Without Risk? A Social Analysis of the Vaccination Programme in England

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Abstract

In this chapter we examine the social forces shaping the design and delivery of the COVID-19 vaccination programme in England. Looking beyond direct inclusion or exclusion in policy decision-making, we view health and healthcare as an arena containing several powerful interest groups. Our approach considers the influences, interests and strategies that can work to reshape, constrain, challenge, or reject policy and policy decision-making – though we also consider if and how actors might collaborate or develop alliances and allegiances that support and facilitate policy. We analyse these dynamics in the context of the various dimensions of the COVID-19 vaccination programme in England (in relation to supply and manufacturing, regulation, prioritisation, vaccine nationalism and vaccine coverage). Overall, we argue that, though there were examples of actors working to challenge or reject policy and decision-making in the development and delivery of the vaccination programme, there were limited impacts on or resulting changes to policy – particularly where this was counter to the interests of government or the pharmaceutical industry. Additionally, groups have to a greater extent acted and collaborated in a manner that has been supportive and facilitative of policy.

Keywords: COVID-19 vaccines; pharmaceutical interventions; pharmaceutical industry; vaccine coverage; vaccine nationalism; health policy

Introduction

British scientists at the University of Oxford and counterparts globally began work on vaccine development for COVID-19 almost immediately after the virus came to the attention of the scientific community in January 2020 (Department of Health and Social Care (DHSC), 2021). Less than a year later, in December 2020, the government in England initiated its COVID-19 vaccination programme, with a 90-year-old woman at University Hospital in Coventry the first person not only in England but in the world to be given a COVID-19 vaccine outside of a clinical trial. By July 2021, every adult in England became eligible for at least the first COVID-19 vaccine dose. In this chapter we examine the social forces shaping the design and delivery of the vaccination programme in England. This chapter is rooted in documentary analysis of policy and official government documents, scientific publications and news media articles published primarily in 2020 and 2021. Humphreys and Lorne (2021, previous volume) analyse the failures of the non-pharmaceutical interventions adopted by the government in England prior to the availability of COVID-19 vaccines during the first year of the pandemic (see also Calnan and Douglass, 2022). As such, this chapter focuses on the vaccination programme and examines how it compares to the non-pharmaceutical policy failings identified by these authors.[1]

Influenced by the approach to the analysis of health policy established by Calnan (2020) we approach health and healthcare as an arena containing several powerful interest groups. Relevant actors include the government and scientific and medical experts, but also commercial actors, such as the pharmaceutical industry, as well as the public. Our approach looks beyond direct inclusion or exclusion in policy decision-making and considers influences, interests and strategies potentially shaping policy and policy outcomes. The theory of countervailing powers

[1] This chapter is comprised of revised and updated material that was first published in Calnan and Douglass (2022).

suggests that actors will exert pressure to influence, shape, constrain or reject policy decision-making, and as such, counter the power of a dominant actor or actors where it harms or contrasts with their interests, objectives, or values (Gabe et al. 2012; Light, 1995). Though we draw influence from this theoretical perspective, empirical evidence of countervailing impacts and effects has been shown to be limited, particularly where powerful commercial interests are present (Busfield, 2010; Gabe et al. 2012; see also Mulinari and Vilhelmsson, 2020: p329). As such we begin from the broader premise that groups (or subgroups) may, as the theory of countervailing powers suggests, act to reshape, constrain, challenge, or reject policy and policy decision-making, whilst also arguing that it is also analytically important to assess if and how groups cooperate, collaborate, or develop allegiances that support and facilitate policy. Our aim in this chapter is to analyse these dynamics in the context of the COVID-19 vaccination programme in England and examine the impacts on its design and delivery and successes and failings.

First, we discuss the supply side of the vaccination programme. In doing this we also outline the unique approach and relationships between actors established in the development and trialling of COVID-19 vaccines, particularly in terms of funding and accelerated regulatory review. Following this, we move to discuss the vaccination prioritisation order recommended by scientific experts and adopted by the government whilst also exploring challenges to and criticisms of the approach adopted. We also explore the presence of vaccine nationalism in the policy of government and the actors challenging it. In the final section of the chapter, we discuss vaccine coverage, vaccine hesitancy and socio-economic inequalities in vaccine take-up and analyse whether the public (or sections of the public) supported and facilitated or challenged and constrained the vaccination programme.

