, friends, colleagues, and acquaintances ahead of eligibility as favouritism/nepotism (Chereches et al., 2013).

In response to critiques by Xenakis (2010) and Ang (2020) regarding the limitations of national indicators and expert perceptions in representing the prevalence of corruptive behaviour, particularly in mature

democracies like the UK, we utilise an alternative approach, examining public attitudes towards corruptive behaviour. While providing a novel perspective, measuring such attitudes presents challenges, as participants may refrain from admitting to corruptive behaviour due to feelings of shame and guilt (Corstange, 2009; Williams & Horodnic, 2020). To mitigate the impact of this 'social desirability bias', previous studies tasked individuals with evaluating various actions as corruptive or non-corruptive, rather than directly assessing their personal involvement in corruptive behaviours (Wroe et al., 2013). However, while this approach provides valuable insight into individuals' ability to recognise corruptive behaviour, it does not reveal their personal agreement with such conduct. To gain a more nuanced understanding of public attitudes towards corruptive behaviour, while mitigating the 'social desirability bias', we adopt an alternative approach inspired by Gouvêa Maciel (2021) and Bauhr and Oscarsson (2011). This approach assesses the degree of *public tolerance* towards different forms of corruptive behaviour, shifting the focus from personal involvement to more abstract considerations.

Following Horodnic et al. (2021), we posit that tolerance towards corruptive behaviour correlates with individuals' engagement in such practices. This assertion stems from the understanding that individuals who perceive corruptive behaviour as acceptable are more inclined to engage in or overlook it (Çevik, 2016). Nevertheless, we acknowledge that tolerance towards corruptive behaviour does not always reflect the actual prevalence of corruptive behaviour in society, as tolerance does not always translate into action. Despite this, we maintain that understanding public tolerance towards corruptive behaviour offers valuable insights into societal norms surrounding corruption, beyond national indicators and expert perceptions.

2.2. The Effects of Corruptive Behaviour from a Local Perspective

The macroeconomic effects of corruptive behaviour are well-documented. Previous research has demonstrated that corruptive behaviour diminishes economic efficiency by distorting resource allocation and increasing transaction costs (Lambsdorff, 2003; Brown & Shackman, 2007; Lučić et al., 2016). It also exacerbates economic inequalities by conferring advantages upon those who have the means to engage in such behaviour (Gupta et al., 2002; Jong-Sung & Khagram, 2005). Applying these findings to our case

study, we align with existing literature (Farzanegan & Hofmann, 2021; Spreco et al., 2022) in assuming that public tolerance towards corruptive behaviour is negatively associated with the efficiency of the UK's COVID-19 vaccination rollout.

H1: Higher levels of public tolerance towards corruptive behaviour within LAs are associated with reduced efficiency in administering COVID-19 vaccines.

Drawing from the academic debate within the field of political geography, which analyses governance quality, including corruption control, at regional (Rodríguez-Pose & Di Cataldo, 2015) and local levels (Rodríguez-Pose & Zhang, 2019), we examine the effect of public tolerance towards corruptive behaviour at the level of LAs. In doing so, we also align our research with calls from within the public sector management literature advocating for context-specific analyses of local governance (Carothers & de Gramont, 2013).

In the UK, LAs represent the smallest administrative unit responsible for various local government functions, including social care, housing, education, emergency planning, and public health (Department of Health, 2012; Paun et al., 2019). During the COVID-19 pandemic, LAs coordinated and delivered a range of public health interventions, including setting up and operating vaccination centres, identifying priority groups, and promoting vaccine uptake among hard-to-reach communities (Local Government Association, 2021). Due to their central role in implementing the UK's COVID-19 vaccination programme, LAs are compelling units for analysing the geographical disparities in the efficiency and equity of its local implementation.

Since LAs are governed by elected councillors tasked with setting local policies and overseeing local staff, we assume that the composition of local governments impacts the implementation of the COVID-19 vaccination programme at the local level. Although various factors influencing the quality of regional and local governments have been discussed in the literature (Andrew & Goldsmith, 1998; Rodríguez-Pose & Di Cataldo, 2015), operationalising this concept presents challenges due to its complex nature. Inspired by Ferraresi and Gucciardi (2022), we take a simplified approach, assessing local government quality through the lens of *political alignment* between local governments and the national government. Accordingly, we

define LAs as politically aligned if they are governed by the same political party as the national government.

Allain-Dupré et al. (2021) found that challenges in the vaccination rollout often occurred due to a lack of coordination across government levels and insufficient involvement of subnational governments in strategic decision-making. As elected officials from the same political party often share values and are able to leverage formal and informal relationships to exchange information, political alignment can reduce such challenges (Allern et al., 2021) by improving coordination and communication between local and national governments and reducing conflicts and delays arising from divergent political agendas (Migueis, 2013). Consequently, we assume that political alignment improves the efficiency of the local COVID-19 vaccination rollout.

H2: LAs politically aligned with the national government exhibit higher efficiency in administering COVID-19 vaccines compared to LAs not politically aligned with the national government.

Building on Lui (1985), we also anticipate that political alignment may moderates the effect of public tolerance towards corruptive behaviour on the efficiency of the local COVID-19 vaccination rollout. While many studies associate corruptive behaviour with adverse outcomes, some scholars (Leff, 1964; Lui, 1985) suggest it can enhance economic efficiency in specific circumstances by mitigating bureaucratic inefficiencies and circumventing red tape (Pourtaleb et al., 2020). For instance, Horodnic et al. (2021) found that during the COVID-19 pandemic, individuals were more likely to resort to informal payments when they perceived formal institutions, including the healthcare system, as weak. Thus, we assume that in our study context, corruptive behaviour might have mitigated reduced implementation efficiency in politically unaligned LAs.

H3: Political alignment moderates the effect of public tolerance towards corruptive behaviour on LAs' efficiency in administering COVID-19 vaccines.

Following World Health Organization (WHO) guidance, the UK Government established clear eligibility criteria, prioritising healthcare workers, the elderly, and the clinically extremely vulnerable until April 2021

(Public Health England, 2021). Consequently, we assume that LAs characterised by an older population, a high prevalence of healthcare workers, and a significant number of clinically vulnerable citizens exhibit greater efficiency in their local vaccination rollout, particularly in its initial phase. Importantly, a positive and significant effect of these eligibility criteria on implementation efficiency can also be interpreted as indicative of vaccine equity in the programme's implementation, demonstrating that those meant to be prioritised were indeed prioritised.

H4: LAs characterised by a higher proportion of elderly residents, healthcare workers, and clinically extremely vulnerable individuals demonstrate greater efficiency in administering COVID-19 vaccines., reflecting vaccine equity.

Moreover, age has been identified as a significant socio-demographic factor affecting tolerance towards corruptive behaviour (Gouvêa Maciel, 2021). Moreover, while there is limited evidence comparing healthcare workers' tolerance for corruptive behaviour to other professions, Guo and Tu (2017) found that workplace stress and a lack of understanding about corruption increased tolerance among civil servants in China. Applying these findings to our study, pandemic-related stress may have increased healthcare workers' tolerance towards corruptive behaviour. However, commonly attending ethical training, along with witnessing the pandemic's severe consequences, may have made them less tolerant towards corruptive behaviour. Likewise, empirical research on the tolerance of corruptive behaviour among clinically vulnerable individuals compared to others is scarce, too. Generally, clinically vulnerable individuals often rely heavily on healthcare systems and social services, making them more susceptible to exploitation rather than being perpetrators of corruption. However, in scarce service contexts, they might tolerate corruptive behaviour out of necessity rather than a propensity for corruption (Habibov & Cheung, 2017).

2.3. Integrating Socio-Cultural Factors

Drawing from recent academic discourses on social capital (Borgonovi & Andrieu, 2020; Machida et al., 2022; Jennings et al., 2023), cultural orientations (Yu et al., 2021; Hornsey & Pearson, 2022), political ideology (Hessami, 2011; Gouvêa Maciel, 2021, Duch et al., 2022), and urbanisation (Bauhr & Oscarsson, 2011; Duffy et al., 2022; Wu et al., 2023) in shaping public health policy outcomes, we incorporate related

factors influencing both tolerance towards corruptive behaviour and vaccine hesitancy as control variables. Appendix B provides a summary table detailing the anticipated effects of these control variables.

The Role of Political Ideology

Incorporating insights from studies on the influence of political ideology on vaccine hesitancy (Troiano & Nardi, 2021; Jennings et al., 2023) and corruptive behaviour (Hessami, 2011; Gouvêa Maciel, 2021, Duch et al., 2022), we consider local voting intention as a control variable.

For instance, Jennings et al. (2023) found that individuals with right-wing political ideologies tend to exhibit greater vaccine hesitancy, a finding supported by Troiano and Nardi (2021). Furthermore, political ideology also shapes public attitudes towards corruptive behaviour. For instance, Gouvêa Maciel (2021) found that European citizens leaning towards right-wing political ideologies exhibit lower tolerance towards corruptive behaviour. Conversely, Duch et al. (2022) observed that those leaning towards left-wing political ideologies are less supportive of market provision of COVID-19 vaccines. Likewise, Hessami (2011) found heightened corruption levels in areas under the governance of right-wing parties.

The Role of Social Capital

According to Nahapiet and Ghoshal (1998), social capital consists of at least three dimensions: the structural (connection among actors), the cognitive (shared goals and values among actors), and the relational (trust among actors). Consequently, it is cultivated through trust-based networks, facilitating mutually beneficial activities (Putnam, 2007). Previous research has demonstrated that social capital is associated with corruptive behaviour (Neild, 2002; Horodnic et al., 2021; Lamot & Kirbiš, 2024) and vaccine hesitancy (Borgonovi & Andrieu, 2020; Murphy et al., 2021; Machida et al., 2022). When treated as an endogenous factor (Jackman & Miller, 1998), social capital can also be linked to local politics, particularly voting intention (Jöst, 2023).

In the context of our study, structural social capital may help individuals obtain information about the COVID-19 vaccination programme (e.g., details about the location and opening hours of local vaccination centres) and provide practical support (e.g., assistance in reaching vaccination centres), potentially boosting

vaccination rates (Machida et al., 2022). Likewise, cognitive social capital may foster a sense of collective responsibility (e.g., willingness to be vaccinated to protect others in the community), thereby reducing vaccine hesitancy (Borgonovi & Andrieu, 2020). Besides, relational social capital (e.g., trust in health authorities) may also reduce vaccine hesitancy (Murphy et al., 2021).

Moreover, Horodnic et al. (2024) and Lamot and Kirbiš (2024) suggest that public tolerance towards corruptive behaviour is negatively associated with relational social capital (trust). In contrast, Neild (2002) argues that the fundamental features of structural social capital can be susceptible to corruptive behaviour, as individuals endowed with strong social ties may leverage them for personal gain.

The Role of Cultural Orientation

Hofstede (2011, p. 3) defines cultural orientation as the "collective mental programming" that distinguishes groups, guiding choices about what is good or bad and acceptable or not (Kaufmann et al., 2018). Consequently, cultural dimensions such as uncertainty avoidance, power distance, masculinity, and individualism (Hofstede, 2011) significantly shape corruptive behaviour (Davis & Ruhe, 2003; Seleim & Bontis, 2009) and vaccine hesitancy (Yu et al., 2021; Hornsey & Pearson, 2022; Lu, 2022; Lamot & Kirbis, 2024).