Vaccine Development and Supply

The Vaccine Taskforce (VTF) was established by the government in April 2020 to support COVID-19 vaccine research and manufacture. The VTF worked to serve the health, political and economic interests of government – with an effective vaccine saving lives, protecting the health service and allowing the loosening of restrictions on social life and the economy. The VTF was comprised of government representatives, academics and industrialists and worked primarily to secure COVID-19 vaccines for domestic use. The VTF secured agreements to purchase 367 million doses across six different vaccines representing four forms or types of vaccine technology by January 2021 (Bingham, 2021; DHSC, 2021a). As part of this, the government were the first in world to buy both the Pfizer/BioNTech and Oxford-AstraZeneca vaccines. By late July 2021, agreements had been secured for 527 million doses across eight different vaccines with four vaccines (Pfizer/BioNTech and Oxford-AstraZeneca, Moderna, and Janssen) approved for use by the regulatory authorities at the time of writing (BBC News, 2021a). In the early stages of vaccine development, it was also deemed necessary by the VTF to improve manufacturing capacity domestically to protect supply (in the event of export controls being established by other countries). Investment in manufacturing capacity also formed part of agreements with manufacturers to share the financial risk of manufacturing COVID-19 vaccines (which we explore further below).

Public money has funded much of the research underpinning the Oxford-AstraZeneca vaccine. Department of Health and Social Care (2021) documents shows that the government invested £120 million in the years between 2016 and 2021 into vaccine development. As part of this, The University of Oxford received £1.87 million to develop a vaccine for MERS (DHSC, 2021). Oxford were awarded further funding in February and April 2020 to repurpose their work on the MERS vaccine to combat COVID-19, which was achieved in only 65 days, and then to begin clinical trials. Funding of £20 million was provided to Oxford for these

development and clinical trials phases (House of Commons Health and Social Care and Science and Technology Committees, 2021, p. 109).

Cross et al. (2021) have traced the history of funding directly and indirectly contributing to the development of the Oxford-AstraZeneca vaccine. These authors have analysed research grants awarded to the University of Oxford and for research into the technology underpinning the vaccine since the year 2000. They identify that 97% of the funding for the vaccine both before and during the pandemic came from government or charitable sources totalling hundreds of millions of pounds. Most of the funding was provided by the British and American governments, the Wellcome Trust, the European Commission, and various scientific institutes. In comparison, less than 2% of the funding directly or indirectly contributing to the development of the Oxford-AstraZeneca vaccine was provided by the pharmaceutical industry. Similarly, Pfizer- BioNTech and Moderna received significant amounts of public money to develop vaccines. Moderna received £345 million from the German government and the US government almost completely funded the Pfizer-BioNTech vaccine (with the US government contributing $18 billion towards the more general development and manufacturing of COVID-19 vaccines through Operation Warp Speed) (Ramachandran, Dhodapkar, Ross, & Schwartz, 2021).

When negotiating contracts for supply of COVID-19 vaccines with manufacturers, the government uniquely provided funding ‘at risk’ for the development and manufacture of COVID-19 vaccines (DHSC, 2021). This means that government funding has paid not only for much of the research and testing of vaccines, and been used to scale up manufacturing capacity, but also, as part of purchase agreements with companies, government funding has been used to absorb the manufacturing risk. Continued funding for vaccine development was linked to clinical and regulatory milestones. However, as Kate Bingham (the first chair of the VTF) noted, funding was provided in unprecedented and risky ways compared to the standard model

of vaccine development and prior to confirmation by the independent regulator that the vaccines would be safe and hold efficacy (Bingham, 2021) (see below for discussion of regulation).

Despite the research shaping COVID-19 vaccine development mostly taking place at universities and funded by public money, and the at-risk public funding provided to manufacture vaccines (that may not have proven ultimately to be safe or hold efficacy, see next section), the pharmaceutical industry argues that ownership rights and profit generation are key drivers of innovation (Safi, 2021). Pfizer and Moderna (though charging countries slightly different amounts per dose depending on contract) have and will make vast profits from the sale of COVID-19 vaccines during a global emergency. In the first quarter of 2021 alone, for example, Pfizer made hundreds of millions in profit (Hassan, Yamey, & Abbasi, 2021). Pharmaceutical companies have resisted attempts (e.g. the WHO's COVID-19 Technology Access Pool) to encourage the waiving of intellectual property rights and the sharing of vaccine technology so that it can be produced cheaply and more quickly (which would particularly be to the benefit of low-and middle-income countries but against commercial interests) (Ramachandran et al., 2021). Access to vaccines has clearly been based on power and ability to pay (Hassan et al., 2021), although COXAX (an initiative co-led by the WHO, Gavi and the Coalition for Epidemic Preparedness) through its advanced market commitment, funded by philanthropy and Official Development Assistance, did with some success help the poorest 92 countries in the world access COVID-19 vaccines.