Power distance refers to a society's acceptance of unequal power distribution (Hofstede, 2011). Higher power distance indicates greater tolerance for hierarchy and centralised decision-making, whereas lower power distance suggests a preference for egalitarian structures and participatory decision-making. Davis and Ruhe (2003) associate high power distance societies with increased corruptive behaviour, as individuals in such societies tend to subject their leaders to less scrutiny. Moreover, high power distance societies have been associated with increased vaccine hesitancy (Hornsey & Pearson, 2022), particularly when leaders within such societies show scepticism towards vaccinations.

Uncertainty avoidance reflects a society's tolerance towards ambiguity and the unknown (Hofstede, 2011). High uncertainty avoidance societies tend to prefer rules and structure, while those with lower uncertainty avoidance are more comfortable with flexibility and informality. Research indicates that high uncertainty

avoidance societies are associated with increased corruptive behaviour, as individuals in such societies may resort to corruptive behaviour to mitigate perceived threats (Davis & Ruhe, 2003; Seleim & Bontis, 2009). This aversion towards uncertainty also correlates with concerns about vaccine side effects and, thus, vaccine hesitancy (Lu, 2022).

Collectivism refers to prioritising group goals over personal ones (Hofstede, 2011). Collectivist societies value loyalty and in-group harmony, whereas individualistic societies prioritise independence. Collectivist societies have been linked to higher levels of corruptive behaviour, as strong social networks within such societies inadvertently foster environments conducive to corrupt practices (Davis & Ruhe, 2003; Seleim & Bontis, 2009). However, at the same time, individuals in collectivist societies are more inclined to take actions that benefit society, potentially mitigating vaccine hesitancy (Yu et al., 2021; Leonhardt & Pezzuti, 2022; Lu, 2022; Kamot & Kirbis, 2024).

Lastly, masculinity reflects societal values of assertiveness, competition, and achievement as opposed to nurturing, cooperation, and relationship-building (Hofstede, 2011). High levels of masculinity within societies have been associated with corruptive behaviour, as assertiveness and materialism can foster environments conducive to exploitation (Davis & Ruhe, 2003). Similarly, Bauhr and Oscarsson (2011) found that women are generally less tolerant towards corruptive behaviour. Additionally, research has also found higher vaccine hesitancy among men compared to women (Lazarus et al., 2021).

The Role of Urbanisation

Lastly, we consider the degree of urbanisation within LAs as another control variable. While urbanisation can improve access to vaccination sites, potentially increasing vaccination coverage (Duffy et al., 2022), it also poses challenges, as urban LAs with large populations may encounter greater challenges in executing an efficient vaccination rollout and often exhibit higher levels of vaccine hesitancy (Wu et al., 2023). Additionally, Bauhr and Oscarsson (2011) found that urban residents exhibit greater tolerance towards corruptive behaviour.

3. Methodology

3.1. Data Collection

We combined secondary data provided by the UK Government, describing the speed of the COVID-19 vaccination programme in different LAs, with primary data capturing public tolerance towards corruptive behaviour in England and Scotland.

Secondary Data Collection

Secondary data on vaccination coverage was sourced from the UK Government's COVID-19 data repository (GOV.UK, 2022). This database encompasses daily vaccination rates from the start of the UK's COVID-19 vaccination rollout on the 8th of December 2020 to the 30th of June 2021, with vaccinations recorded by their administration dates (GOV.UK, 2022). To ensure consistency, we utilised vaccination coverage as a percentage of the total population rather than the total cumulative number of vaccinated people in each LA, accounting for population changes over time (GOV.UK, 2022).

According to GOV.UK (2022), vaccinations in England were monitored through the National Immunisation Management System (NIMS), which became operational in November 2020. In Scotland, vaccinations were reported using the TURAS Vaccination Management Tool. These systems recorded vaccinations administered across various settings, including GP practices, pharmacists, hospitals, and local vaccination centres, to people over the age of 12 with an NHS number. Our dataset covers 315 of 333 (95%) English and all 32 Scottish LAs. The geographic locations of vaccinations were recorded based on individuals' registered addresses rather than the location of the vaccination site.

In summary, the chosen secondary dataset provides comprehensive daily vaccination coverage figures for most LAs of England and Scotland, providing valuable insights into the initial phase of the COVID-19 vaccination programme. Sourced directly from the UK Government, it also ensures reliability and consistency in data collection practices. Moreover, its public availability enhances transparency and facilitates replication of analyses by other researchers.

Primary Data Collection

Primary data collection took place between the 24th and 27th of October 2021 in collaboration with Deltapoll, a reputable public opinion consultancy firm (Deltapoll, 2024) with broad access to diverse demographics and geographies, as well as streamlined data collection processes, facilitating the timely completion of the primary data collection.

To draw a sample of British adults aged 18 and older (the target population), quota sampling was utilised to closely match the sample profile with that of the target population as described by the 'UK Census 2011'. This approach resulted in a sample size of 1,598 individuals across 345 LAs. Quota sampling was chosen due to the challenges of obtaining a complete register of all British residents, making probability sampling unfeasible. While widely accepted in survey research, quota sampling is inherently biased toward individuals willing to participate in the study. Hence, despite efforts to match population demographics, sampling bias can still occur if certain demographics are either overrepresented or underrepresented (Yang & Banamah, 2014).

To assess the representatives of our sample, we applied rim-weighting to our data. This statistical technique involves iteratively adjusting weights assigned to survey respondents until the weighted sample closely matches the characteristics of the chosen target population (Sharot, 1986), in our case the demographic distributions of the UK Census 2011. Upon comparing the rim-weighted averages with the original sample averages, we found that our sample closely mirrors the target population in terms of gender (female: 51%), age (average age: 47.7 years), and ethnicity (BAME: 13%). However, it became evident that individuals with a university degree (university degree: 50%) are overrepresented in our sample. Therefore, some caution is advised when extrapolating findings beyond the sampled population to avoid overgeneralisation. Appendix A provides a comparison of the unweighted and weighted descriptive statistics of several socio-economic characteristics.

3.2. Operationalisation of Independent Variables

While Table 1 reports descriptive statistics for all independent variables, detailed descriptions of individual measurements are provided below.

Table 1: Descriptive statistics of independent variables

Independent Variable	mean	std. dev.	min	max
Tolerance towards Corruptive Behaviour				
agreement with monetary bribery (yes=1)	0.28	0.45	0	1
agreement with in-kind bribery (yes=1)	0.27	0.45	0	1
agreement with nepotism/favouritism (yes=1)	0.34	0.47	0	1
Political Alignment				
local conservative majority/coalition (yes=1)	0.40	0.49	0	1
Eligibility Criteria				
age (in years)	47.72	8.83	18	80
clinically extremely vulnerable (yes=1)	0.15	0.36	0	1
frontline worker (yes=1)	0.07	0.26	0	1
Control Variables				
conservative voting intention (yes=1)	0.37	0.48	0	1
predominantly rural (yes=1)	0.19	0.39	0	1
missing relational social capital (factor)	0.00	0.85	-1.70	2.95
structural social capital (yes=1)	0.25	0.43	0	1
power distance (%)	56.96	21.39	0	100
individualism (%)	62.75	23.30	0	100
masculinity (%)	35.96	20.02	0	100
uncertainty avoidance (%)	61.63	21.80	0	100

Note: n=1,598. Source: Own calculations.

Independent Variables of Main Interest

Inspired by Gouvêa Maciel (2021) and Bauhr and Oscarsson (2011), we presented survey participants with three scenarios, each describing a distinctive type of corruptive behaviour – favouritism/nepotism and bribery (in-kind/monetary) – to measure *public tolerance towards corruptive behaviour*, our independent variable of main interest. Participants indicated whether they found the described corruptive behaviour acceptable for gaining early access to a COVID-19 vaccine either for themselves or for vulnerable relatives. Responses were measured on an ordinal scale ranging from ‘strongly disagree’ (1) to ‘strongly agree’ (4).

To test our first hypothesis, we created three dichotomous independent variables of main interest, each representing a specific type of corruptive behaviour. A value of 1 indicates tolerance, while a value of 0

indicates intolerance or response uncertainty. Our findings show that 28% of the survey participants perceived bribing a GP or an NHS staff member with money to gain early access to the COVID-19 vaccination as acceptable, 27% perceived offering presents as acceptable, and 34% perceived leveraging personal relationships with GPs or NHS staff members as acceptable.

Moderating Variable

To test our second and third hypotheses, we followed Callen et al. (2020) by including *political alignment* of the local government with the national government as a moderating variable. As of 2021, a value of 1 represented individuals residing in 'politically aligned' LAs governed by the Conservative and Unionist Party, while a value of 0 referred to individuals residing in 'politically unaligned' LAs governed by other political parties. Notably, 40% of the survey participants resided in politically aligned LAs.

Eligibility Criteria

We operationalised *vaccine eligibility* in line with Public Health England (2021), including two dichotomous variables in our analysis. The first indicates whether survey participants were *clinically extremely vulnerable* (e.g., organ, bone marrow, or stem cell transplant recipients; people who were undergoing active chemotherapy; people on immunosuppressive therapies), coded as 1. The second indicates whether they were *healthcare or social workers*, including volunteers, also coded as 1. Moreover, we incorporated participants' *age* in the regression model. While 15% of the survey participants considered themselves clinically extremely vulnerable, 7% described themselves as a healthcare or social worker. In addition, the average survey participant was 48 years old.

Control Variables

We added four groups of controls covering: i) cultural orientation, ii) structural and relational social capital, iii) voting intentions, and iv) degree of urbanisation.

We measured *cultural orientations* utilising Hofstede's (2011) cultural dimensions: *individualism* (prioritising personal goals over group goals), *masculinity* (valuing assertiveness and competition over

nurturing and cooperation), *power distance* (acceptance of unequal power distribution), *and uncertainty avoidance* (intolerance for ambiguity and risk). Participants responded to three scenario pairs for each of Hofstede's cultural dimensions. For example, for individualism, they had to decide if they would feel more comfortable in 'scenario A' in which "people have strong and long-lasting loyalties with their groups" or in 'scenario B' in which "people choose their friends based on common interest and appeal". Responses were measured on an ordinal scale ranging from "I feel much more comfortable with scenario A than B" (1), through "I feel equally comfortable with scenario A and B (3), to "I feel much more comfortable with scenario B than A" (5). Answers were normalised on a scale ranging from 0 to 100 (1=0; 2=25; 3=50; 4=75; 5=100) before individual averages were calculated for each of the four domains. On average, the survey participants scored 57 for power distance, 63 for individualism, 36 for masculinity, and 62 for uncertainty avoidance.

Concerning participants' *social capital*, we follow Nahapiet and Ghoshal (1998) in distinguishing between structural and relational social capital. We operationalised *missing relational social capital* as the degree of mistrust participants showed towards different groups of people. Participants indicated their level of mistrust in i) their family, ii) their neighbourhood, iii) people they know personally, iv) people they met for the first time, v) religious people in general, and vi) people of another nationality. Responses were measured on an ordinal scale ranging from 'trust completely' (1) to 'do not trust at all' (4). Using factor analysis, these responses were aggregated into a composite variable (see Appendix C), with higher values indicating greater mistrust (scores range from -1.70 to 2.95). We opted for this method because previous research on health policies demonstrated the effectiveness of factor analysis in operationalising social capital dimensions (Mitchell & Bossert, 2007; Story, 2014). Finally, to operationalise *structural social capital*, participants were asked whether they had been active members (participating in activities at least monthly) of any sports or entertainment club, local neighbourhood group, or political party in the 18 months prior to the survey, with members coded as 1. Among survey participants, 25% were active members of a club or political party, 10% mistrusted their family members, 32% their neighbours, and 38% people of other nationalities.

Given the significant effects of political ideology on vaccine hesitancy (Jennings et al., 2023) and tolerance towards corruptive behaviour (Gouvêa Maciel, 2021; Duch et al., 2022), we included *voting intentions* as a control variable to separate the effect of conservatism from political alignment. We asked survey participants which party they would vote for if a national election were held the next day. Following The Political Compass (2019), a value of 1 represents individuals who would vote for a conservative party (e.g., the Conservative and Unionist Party, the United Kingdom Independence Party, Democratic Unionist Party), while a value of 0 represents individuals who would vote for a liberal party (e.g., the Labour Party, the Green Party, the Scottish National Party, The Liberal Democrats). On average, 37% of the survey participants indicated that they would vote for a conservative party.

Finally, we operationalised *the degree of urbanisation* using the urban-rural classification by Bibby and Shepherd (2004). Here, a value of 1 represents individuals living in 'Predominantly Rural' LAs, which includes all LAs with at least 50% of the population residing in rural settlements or larger market towns. In our survey, 19% of the participants lived in LAs classified as 'Predominantly Rural'.

3.3. Analytical Model

With survey participants clustered in LAs, our data exhibit complex hierarchical structures akin to prior studies investigating social drivers of health-related phenomena (Lofors & Sundquist, 2007). In the presence of such spatial autocorrelation, employing standard OLS regressions would violate the assumption of independence between observations, potentially leading to biased standard errors (Rabe-Hesketh & Skrondal, 2008). A common way to address such spatial autocorrelation is to use multilevel approaches (Hox, 2010).

Micro-Macro Phenomena in Multilevel Modelling

Most multilevel models adopt a *macro-micro* perspective, explaining micro-level attitudes (e.g., participants' vaccination hesitance) through macro-level factors (e.g., LA's political alignment). In contrast, empirical studies adopting a *micro-macro* perspective to explain macro-level structures (e.g., LAs'

vaccination coverage) through micro-level behaviour (e.g., participants' tolerance towards corruptive behaviour) remain scarce as they pose methodological challenges (Foster-Johnson & Kromrey, 2018).

Traditionally, two approaches are employed to analyse *micro-macro* phenomena. The less accepted of the two approaches involves disaggregating group-level data to the individual level, often leading to biased standard errors and inflated Type I error rates (Foster-Johnson & Kromrey, 2018). More commonly, researchers aggregate lower-level variables to the higher level by computing group averages. While convenient, this approach also has limitations, including reduced statistical power, reduced variability in the data, and less reliable standard errors (Croon & Van Veldhoven, 2007). To reduce these issues, Croon and Van Veldhoven (2007) suggested analysing *micro-macro* phenomena using a 'person-as-variables' approach, similar to structural equation modelling. This approach treats individuals as indicators for unobserved group-level scores, defining latent constructs at both levels (Curran, 2003).

While being perceived as more sophisticated, a recent comparison by Foster-Johnson and Kromrey (2018) found that this approach offers little advantage over the traditional aggregation approaches, provided that heteroscedastic-consistent (robust) standard errors are utilised. Based on this finding, we opted to use the traditional aggregation approach estimating heteroscedastic-consistent (robust) standard errors. This decision is supported by two additional considerations. First, reduced statistical power and biased variance estimates are primary concerns in settings with small sample sizes (Foster-Johnson & Kromrey, 2018). These concerns are typically eliminated with sample sizes approaching 50 groups (Clarke, 2008; Foster-Johnson & Kromrey, 2018). Hence, our dataset, covering 322 LAs, can be considered as being sufficiently large to avoid these issues. Second, while aggregating individual-level data at the LA level conceals intra-regional variance within LAs (Croon & Van Veldhoven, 2007), our focus on analysing inter-regional variance among LAs, rather than intra-regional variance within LAs, eliminates this concern.

Applying Cox Proportional-Hazards Models

Given that vaccination coverage was reported daily over 204 days for each LA, we employed the Cox Proportional Hazards Model (Cox, 1972) to estimate the effects of the independent variables on the efficiency of the local rollout of the COVID-19 vaccination programme. Widely used in medical research

to assess the impact of one or more independent variables on patients' survival time (Hox, 2010), the Cox Proportional Hazard Model is also commonly utilised to investigate the impact of socio-economic factors on vaccination campaigns. For example, Ngo et al. (2022, p. 3) used the Cox Proportional Hazards Model "to explore the survival time distribution of reaching the 30% vaccination uptake rate, which serves as a failure event". Similarly, Hu et al. (2014) applied the Cox Proportional Hazards Model to understand the determinants of vaccination coverage among children in China.

The Cox Proportional Hazards Model is expressed by the hazard function, which represents the risk of an event occurring in a given time interval. In this study, this event is defined as the point in time at which 50% of the population within an LA had received their first dose of a COVID-19 vaccine. We consider achieving this specific vaccination threshold as an irreversible event because, while the immunity from a COVID-19 vaccine may diminish over time, the act of getting vaccinated itself is permanent. As Reddinger et al. (2024, p. 484) highlight, in vaccination studies, the hazard rate represents "the probability of receiving a first dose conditional on being unvaccinated," which translates to the probability of reaching the 50% vaccination milestone conditional on not having reached it yet in the context of our study.

The underlying equation is:

$$\boldsymbol{h_i(t) = h_0(t) * exp(b_{i1}x_{i1} + b_{i2}x_{i2} + \cdots + b_{ip}x_{ip})} \quad \textbf{(1)}$$

, with t representing the survival time, $h_i(t)$ the hazard function of LA i; $h_0(t)$ the baseline hazard function; and $exp(b_{i1}, b_{i2}, \ldots, b_{ip})$ the hazard ratios of the aggregated covariates $(x_{i1}, x_{i2}, \ldots, x_{ip})$ classified according to the following categories: tolerance towards corruptive behaviour, political alignment, eligibility criteria, and control variables. The hazard ratio is akin to the odds ratio for logistic regressions. A hazard ratio exceeding one signifies a positive correlation between the covariate and the event probability. Consequently, such a finding indicates a reduction in the time required to vaccinate 50% of the population associated with the covariate under consideration.

Assessing Model Assumptions

The Cox Proportional Hazards Model is underpinned by several key assumptions, the most significant being the proportional hazards assumption, which posits that the hazard ratio remains constant over time across different covariates (Kuitunen, 2021). To verify this assumption, we assessed Schoenfeld residuals and tested their independence over time. With a p-value of 0.9468, we found no evidence of a violation of this assumption.

The Cox Proportional Hazards Model also assumes that each observation is independent, implying that the occurrence of the event for one observation does not influence its occurrence for others (Rabe-Hesketh & Skrondal, 2008). While individual-level observations may not be independent, aggregated data at the LA level exhibits less dependency. Nevertheless, it could be argued that public attitudes in neighbouring LAs might influence each other. However, since we are estimating robust standard errors, this influence is anticipated to be negligible.

Lastly, to ensure that our estimates are not affected by multicollinearity, we estimated the Variance Inflation Factors (VIF) for each regression model. The multicollinearity threshold is commonly set at a VIF value exceeding 10, though some researchers adopt a more conservative threshold of 5 (Akinwande et al., 2015). Our VIF means ranged between 1.37 and 1.39, indicating that multicollinearity can be ruled out for this analysis.

Overall, we believe that the Cox Proportional Hazards Model offers several advantages for our research. First, it allows us to assess the time to reach 50% vaccination coverage, which varies across LAs and may be influenced by various factors characterising LAs. Second, it suits the irreversible nature of receiving a COVID-19 vaccination (Reddinger et al., 2024). Third, other analytical methods applied in similar research contexts have not consistently yielded more robust results (Reichmuth et al., 2023).

4. Empirical Results

The following section presents the empirical findings derived from our statistical analysis. First, we present the descriptive results, including incidence rates and visual representations of associations between the

independent variables of main interest and the dependent variable. Second, we discuss the hazard ratios derived from the Cox Proportional Hazards Models.

4.1. Descriptive Results

Table 2 illustrates that by the 30th of June 2021, every LA included in the analysis had administered a first dose of the COVID-19 vaccine to at least 50% of its population. On average, it took 111 days to reach this milestone, with the fastest LA achieving it in just 82 days and the slowest in 195 days. Interestingly, the results suggest that these local disparities are associated with the composition of the local government. While it only took on average 104 days to reach the 50%-threshold in politically aligned LAs, it took 118 days in politically unaligned LAs – a statistically significant difference (log-rank test for the equality of survivor functions: prob > chi2 = 0.0000).

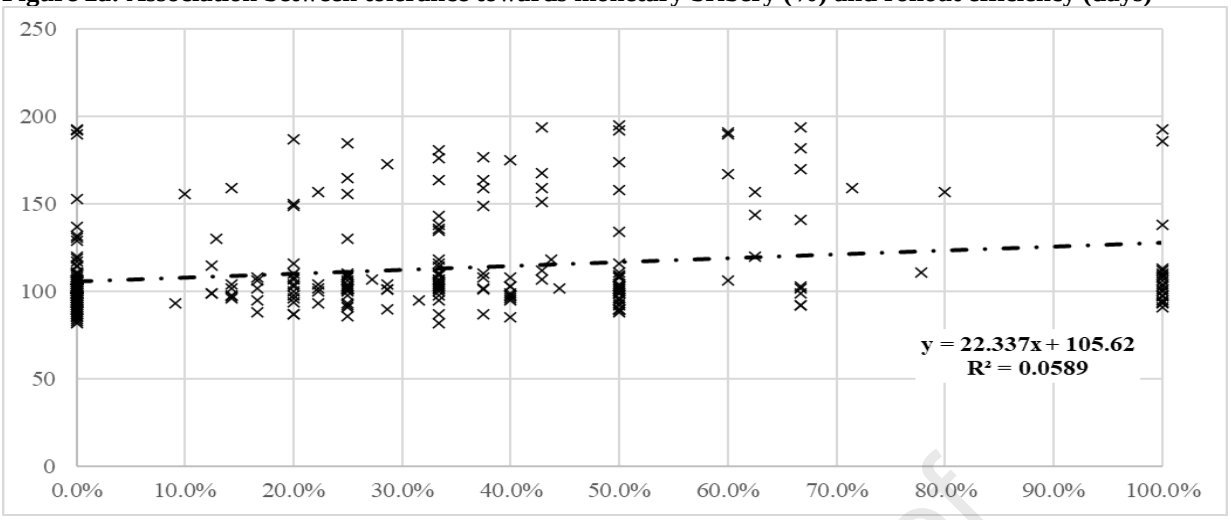
Table 2: Summary of survival-time statistics

	Exit time (days)				Exits (%)	Incident rate (%)
	mean	**median**	**min**	**max**		
politically unaligned	118	104	83	195	100	0.85
politically aligned	104	101	82	194	100	0.96
overall	111	103	82	195	100	0.90

Note: 'exit' is defined as 50% of the population within an LA being vaccinated. Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

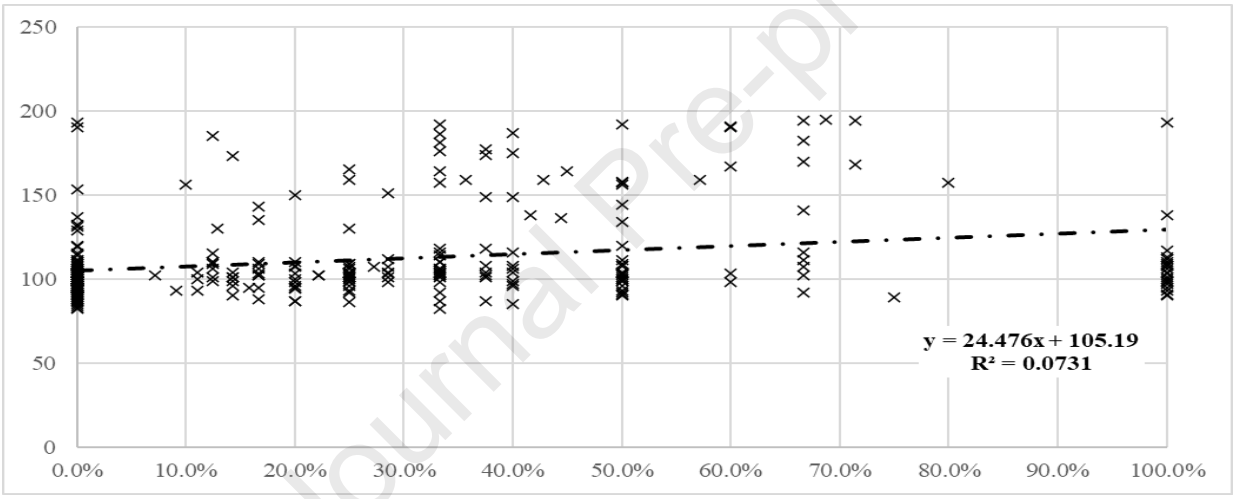
Additionally, a scatter plot analysis (see Figure 2a-2c) reveals a weak positive correlation between public tolerance towards corruptive behaviour and the time required to reach 50% vaccination coverage.

Figure 2a: Association between tolerance towards monetary bribery (%) and rollout efficiency (days)



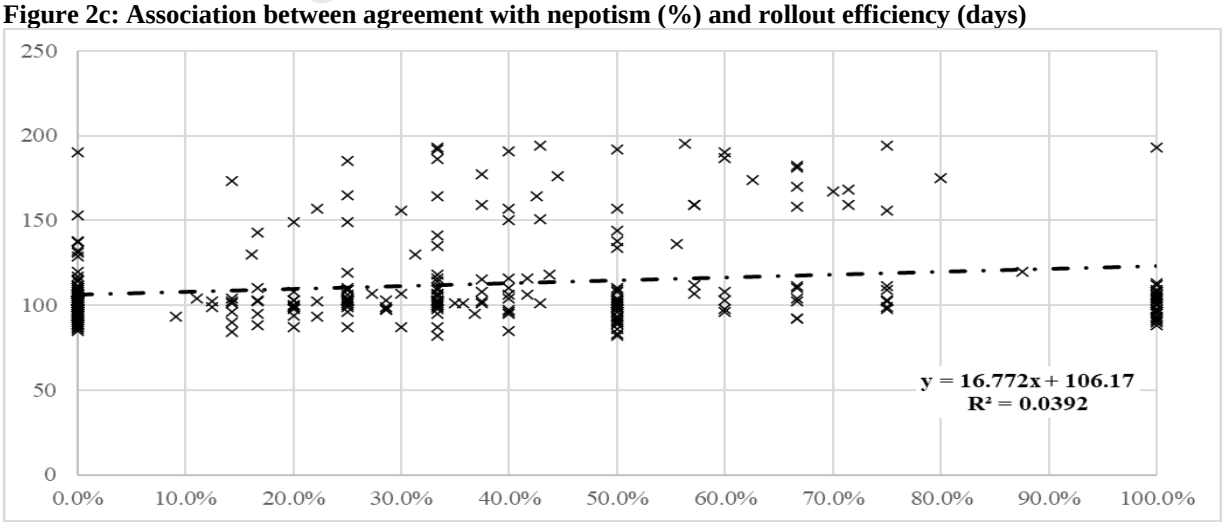
Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

Figure 2b: Association between tolerance towards in-kind bribery (%) and rollout efficiency (days)



Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

Figure 2c: Association between agreement with nepotism (%) and rollout efficiency (days)



Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

4.2. Analytical Results

While these findings suggest a negative association between public tolerance towards corruptive behaviour / a positive association between political alignment and the *efficiency* of the local rollout of the COVID-19 vaccination programme, they do not conclusively establish the significance of these effects when other factors are considered. To explore further, we utilised a stepwise approach in developing a series of regression models, introducing independent variables in succession.

Analysing Independent Variables on Main Interest

In the first step, we included the three variables of main interest, capturing public tolerance towards corruptive behaviour (refer to Table 3, m1-m3), as well as the moderating variable, measuring political alignment (refer to Table 3, m4), independently.

Table 3: The effects of public tolerance towards corruptive behaviour and the political environment

Independent Variable	**m1**	**m2**	**m3**	**m4**
Tolerance towards Corruptive Behaviour				
agreement with monetary bribery	0.3820*** (0.2434)			
agreement with in-kind bribery		0.3023*** (0.1827)		
agreement with nepotism/favouritism			0.4545*** (0.3054)	
Political Alignment				
local conservative majority/coalition				1.7354*** (0.2089)
prob > chi2	0.0000	0.0000	0.0000	0.0000
clusters	322	322	322	322
n	35,863	35,863	35,863	35,863

Note: ***Significant at 1% level ($p < 0.01$); **Significant at 5% level ($p < 0.05$), *Significant at 10% level ($p < 0.1$). Estimates are based on the 50% vaccination threshold. Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

The regression analysis supports our descriptive findings, affirming that public tolerance towards all three forms of corruptive behaviour significantly impedes the efficiency of the local rollout of the COVID-19 vaccination programme. While public tolerance towards in-kind bribery significantly increases the time required to vaccinate 50% of the population by 70% (m2), tolerance towards monetary bribery prolongs the time by 61% (m1), and tolerance towards nepotism by 55% (m3). Moreover, the regression analysis

underscores that political alignment with the national government significantly reduces the time required to vaccinate 50% of the population by 74% (m4).

In the second step (refer to Table 4, m5-m7), we expanded our investigation by jointly incorporating both our variables of main interest (public tolerance towards corruptive behaviour) and the moderator (political alignment). The effects of both public tolerance towards corruptive behaviour and political alignment remain statistically significant and positive.

These findings confirm our first and second hypotheses and align with previous research demonstrating a negative impact of corruptive behaviour on healthcare efficiencies at the national level (Farzanegan & Hofmann, 2021; Spreco et al., 2022). Importantly, our findings add to this evidence by demonstrating that the negative impact of corruptive behaviour on healthcare efficiency appears to extend to the local level. Moreover, our results add to Callen et al. (2020), suggesting that political alignment can enhance the efficiency of healthcare policy implementation.

Incorporating Interaction Effects

In a third step, we introduced interaction effects between the independent variables of main interest and the moderator to examine whether the impact of tolerance towards corruptive behaviour on the efficiency of the local rollout of the COVID-19 vaccination programme differs between politically aligned and unaligned LAs (refer to Table 4, m8-m10).

While the effects of public tolerance towards corruptive behaviour remain significant, the effect of political alignment becomes insignificant after considering the interaction effects. Importantly, the results indicate significant positive interaction effects between political alignment and public tolerance towards all three types of corruptive behaviour (m8-m10).

Since this finding contradicts our third hypothesis, it warrants further discussion. Following Lui (1985) and Horodnic et al. (2021), we initially assumed that corruptive behaviour might substitute for reduced government quality in politically unaligned LAs. Consequently, we expected public tolerance towards corruptive behaviour to increase implementation efficiency in politically unaligned LAs. However, our

analysis reveals a contrasting pattern: tolerance towards corruptive behaviour increases implementation efficiency in politically unaligned LAs instead. This unexpected result prompts a re-evaluation of the assumed relationship between political alignment, public tolerance towards corruption, and the efficiency of the vaccination programme rollout at the local level.

Table 4: Interactions between the political environment and tolerance towards corruptive behaviour

Variable	m5	m6	m7	m8	m9	m10
Tolerance towards Corruptive Behaviour						
agreement with monetary bribery	0.4571*** (0.1032)			0.2850*** (0.0833)		
agreement with in-kind bribery		0.3519*** (0.0908)			0.2008*** (0.0658)	
agreement with nepotism/favouritism			0.5097*** (0.0989)			0.3248*** (0.0908)
Political Alignment						
local conservative majority/coalition	1.5903*** (0.1960)	1.5930*** (0.1935)	1.6519*** (0.1987)	1.2269 (0.1964)	1.2116 (0.1982)	1.2355 (0.1825)
Interaction Effects						
political alignment*monetary bribery				2.9110** (1.2626)		
political alignment*in-kind bribery					3.0960** (1.5374)	
political alignment*nepotism bribery						2.6413** (1.0189)
prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
clusters	322	322	322	322	322	322
n	35,863	35,863	35,863	35,863	35,863	35,863

Note: ***Significant at 1% level ($p < 0.01$); **Significant at 5% level ($p < 0.05$), *Significant at 10% level ($p < 0.1$). Estimates are based on the 50% vaccination threshold. Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

Adding Eligibility Criteria and Control Variables

As correlations with other factors such as eligibility criteria, political ideology, social capital, and cultural orientations (as detailed in Appendix D.) may contribute to this phenomenon, we included them in our regression models in the fourth step of our analysis (refer to Table 5).

Firstly, the interaction effects between political alignment and public tolerance towards different types of corruptive behaviour remain significant after adding the control variables, confirming their robustness. Secondly, the effects of the control variables largely align with existing literature (Murphy et al., 2021; Hornsey & Pearson, 2022; Wu et al., 2023). Consistent with previous research, high levels of mistrust, high power distance, and masculinity are found to decrease the efficiency of the local rollout of the COVID-19 vaccination programme, while rurality is found to increase it.

Table 5: Full regression models including control variables

Variable	m11	m12	m13
Tolerance towards Corruptive Behaviour			
agreement with monetary bribery	0.8861		
	(0.3145)		
agreement with in-kind bribery		0.4373**	
		(0.1684)	
agreement with nepotism/favouritism			0.8275
			(0.2432)
Political Alignment			
local conservative majority/coalition	1.3032*	1.2402	1.1812
	(0.1972)	(0.1821)	(0.1757)
Eligibility Criteria			
age	1.0122**	1.0096*	1.0139**
	(0.0057)	(0.0058)	(0.0061)
clinically extremely vulnerable	0.4682***	0.4398***	0.4466***
	(0.1163)	(0.1134)	(0.1124)
frontline worker	0.7776	0.8598	0.8766
	(0.3787)	(0.4086)	(0.4204)
Control Variables			
conservative voting intention	0.9048	0.9471	0.8706
	(0.1585)	(0.1660)	(0.1509)
predominantly rural	4.0153***	3.9799***	4.1751***
	(0.5890)	(0.5799)	(0.6135)
missing relational social capital	0.7928**	0.8050**	0.8002**
	(0.0828)	(0.0863)	(0.0844)
structural social capital	0.9047	1.0172	0.9513
	(0.2104)	(0.2379)	(0.2113)
power distance	0.9948	0.9924*	0.9945
	(0.0044)	(0.0044)	(0.0045)
individualism	1.0107**	1.0078*	1.0103**
	(0.0049)	(0.0047)	(0.0050)
masculinity	0.9858***	0.9882**	0.9862***
	(0.0050)	(0.0050)	(0.0050)
uncertainty avoidance	1.0031	1.0015	1.0036
	(0.0050)	(0.0048)	(0.0048)
Interaction Effects			
politically aligned*monetary bribery	2.2563*		
	(0.9702)		
politically aligned*in-kind bribery		2.6759**	
		(1.3185)	
politically aligned*nepotism			2.6838***
			(0.9962)
prob > chi2	0.0000	0.0000	0.0000
clusters	322	322	322
n	35,863	35,863	35,863

Note: ***Significant at 1% level ($p < 0.01$); **Significant at 5% level ($p < 0.05$), *Significant at 10% level ($p < 0.1$). Estimates are based on the 50% vaccination threshold. Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

Thirdly, concerning the eligibility criteria, we observe that, as expected, a higher average age within an LA significantly reduced the time to vaccinate 50% of the population significantly. In contrast, a larger population of clinically extremely vulnerable individuals within an LA significantly prolonged the time required, whereas the prevalence of healthcare workers within an LA showed no significant effect. While

partially contradicting our fourth hypothesis, these observations could be attributed to the inherent challenges in coordinating the vaccination process for a larger population of clinically extremely vulnerable individuals who were advised to shield until April 2021 (GOV.UK, 2021). Moreover, the anticipated positive effect of prioritising healthcare workers for vaccination may have been offset by increased vaccination hesitancy within this group (Peterson et. Al, 2022).

Comparing Politically Aligned with Politically Unaligned LAs

To further investigate the difference between politically aligned and unaligned LAs in their capacity to implement the COVID-19 vaccination programme locally (refer to Table 6, m14-m19), separate regression models were conducted for each group. The results of these regression models reveal that the effects of public tolerance towards in-kind bribery and nepotism/favouritism, age, and clinical extreme vulnerability on the efficiency of the local rollout of the COVID-19 vaccination programme differ between politically aligned and unaligned LAs.

Firstly, while tolerance towards nepotism/favouritism is significantly more common (Pearson chi2(1): 5.22**) in politically unaligned LAs (36%) than in politically aligned LAs (30%), it is found to significantly reduce the time required to vaccinate 50% of the population in politically aligned LAs (m19: 2.053***). In comparison, this effect is not significant in politically unaligned LAs (m16: 0.810). Instead, tolerance towards in-kind bribery is found to significantly increase the time required to vaccinate 50% of the population (m15: 0.382**) in politically unaligned LAs.

Secondly, we observe that age significantly reduces the time required to vaccinate 50% of the population in politically unaligned LAs (m14: 1.026***, m15: 1.024***, m16: 1.025***), while this effect remains insignificant in politically aligned LAs (m17: 0.998, m18: 0.996, m19: 1.002). Conversely, clinical extreme vulnerability significantly increases the time required to vaccinate 50% of the population in politically aligned LAs (m17: 0.458*, m18: 0.456*, m19: 0.421**), whereas this effect is not statistically significant in politically unaligned LAs (m14: 0.656, m15: 0.621, m16: 0.669).

These results carry ethical and societal significance, as delaying vaccination for vulnerable groups, who are at higher risk of severe illness and mortality from COVID-19, worsen existing health disparities and societal inequalities. Prioritising these populations not only addresses their immediate health needs but also alleviates strain on healthcare systems by reducing the burden of severe COVID-19 cases.

In summary, our findings underscore the complexity of balancing efficiency and equity in public health initiatives. While prioritising rapid vaccine rollout is crucial for achieving herd immunity and controlling the spread of the virus, it is equally important to ensure that vulnerable populations are not left behind.

Table 6: Effect comparisons between politically aligned and unaligned LAs

Variable	politically unaligned LAs			politically aligned LAs		
	m14	**m15**	**m16**	**m17**	**m18**	**m19**
Tolerance towards Corruptive Behaviour						
agreement with monetary bribery	0.9964			1.4491		
	(0.4363)			(0.5461)		
agreement with in-kind bribery		0.3822**			1.0995	
		(0.1711)			(0.3616)	
agreement with nepotism/favouritism			0.8099			2.0525**
			(0.2577)			(0.7011)
Eligibility Criteria						
age	1.0259***	1.0244***	1.0252***	0.9976	0.9963	1.0020
	(0.0083)	(0.0088)	(0.0087)	(0.0081)	(0.0082)	(0.0089)
clinically extremely vulnerable	0.6559	0.6206	0.6692	0.4575*	0.4562*	0.4211**
	(0.2440)	(0.2231)	(0.2518)	(0.1849)	(0.1887)	(0.1687)
frontline worker	0.9691	1.1919	0.9755	0.5640	0.5987	0.6791
	(0.7009)	(0.8552)	(0.7104)	(0.3443)	(0.3574)	(0.3979)
Control Variables						
conservative voting intention	1.0736	1.1363	1.0682	0.6846	0.6927	0.6301*
	(0.2787)	(0.2807)	(0.2661)	(0.1845)	(0.1871)	(0.1737)
predominantly rural	4.2146***	3.8312***	4.1618***	4.2669***	4.3144***	4.4762***
	(1.1393)	(1.0233)	(1.0710)	(0.8256)	(0.8378)	(0.8678)
missing relational social capital	0.9051	0.9638	0.9186	0.7827*	0.7861*	0.7822*
	(0.1498)	(0.1661)	(0.1518)	(0.1101)	(0.1107)	(0.1117)
structural social capital	1.1368	1.3730	1.1470	1.0244	1.0608	1.0651
	(0.4057)	(0.5088)	(0.3928)	(0.3283)	(0.3343)	(0.3436)
power distance	1.0032	1.0003	1.0028	0.9893	0.9876*	0.9908
	(0.0070)	(0.0067)	(0.0069)	(0.0073)	(0.0068)	(0.0072)
individualism	1.0143*	1.0107	1.0132*	1.0089	1.0077	1.0102
	(0.0078)	(0.0073)	(0.0078)	(0.0073)	(0.0071)	(0.0072)
masculinity	0.9906	0.9922	0.9913	0.9813***	0.9829**	0.9808***
	(0.0078)	(0.0075)	(0.0077)	(0.0067)	(0.0067)	(0.0065)
uncertainty avoidance	0.9942	0.9896*	0.9934	1.0114	1.0112	1.0127*
	(0.0078)	(0.0062)	(0.0065)	(0.0075)	(0.0075)	(0.0074)
prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
cluster	174	174	174	148	148	148
n	20,505	20,505	20,505	15,358	15,358	15,358

Note: ***Significant at 1% level ($p < 0.01$); **Significant at 5% level ($p < 0.05$), *Significant at 10% level ($p < 0.1$). Estimates are based on the 50% vaccination threshold. Source: Own calculations based on GOV.UK (2022). Coronavirus (COVID-19) in the UK.

5. Discussion and Conclusion

Using the UK COVID-19 vaccination programme as a case study, this paper contributes to the academic literature on corruptive behaviour in healthcare settings (Rose, 2006; Hunt, 2010; Farzanegan & Hofmann, 2021; Spreco et al., 2022; Timofeyev & Jakovljevic, 2022; Usman et al., 2022), providing a more nuanced spatial perspective. Here, 'nuanced spatial perspective' refers to evaluating the efficiency and equity of the COVID-19 vaccination programme in England and Scotland at the LA level, considering local governance and political contexts (Rodríguez-Pose & Di Cataldo, 2015; Rodríguez-Pose & Zhang, 2019). By doing so, it also addresses calls from scholars like Xenakis (2010), Doshi and Ranganathan (2019), and Ang (2020) to analyse corruptive behaviour within the context of mature democracies like the UK.

5.1. Key Takeaways

Our study reveals that a significant portion of respondents perceived monetary bribery (28%), offering gifts (27%), and leveraging personal connections with healthcare professionals (34%) as acceptable means to expedite their access to the COVID-19 vaccine. These tolerance rates are notably higher compared to previous studies on corruptive behaviour in European healthcare settings. For instance, Bauhr and Oscarsson (2011) found that only 16% (2%) of their survey participants tolerated private (public) doctors allowing queue-jumping for a friend or relatives, before the COVID-19 outbreak in Sweden. Similarly, Horodnic et al. (2021) reported that only 3% of their survey participants admitted to using informal payments in Western European public hospitals during the early months of the COVID-19 pandemic. Furthermore, when asked about preferences for private distribution of COVID-19 vaccines, only 21% of UK participants supported a mix of public and private distribution at the beginning of the COVID-19 vaccine rollout (Duch et al., 2021).

Hence, our findings reveal that, despite the UK's reputation as a low-corruption country, evidenced by its 11th position in Transparency International's Corruption Perceptions Index (Transparency International, 2021), surprisingly large pockets of society tolerated corruptive behaviour during the COVID-19 vaccination rollout. This finding raises important questions about the nature and interpretation of corruptive behaviour in mature democracies like the UK. While the mainstream literature often views corruptive

behaviour as a problem of less developed countries, our research challenges this perspective. Echoing Doshi and Ranganathan (2019), our study underscores the need to examine corruptive behaviour also in countries perceived as having low levels of corruption, particularly in times of crisis.

Moreover, we found that LAs with high public tolerance towards corruptive behaviour took longer to reach the 50% vaccination threshold compared to those with lower tolerance. This finding corroborates previous research on the negative impact of corruptive behaviour on healthcare efficiencies at the national level (Farzanegan & Hofmann, 2021; Spreco et al., 2022), and indicates that this detrimental effect extends to the local level. Additionally, our findings suggest that public healthcare outcomes are influenced not only by corruptive attitudes of those in power but also by patient's tolerance towards them.

Besides, our findings highlight a complex interplay between political alignment, public tolerance towards corruptive behaviour, and the efficiency and equity of the local COVID-19 vaccination rollout. While politically aligned LAs reached the 50% vaccination milestone faster than politically unaligned ones, vulnerable groups, who should have been prioritised, were either vaccinated at a similar or even slower pace than the rest of the population. This suggests that while politically aligned LAs demonstrated efficiency in their vaccination efforts, the prioritisation of speed – potentially accelerated by public tolerance towards corruptive behaviour – might have led to a slower vaccination process for most vulnerable individuals.

While surprising at first glance, this observation could be attributed to the limitations of political alignment. While being politically aligned can expedite the implementation of national decisions (Allern et al., 2021), it does not guarantee effective communication and engagement with the local communities during implementation. Rather, it is reasonable to assume that the ability to establish positive relationships with the local community, reaching out to marginalised and hard-to-reach populations, and developing tailored strategies that address their specific needs (Farina & Lavazza, 2021) is crucial during vaccination campaigns, and extends beyond political alignment with the national government. In some cases, political alignment with the national government might even disadvantage citizens living in aligned LA. For example, Callen et al. (2020) found that while political alignment increases the quantity of health services

in aligned LAs in Pakistan, it reduces their quality. They highlight that the benefits of political alignment are often offset by a policy mix skewed towards non-programmatic spending, which focuses more on immediate, visible achievements rather than equitable, long-term improvements.

Hence, building on Ang's (2020) perspective that corruptive behaviour can be seen as the 'steroids of capitalism' – growth-enhancing but with serious side effects – our study suggests that public tolerance towards corruptive behaviour can boost efficiency, potentially at the expense of equitable access to scarce health resources, in specific socio-political contexts. Thus, our findings emphasise the significant influence of local political context on healthcare efficiency and equity.

5.2. Political and Societal Implications

To promote equity in vaccination campaigns, several policy interventions can be considered. First, while prioritising vulnerable populations is crucial, ensuring adherence to these guidelines among all healthcare providers is equally essential. This can be achieved through the implementation of equity impact assessments and regular monitoring of vaccination coverage rates across different demographic groups and geographic regions (Cutts et al., 2016). Second, addressing socio-economic barriers to healthcare access, such as providing transportation assistance, language interpretation services, and targeted outreach programmes to underserved communities, can further promote equitable vaccine distribution (Ozawa, 2019). Likewise, collaborating with community organisations, religious leaders, and trusted local figures can help build trust in vaccination efforts and reduce vaccine hesitancy (Syed, 2023). Third, to improve patient outcomes within marginalised and vulnerable communities, it is also essential to bolster healthcare professionals' ability to deliver patient-centred care. This can be achieved through comprehensive training programmes that cultivate an understanding of the unique perspectives and needs prevalent in these communities (Kwame & Petrucka, 2021). Finally, since patient attitudes toward corruptive behaviour significantly influence public healthcare outcomes, policy interventions aimed at strengthening bottom-up accountability are necessary. These may include educational campaigns aimed at informing the public about the negative impacts of corruptive behaviour on healthcare quality and equity, reinforcing ethical standards and training for healthcare professionals to discourage accepting bribes (Bruckner, 2019), and

protecting whistleblowers who expose corrupt practices in healthcare settings (Yılmaz & Özbek Güven, 2024).

Considering the overlapping nature of attitudes towards corruptive behaviour and marketisation as highlighted in previous research (Vian et al., 2006; Duch et al., 2022), our findings resonate with broader discussions concerning the marketisation and privatisation of healthcare systems in Western democracies (Callahan, 2008). In market-driven healthcare systems, prioritising efficiency can lead to inequitable access to care, as resources may be allocated based on financial incentives rather than medical needs (Mwachofi & Al-Assaf, 2011). This trade-off between efficiency and equity has been a subject of scholarly inquiry in healthcare policy and ethics. For instance, Daniels and Sabin (2008) discuss the concept of 'accountability for reasonableness', which posits that healthcare resource allocation decisions should be based on fair and transparent processes that balance efficiency and equity.

Overall, our findings suggest that equitable access to public healthcare requires thorough discussions, even in countries that are being perceived as having strong and equitable public healthcare systems like the UK. To this end, we believe it is essential for policymakers, healthcare professionals, ethicists, and the broader community to engage in deliberative discussions about the values and priorities that underpin healthcare resource allocation decisions. By fostering open dialogue and considering diverse perspectives, societies can work towards balancing efficiency and equity in healthcare delivery. Ultimately, each society must determine its own balance between efficiency and equity and decide how much effort it is willing to invest in achieving it.

5.3. Limitations

While we strongly believe in the added value of our research, our study has certain limitations. First, we can only establish an association between tolerance towards corruptive behaviour and efficiency of the local rollout of the COVID-19 vaccination programme in England and Scotland, not causation. Second, following Gouvêa Maciel (2021) and Bauhr and Oscarsson (2011), we measured corruptive behaviour differently from previous studies, including those conducted by Farzanegan and Hofmann (2021) and Spreco et al., (2022), reducing direct compatibility. Third, some individuals may have resorted to corruptive

behaviour by obtaining fake vaccination certificates (Krap, 2021). While such behaviour would still appear to accelerate the speed of the rollout of the COVID-19 vaccination programme in official statistics, it would not be captured by our corruption measure, which specifically evaluates agreement with using corruptive means to secure early vaccine access. Fourth, political alignment with the national government is just one aspect among many affecting local government quality during times of crisis. Lastly, despite conducting a thorough literature review, some confounding variables may have been overlooked, which can lead to biased coefficient estimates. To adjust for potential bias introduced by omitted variables, we employed robust standard errors in our analysis.

5.4. Future Research

With these limitations in mind, our paper serves as a call for future research and discussion. We encourage future researchers to consider adopting an in-depth qualitative case study approach to investigate extreme cases, such as LA with notably low vaccination rates among clinically extremely vulnerable individuals. Research questions like "What are the root causes contributing to differences in vaccination rates among vulnerable groups?" could explore factors contributing to these disparities. This could involve examining dynamics between the local government, healthcare providers, and vulnerable populations, analysing trust in local government among vulnerable communities, as well as the attitudes and efforts of local healthcare providers towards reaching these communities, through in-depth interviews and focus groups.

Moreover, future research could investigate how societal attitudes towards corruptive behaviour evolve in reaction to shifting socio-political uncertainties. Research questions like “Are there noticeable changes in the acceptance of corrupt practices in times of heightened uncertainties?” could be explored utilising longitudinal datasets and panel data analysis methods to track shifts in public tolerance towards corruptive behaviour and their correlation with perceived risks and uncertainties.

Finally, from a methodological perspective, we encourage scholars to utilise alternative statistical approaches to support causal inference, such as Coincidence Analysis (Whitaker et al., 2020) or Causal Forest (O'Neill et al., 2024). Coincidence Analysis is useful for analysing complex social phenomena by employing truth tables that list all combinations of conditions and their outcomes, identifying

configurations that consistently lead to better outcomes (Whitaker et al., 2020). Meanwhile, Causal Forest is a machine learning technique that extends traditional random forests to estimate heterogeneous treatment effects, detecting varying impacts across subpopulations. As a non-parametric method, it offers a comprehensive analysis by considering multiple treatments and covariates simultaneously (O'Neill et al., 2024).

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to enhance the papers readability and grammatical correctness. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

References

Akinwande, M., Dikko, H., and Samson, A. (2015). Variance Inflation Factor: As a Condition for the Inclusion of Suppressor Variable(s) in Regression Analysis. *Open Journal of Statistics*, 5, 754-767.

Allain-Dupré, D., Chatry, I., Michalun, V., and Moisio, A. (2020). The territorial impact of COVID-19: managing the crisis across levels of government. *OECD Policy Responses to Coronavirus (COVID-19)*, *10*, 1620846020-909698535.

Allern, E.H., Otjes, S., Poguntke, T., Hansen, V.W., Saurugger, S., and Marshall, D. (2021). Conceptualizing and measuring party-interest group relationships. *Party Politics*, 27(6), 1254-1267.

Ang, Y.Y. (2020). Unbundling Corruption: Revisiting Six Questions on Corruption. *Global Perspectives*, 1(1).

Andrew, C., and Goldsmith, M. (1998). From local government to local governance—and beyond? *International Political Science Review*, 19(2), 101-117.

Badr, H., Zhang, X., Oluyomi, A., Woodard, L.D., Adepoju, O.E., Raza, S.A., and Amos, C.I. (2021). Overcoming COVID-19 Vaccine Hesitancy: Insights from an Online Population-Based Survey in the United States. *Vaccines*, 9, 1100.

Baraniuk, C. (2021). Covid-19: How the UK vaccine rollout delivered success, so far. *BMJ*, 372, n421.

Bauhr, M., and Oscarsson, H. (2011). Public Perceptions of Corruption: The Prevalence and Moral Rejection of Corruption in Sweden. Working Papers/Books, Department of Political Science, Statsvetenskapliga Institutionen: Sweden. https://gupea.ub.gu.se/handle/2077/39014.

Bibby, P., and Shepherd, J. (2004). *Developing a new classification of urban and rural areas for policy purposes–the methodology*. London, Defra.

Borgonovi, F., & Andrieu, E. (2020). Bowling together by bowling alone: Social capital and Covid-19. *Social science & medicine*, *265*, 113501.

Brown, S. F., and Shackman, J. (2007). Corruption and related socioeconomic factors: A time series study. *Kyklos*, 60, 319-347.

Bruckner, T. (2019). The ignored pandemic: how corruption in healthcare service delivery threatens Universal Health Coverage. Transparency International. https://apo.org.au/node/226771.

Callahan, D. (2008). Europe and the United States: contrast and convergence. J Med Philos, 33(3), 280-93.

Callen, M., Saad G., and Arman R. (2020). "Can Political Alignment Be Costly?" The Journal of Politics 82, 2, 12–626.

Carothers, T., and de Gramont, D. (2013). Development Aid Confronts Politics: The Almost Revolution. Carnegie Endowment for International Peace: New York, NY.

Çevik, S. (2016). Tax morale and tax compliance in socio-political context. *Political Economy of Taxation, Istanbul: IJOPEC*, 37-57.

Chereches, R. M., Ungureanu, M. I., Sandu, P., & Rus, I. A. (2013). Defining informal payments in healthcare: a systematic review. *Health Policy*, *110*(2-3), 105-114.

Clarke, P. (2008). When can group level clustering be ignored? Multilevel models versus single-level models with sparse data. *Journal of Epidemiology and Community Health*, *62*, 752–758.

Cox, D.R. (1972). Regression models and life-tables. *Journal of the Royal Statistical Society: Series B (Methodological)*, 34(2), 187-202.

Corstange, D. (2009). Sensitive questions, truthful answers? Modeling the list experiment with LISTIT. *Political Analysis*, 17(1), 45-63.

Croon, M.A., and Van Veldhoven, M.J.P.M. (2007). Predicting group-level outcome variables from variables measured at the individual level: A latent variable multilevel model. *Psychological Methods*, 12(1), 45-57.

Curran, P.J. (2003). Have multilevel models been structural equation models all along? *Multivariate Behavioral Research*, *38*, 529–569.

Cutts F.T., Claquin P., Danovaro-Holliday M.C., Rhoda D.A. (2016). Monitoring vaccination coverage: Defining the role of surveys. *Vaccine*, 34(35), 4103-4109.

Daniels, N., and Sabin, J.E. (2008). Setting Limits Fairly. Learning to share resources for health. Oxford: Oxford University Press.

Davis, J.H., and Ruhe, J.A. (2003). Perceptions of country corruption: Antecedents and outcomes. *Journal of Business Ethics*, 43, 275-288.

Defra (2022). *Statistical Digest of Rural England*. GOV.UK: Department of Environment, Food, and Rural Affairs. https://assets.publishing.service.gov.uk/government/uplo

Deltapoll (2024). *Who we are*. https://deltapoll.co.uk/who-we-are

Department of Health (2012). *The new public health role of local authorities*. https://assets.publishing.service.gov.uk/government/uploads/system/

Doshi, S., and Ranganathan, M. (2019). Towards a critical geography of corruption and power in late capitalism. *Progress in Human Geography*, 43(3), 436-457.

Duch, R., Roope, L.S.J., and Violato, M. (2021). Citizens from 13 countries share similar preferences for COIVD-19 vaccine allocation priorities. *Proceedings of the National Academy of Sciences*, 118(38), e2026382118.

Duch, R., Robinson, T. S., Clarke, P. M., Roope, L. S., and Violato, M. (2022). Reply to Spreco et al.: Perceived corruption and preferences for COVID-19 vaccine allocations. *Proceedings of the National Academy of Sciences*, *119*(19), e2201847119.

Duffy C., Newing A., and Górska J. (2022). Evaluating the geographical accessibility and equity of COVID-19 vaccination sites in England. *Vaccines* 10(1), 50. 10.3390/vaccines10010050.

Farina M., and Lavazza A. (2021). Advocating for Greater Inclusion of Marginalized and Forgotten Populations in COVID19 Vaccine Rollouts. *International Journal of Public Health*, 66, 1604036.

Farzanegan, M.R., and Hofmann, H.P. (2021). Effect of public corruption on the COVID-19 immunization progress. *Scientific Reports*, 11, 23423.

Ferraresi, M., and Gucciardi, G. (2022). Political alignment, centralisation, and the sense of government unpreparedness during the COVID-19 pandemic. *European Journal of Political Economy*, 73, 102144.

Foster-Johnson, L., and Kromrey, J.D. (2018). Predicting group-level outcome variables: An empirical comparison of analysis strategies. *Behavior Research Methods*, 50, 2461-2479.

Friedrich, C.J. (1966). Political Pathology. *The Political Quarterly*, 37, 70-85.

Guo, X., and Tu, W. (2017). Corruption tolerance and its influencing factors—the case of China's civil servants. Journal of Chinese Governance, 2(3), 307–328.

Gouvêa Maciel G. (2021). What We (Don't) Know so Far About Tolerance Towards Corruption in European Democracies: Measurement Approaches, Determinants, and Types. *Social Indicators Research*, 157(3), 1131-1153.

GOV.UK (2021). Shielding advice for the clinically extremely vulnerable to stop from April. https://www.gov.uk/government/news/shielding-advice-for-stop-from-April

GOV.UK (2022). Coronavirus (COVID-19) in the UK. Metrics Documentation. https://coronavirus.data.gov.uk/metrics/doc/cumPeopleVaccinatedFirstDoseByVaccinationDate

Gupta, S., Davoodi, H. and Alonso-Terme, R. (2002). Does corruption affect income inequality and poverty? *Economics of Governance*, 3, 23-45.

Habibov, N., and Cheung, A. (2017). Revisiting informal payments in 29 transitional countries: the scale and socio-economic correlates. *Social Science & Medicine, 178*, 28-37.

Hessami, Z. (2011). On the link between government ideology and corruption in the public sector. In *ISNIE Conference Paper*. https://extranet.sioe.org/uploads/isnie2011/hessami.pdf

Hofstede, G. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings in Psychology and Culture*, 2(1), 2307-0919.

Hornsey, M.J., and Pearson, S. (2022). Cross-national differences in willingness to believe conspiracy theories. *Current Opinion in Psychology*, 101391.

Horodnic, A.V., Williams, C.C., Drugă R.I., Incaltarau C. (2021). Informal Payments by Patients in Central and Eastern Europe during the COVID-19 Pandemic: An Institutional Perspective. *Int J Environ Res Public Health*, 18(20):10914.

Hox, J.J. (2010). *Multilevel analysis. Techniques and applications*. New York, Routledge.

Hu, Y., Chen, Y., Guo, J., Tang, X., and Shen, L. (2014). Completeness and timeliness of vaccination and determinants for low and late uptake among young children in eastern China. *Human Vaccines & Immunotherapeutics*, 10(5), 1408-1415.

Hunt, J. (2010). Bribery in health care in Uganda. *Journal of Health Economics*, 29(5), 699-707.

Jackman, R.W., and Miller, R.A. (1998). Social capital and politics. *Annual Review of Political Science*, 1, 47-73.

Jennings, W., Valgarðsson, V., McKay, L., Stoker, G., Mello, E., and Baniamin, H. M. (2023). Trust and vaccine hesitancy during the COVID-19 pandemic: a cross-national analysis. *Vaccine*, 100299.

Jong-Sung, Y., and Khagram, S. (2005). A comparative study of inequality and corruption. *American Sociological Review*, 70(1), 136-157.

Jöst, P. (2023). Where Do the Less Affluent Vote? The Effect of Neighbourhood Social Context on Individual Voting Intentions in England. *Political Studies*, 71(2), 518-541.

Kapoor, M., and Ravi, S. (2012). Determinants of Corruption: Government Effectiveness vs. Cultural Norms. T*he B.E. Journal of Economic Analysis & Policy*, 12(1).

Kashyap, A., and Wurth, M. (2021). *Rights Key to Tackle Corruption, Inequity in Vaccine Access*. https://www.hrw.org/news/2021/03/11/rights-key-tackle-corruption-inequity-vaccine-access

Kaufmann, W.; Hooghiemstra, R.; Feeney, M.K. (2018). Formal institutions, informal institutions, and red tape: A comparative study. *Public Adm*, 96, 386–403.

Krap, P. (2021). *Anti-vaxxers using bribery and fake certificates to avoid vaccination, Australian government warned*. https://www.theguardian.com/australia-news/2021/nov/19/anti-vaxxers-using-bribery-and-fake-certificates-to-avoid-vaccination-australian-government-warned021/nov/19/

Kuitunen, I., Ponkilainen, V.T., Uimonen, M.M., Eskelinen, A., and Reito, A. (2021). Testing the proportional hazards assumption in cox regression and dealing with possible non-proportionality in total joint arthroplasty research: methodological perspectives and review. *BMC Musculoskelet Disord*, 22, 489.

Kwame, A., Petrucka, P.M. (2021). A literature-based study of patient-centered care and communication in nurse-patient interactions: barriers, facilitators, and the way forward. *BMC Nurs*, 20, 158.

Lambsdorff, G.J. (2003). How corruption affects productivity. *Kyklos*, 56, 457-474.

Lamot, M., and Kirbiš, A. (2024). Multilevel analysis of COVID-19 vaccination intention: the moderating role of economic and cultural country characteristics, *European Journal of Public Health*, 34(2): 380–386.

Lazarus, J.V., Ratzan, S.C., Palayew, A., Gostin, L. O., Larson, H.J., Rabin, K., ... and El-Mohandes, A. (2021). A global survey of potential acceptance of a COVID-19 vaccine. *Nature Medicine*, 27(2), 225-228.

Leff, N. (1964). Economic Development Through Bureaucratic Corruption. *American Behavioral Scientist*, 8(2), 8-14.

Leonhardt J.M., Pezzuti T. (2022). Vaccination acceptance across cultures: the roles of collectivism, empathy, and homophily. *J Int Mark*, 30: 13–2.

Local Government Association (2021). *Local authority COVID-19 compliance and enforcement good practice framework*. https://www.local.gov.uk/local-authority-covid-19-compliance-and-enf

Lofors, J., and Sundquist, K. (2007). Low-linking social capital as a predictor of mental disorders: A cohort study of 4.5 million Swedes. *Social Science & Medicine*, 64(1), 21-34.

Lučić, D., Radišić, M., and Dobromirov, D. (2016). Causality between corruption and the level of GDP. E*conomic Research-Ekonomska Istraživanja*, 29(1), 360-379.

Lui, F. (1985). An Equilibrium Queuing Model of Bribery. *Journal of Political Economy*, 93, 760-781.

Machida, M., Kikuchi, H., Kojima, T., Nakamura, I., Saito, R., Nakaya, T., ... and Inoue, S. (2022). Individual-level social capital and COVID-19 vaccine hesitancy in Japan: a cross-sectional study. *Human Vaccines & Immunotherapeutics*, 18(5), 2086773.

Mancuso, M. (1995). *The Ethical World of British MPs*. Montreal: McGill-Queen's University Press.

Mathieu, E., Ritchie, H., Rodés-Guirao, L., Appel, C., Giattino, C., Hasell, J., Macdonald, B., Dattani, S., Beltekian, D., Ortiz-Ospina, E., and Roser, M. (2020). *Coronavirus Pandemic (COVID-19)*. https://ourworldindata.org/coronavirus'

Migueis, M. (2013). "The Effect of Political Alignment on Transfers to Portuguese Municipalities". Economics Politics 25, 1, 110–133.

Mitchell, A.D., and Bossert, T.J. (2007). Measuring dimensions of social capital: Evidence from surveys in poor communities in Nicaragua. *Social Science & Medicine*, 64, 50-63.

Montes, G.C., and Paschoal, P.C. (2016). Corruption: what are the effects on government effectiveness? Empirical evidence considering developed and developing countries. *Applied Economics Letters*, 23(2), 146-150.

Murphy, J., Vallières, F., Bentall, R. P., Shevlin, M., McBride, O., Hartman, T. K., ... & Hyland, P. (2021). Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nature communications*, *12*(1), 29.

Mwachofi A, Al-Assaf A.F. (2011). Health care market deviations from the ideal market. *Sultan Qaboos Univ Med J.*, 11(3), 328-37.

Nahapiet, J., and Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), 242-266.

Neild, R. (2002). *Public corruption: The dark side of social evolution*. London: Anthem

Neville, S., and Warrell, H. (2021). *UK vaccine rollout success build on NHS determination and military precision.* https://www.ft.com/content/cd66ae57-657e-4579-be19-85efcfa5d09b

Ngo, V.M., Zimmermann, K.F., Nguyen, P.V., Huynh, T.L.D., and Nguyen, H.H. (2022). How education and GDP drive the COVID-19 vaccination campaign. *Archives of Public Health*, 80, 171.

ONS (2021). *Coronavirus vaccine hesitancy falling across the regions and countries of Great Britain.* https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandwellbeing/articles/coronavirusvaccinehesitancyfallingacrosstheregionsandcountriesofgreatbritain/2021-08-09

Ozawa S., Yemeke T.T., Evans D.R., Pallas S.E., Wallace A.S., and Lee B.Y. (2019). Defining hard-to-reach populations for vaccination. Vaccine, 37(37), 5525-5534.

O'Neill, S., Grieve, R., Singh, K., Dutt, V., and Powell-Jackson, T. (2024). Stephen Persistence and heterogeneity of the effects of educating mothers to improve child immunisation uptake: Experimental evidence from Uttar Pradesh in India. *Journal of Health Economics*, 96, 102899.

Paun, A., Wilson, J., and Hall, D. (2019). *Local Government.* https://www.instituteforgovernment.org.uk/explainer/local-government

Peterson C.J., Lee B., Nugent K. (2022). COVID-19 Vaccination Hesitancy among Healthcare Workers-A Review. Vaccines (Basel), 10(6): 948.

Pourtaleb, A., Jafari, M., Seyedin, H. *et al. (2020).* New insight into the informal patients' payments on the evidence of literature: a systematic review study. *BMC Health Serv Res*, **20**, 14.

Public Health England (2021). *COVID-19 vaccination first phase priority groups.* https://www.gov.uk/government/publications/covid-19-vaccination-care-home-and-healthcare-settings-posters/covid-19-vaccination-first-phase-priority-groups

Putnam, R.D. (2007). E Pluribus Unum: Diversity and Community in the Twenty-first Century The 2006 Johan Skytte Prize Lecture. *Scandinavian Political Studies*, 30(2), 137-174.

Rabe-Hesketh, S., and Skrondal, A. (2008). *Multilevel and longitudinal modelling using Stata (2nd ed.)*. College Station: Stata Press.

Razai, M.S., Osama, T., McKechnie, D.G.J., and Majeed, A. (2021). Covid-19 vaccine hesitancy among ethnic minority groups. *BMJ*, 372, n513.

Reddinger, J.L., Charness, G., and Levine, D. (2024). Vaccination as personal public-good provision. *Journal of Economic Behavior and Organization*, 224, 481-499.

Reichmuth, M.L., Heron, L., Riou, J., Moser, A., Hauser, A., Low, N., and Althaus, C.L. (2023). Socio-demographic characteristics associated with COVID-19 vaccination uptake in Switzerland: longitudinal analysis of the CoMix study. *BMC Public Health*, 23, 1523.

Rodríguez-Pose, A., and Di Cataldo, M. (2015). Quality of government and innovative performance in the regions of Europe. *Journal of Economic Geography*, 15(4), 673-706.

Rodríguez-Pose, A., and Zhang, M. (2019). Government institutions and the dynamics of urban growth in China. *Journal of Regional Science*, 59(4), 633-668.

Rose, R. (2006). Corruption is bad for your health: findings from Central and Eastern Europe. In: *Transparency International, Global Corruption Report 2006: Special focus on corruption and health*. London, Pluto Press, 39-43.

Sasse, T., and Hodgkin, R. (2022). *Coronavirus vaccine rollout.* https://www.instituteforgovernment.org.uk/explainers/coronavirus-vaccine-rollout

Seleim, A., and Bontis, N. (2009). The relationship between culture and corruption: A cross-national study. *Journal of Intellectual Capital*, 10(1), 165-184.

Sharot, T. (1986). Weighting Survey Results. Journal of Market Research Society, 28(3), 269-284.

Spreco, A., Schön, T., and Timpka, T. (2022). Corruption should be taken into account when considering COVID-19 vaccine allocation. *Proceedings of the National Academy of Sciences*, 119(19), e2122664119.

Story, W.T. (2014). Social capital and the utilization of maternal and child health services in India: A multilevel analysis. *Health & Place*, 28, 73-84.

Syed U., Kapera O., Chandrasekhar A., Baylor B.T., Hassan A., Magalhães M., Meidany F., Schenker I., Messiah S.E., Bhatti A. (2023). The Role of Faith-Based Organizations in Improving Vaccination Confidence & Addressing Vaccination Disparities to Help Improve Vaccine Uptake: A Systematic Review. Vaccines, 11(2), 449.

The Political Compass (2022). *UK Parties 2019 General Election*. https://www.politicalcompass.org/uk2019

Timofeyev, Y., and Jakovljevic, M. (2022). Editorial: Fraud and Corruption in Healthcare. *Frontiers in Public Health*, 10, 921254.

Troiano, G., and Nardi, A. (2021). Vaccine hesitancy in the era of COVID-19. *Public health*, 194, 245-251.

Transparency International (2021). *United Kingdom*. https://www.transparency.org/en/cpi/2021/index/gbr

UNODC (2020). *COVID-19 vaccines and corruption risks: preventing corruption in the manufacture, allocation and distribution of vaccines*. https://www.unodc.org/documents/corruption/COVID-19/Policy_paper_on_COVID-19_vaccines_and_corruption_risks.pdf

Usman, M., Husnain, M., Akhtar, M.W., Ali, Y., Riaz, A., and Riaz, A. (2022). From the COVID-19 pandemic to corrupt practices: a tale of two evils. *Environmental Science and Pollution Research*, 29(20), 30297-30310.

Vian, T. (2008). Review of corruption in the health sector: theory, methods and interventions, *Health Policy and Planning*, 23(2), 8394.

Vian, T., Grybosk, K., Sinoimeri, Z., and Hall, R. (2006). Informal payments in government health facilities in Albania: Results of a qualitative study. *Social Science & Medicine*, 62(4), 877-887.

Whitaker, R.G., Sperber, N., Baumgartner, M., Thiem, A., Cragun, D., Damschroder, L., Miech, E.J., Slade, A., and Birken, S. (2020). Coincidence analysis: a new method for causal inference in implementation science. *Implementation Science*, 15(1), 108.

Williams, C.C., Horodnic, I.A. (2020). Trends in the undeclared economy and policy approaches. In: Evidence from the 2007, 2013 and 2019 Eurobarometer Surveys. European Commission: Brussels, Belgium.

Wroe, A., Allen, N., and Birch, S. (2013). The role of political trust in conditioning perceptions of corruption. *European Political Science Review*, 5(2), 175-195.

Wu, J., Shen, Z., Li, Q., Tarimo, C. S., Wang, M., Gu, J., ... and Miao, Y. (2023). How urban versus rural residency relates to COVID-19 vaccine hesitancy: A large-scale national Chinese study. *Social Science & Medicine*, *320*, 115695.

Xenakis, S. (2010). Pride and prejudice: Comparative corruption research and the British case. *Crime, Law and Social Change*, 54, 39-61.

Yang, K., and Banamah, A. (2014). Quota Sampling as an Alternative to Probability Sampling? An Experimental Study. *Sociological Research Online*, 19(1), 29.

Yılmaz, Ş., & Özbek Güven, G. (2024). The relationship between nurses' moral courage and whistleblowing approaches. *Nursing Ethics*, 09697330241230686.

Yu Y., Lau M.M.C., Lau J.T. Positive (2021). Association between Individualism and Vaccination Resistance against COVID-19 Vaccination among Chinese Adults: Mediations via Perceived Personal and Societal Benefits. *Vaccines*, 9(11), 1225.

Appendix

Appendix A: Comparison of the unweighted and weighted descriptive statistics

Variable	non-weighted mean	weighted mean
gender (female=1)	0.512	0.515
age (years)	47.724	47.690
education (university degree=1)	0.503	0.311
ethnicity (BAME=1)	0.130	0.118

Note: n=1,598. Source: Own calculations.

Appendix B: Anticipated Effects of Control Variables

Dimension	Control Variable	Assumed Effects on Vaccination Hesitancy	Assumed Effects on Tolerance towards Corruptive Behaviour
Social Capital	Missing Relational Social Capital	Negative	Positive
	Structural Social Capital	Positive	Negative
Cultural Orientation	Power Distance	Negative	Positive
	Individualism	Negative	Positive
	Masculinity	Negative	Positive
	Uncertainty Avoidance	Negative	Positive
Political Ideology	Conservative Voting Intention	Varies	Varies
Degree of Urbanism	Predominantly Rural	Varies	Negative

Appendix C: Factor analysis: cognitive social capital

Factor	Eigenvalue	Difference	Proportion	Cumulative	Variable	Factor Loading	kmo	Scoring Coefficient
Factor 1	1.8240	1.4420	1.1283	1.1283	**FZB2_1**	0.4285	0.6741	0.1516
Factor 2	0.3820	0.4546	0.2363	1.3645	**FZB2_2**	0.6331	0.8035	0.2626
Factor 3	-0.0726	0.0635	-0.0449	1.3196	**FZB2_3**	0.5780	0.7171	0.2435
Factor 4	-0.13511	0.0287	-0.0836	1.2361	**FZB2_4**	0.5419	0.7736	0.2082
Factor 5	-0.1638	0.0541	-0.1013	1.1348	**FZB2_5**	0.5270	0.7934	0.1960
Factor 6	-0.2179		-0.1348	1.0000	**FZB2_6**	0.5779	0.8110	0.2216

Note: n=1,598; chi2=0.0000; FZB2_1: Trusting Family, FZB2_2: Trusting Neighbours, FZB2_3: Trusting Friends and Acquaintances, FZB2_4: Trusting New People, FZB2_5: Trusting Religious People; FZB2_6: Trusting Foreigners. Source: Own calculations.

Appendix D: Correlation analysis

	A	CV	FW	AMB	AIKB	ANF	MRC	SC	PD	I	M	UA	LCMC	CVI	PR
age (A)	1.000														
critical vulnerable (CV)	0.0335	1.000													
frontline worker (FW)	-0.1243**	-0.0168	1.000												
agreement with monetary bribery (AMB)	-0.4630***	0.1501***	0.1424**	1.000											
agreement with in-kind bribery (AIKB)	-0.4886***	0.0651	0.1383**	0.8042***	1.000										
agreement with nepotism/favouritism (ANF)	-0.4684***	0.1105**	0.1305**	0.6797***	0.6713***	1.000									
missing relational social capital (MCC)	-0.1485***	-0.0797	-0.0259	0.0422	0.1074*	0.1150**	1.000								
structural social capital (SC)	-0.2343***	0.1560***	0.0357	0.3370***	0.3182***	0.2010***	-0.1943***	1.000							
power distance (PD)	0.3096***	-0.1634***	-0.0324	-0.4116***	-0.3590***	-0.3468***	0.0729	-0.2740***	1.000						
individualism (I)	0.3805***	-0.1135**	-0.0784	-0.5122***	-0.5330***	-0.4602***	0.0274	-0.2567***	0.4983***	1.000					
masculinity (M)	-0.1148**	0.0120	-0.0146	0.1627***	0.1891***	0.2063***	0.0614	0.2280***	0.0403	0.0068	1.000				
uncertainty avoidance (UA)	0.4379***	-0.1122**	-0.0800	-0.4917***	-0.5095***	-0.4481***	-0.0456	-0.2603***	0.4581***	0.5854***	-0.0058	1.000			
local conservative majority/coalition (LCMC)	0.0179	0.0296	-0.0644	-0.1076*	-0.0665	-0.0430	0.0290	-0.0.922	0.1469***	0.1051*	0.0059	0.1094**	1.000		
conservative voting intention (CVI)	0.2261***	0.1018*	-0.0718	0.0299	-0.0397	-0.0619	-0.0831	0.0850	-0.1128**	-0.0232	-0.0232	0.2008***	0.1190**	1.000	
predominantly rural (PR)	0.1885***	0.0581	-0.1284**	-0.1376**	-0.1367**	-0.0978*	-0.0340	-0.0587	0.0254	0.1533*	0.0556	0.1142**	0.2121***	0.1442***	1.000

Note: ***Significant at 1% level ($p < 0.01$); **Significant at 5% level ($p < 0.05$), *Significant at 10% level ($p < 0.1$). Source: Own calculations based on GOV.UK (2021a). Coronavirus (COVID-19) in the UK.

Highlights

- Analyses corruption tolerance in the UK vaccination rollout at the local level.
- Tolerance accelerated rollout in conservative areas but slowed it in liberal ones.
- Conservative areas vaccinated overall population faster, vulnerable groups slower.
- Highlights interplay of politics, corruption tolerance, and rollout efficiency.
- Suggests trade-off between efficiency and equity in vaccination rollout.

Ethical Approval Statement

For this study, ethical approval was granted by the ethics committee of the University of Greenwich in 2021. Prior to engaging in the online survey, all participants provided informed consent, affirming their voluntary participation and understanding of the study's objectives and procedures.