It is true that AstraZeneca have provided vaccines at cost or no profit during the pandemic. The government has said that this will be the case for low-and middle-income countries in perpetuity because of the nature of government funding and involvement in the development and manufacturing of this vaccine (DHSC, 2021). However, the company itself also said that it would define when it believes the emergency is over. Indeed, in November

2021, AstraZeneca declared that it would begin to move away from providing vaccines on a not-for-profit basis (Espiner, 2021). AstraZeneca also own exclusive rights to the vaccine. Despite hope that because of the public funding used to develop the Oxford-AstraZeneca vaccine the technology would be made open source (again, particularly to the benefit of low-and-middle-income countries) this has not happened (Hassan et al., 2021). It is important to note that before the exclusive licensing agreement established with AstraZeneca, as McDonagh (2021) discusses, there was an opportunity to openly license the intellectual property and share knowledge about production processes so that it could be produced by a range of manufacturers. The exclusive license, which the government could have reshaped or challenged because of the funding it provided and used in the development and manufacture of the Oxford-AstraZeneca vaccine, has meant that the technology and knowledge cannot be openly shared – to the commercial benefit of AstraZeneca. Prime Minister Boris Johnson declared in March 2021 that the success of vaccine development was because of 'greed' and because of 'capitalism' (Allegretti & Elgot, 2021) suggesting continuity between the ideological position of his government and the commercial interests of the pharmaceutical industry.

Regulating COVID-19 Vaccines

When developing a new vaccine, the process has traditionally involved several distinct stages of pre-clinical and clinical trials with all data confirming safety, efficacy and quality submitted for regulatory review at the end of the process (see Calnan & Douglass, 2020). The regulation of COVID-19 vaccines has, however, differed from the standard model. The VTF, manufacturers and regulators have worked together so that the timeline for review could be expedited and phase I–III trials have overlapped. The Medicines and Healthcare products Regulatory Agency (MHRA), the UK's regulator of pharmaceuticals, vaccines, and other

medical technology, has reviewed trial data on a rolling basis rather than receiving all the data at the end of the three phases of trials as would normally occur (DHSC, 2021). In an unprecedented manner when compared with the standard model of vaccine development, Phase III trials were still ongoing, and the MHRA were still examining data about safety and efficacy whilst manufacturing of vaccines was already taking place so that the vaccination programme could begin as soon as the MHRA gave approval.

Some members of the medical scientific community, such as Tanveer, Rowhani-Farid, Hong, Jefferson, and Doshi (2021), have, however, been concerned that placebo-controlled trial follow-up for COVID-19 vaccines were abandoned after only a few months despite follow-up being initially planned for two years in most trials. The medical scientific community and The International Coalition of Medicines Regulatory Authorities, which includes the MHRA, argued during the development stage of the first vaccines that a follow-up period for both treatment and placebo arms of the trials should last for a duration of at least one year after participants received two doses. However, when initial authorisations were given by medicines regulators, manufacturers began to offer trial participants who were in the placebo arm of the study vaccination because there were concerns that it was unethical not to do so and trials were not redesigned to manage this issue. There were calls to redesign trials into crossover studies from the medical scientific community, but manufacturers challenged the feasibility, and unblinding of participants occurred (Doshi, 2021). However, it is also true that this allowed the process to be considerably accelerated, people to be vaccinated and, as such, lives saved, whilst also generating an unprecedented volume of real-world data due to the scale of vaccinations necessary.

The WHO Ad Hoc Expert Group on the Next Steps for COVID-19 Vaccine Evaluation (2021) have stated that follow-up to placebo-controlled phase trials is necessary because they lead to the most robust evidence to inform regulatory activity. However, this might have slowed

down initial regulatory authorisations (and thus the need for continued non-pharmaceutical policies) contrary to the economic and political interests of government and the commercial interests of the pharmaceutical industry. The premature unblinding of COVID-19 trial participants also means a lack of robust evidence about duration of protection that would conceivably have facilitated more effective and precise planning around the necessity and timing of booster and recurrent vaccination programmes which could harm public health. There were also concerns this might lead to vaccine hesitancy but there is limited evidence to support this.

Prioritisation Order

Before the NHS could begin delivering vaccines to the public, it was necessary in a context of limited supply and capacity to decide in what order people should be vaccinated. The Joint Committee on Vaccination and Immunisation (JCVI) an independent group of scientific experts, advised the government to prioritise people in phase I of the vaccine rollout in terms of age-based risk with health and social care professionals also prioritised to enable the continued functioning of the health systems (JCVI, 2021a). There were nine priority groups, and a primarily age-based strategy was adopted because it was argued that this would result in the fastest and greatest uptake by those at the highest risk from COVID-19.

The JCVI's age-based recommendations contrasted with interpretations and analysis from some other sections of the medical profession and wider medical science community who argued that ethnic minority groups should have been given priority status even in phase I. This was because, it was argued, evidence indicated that in England black people were four times more likely to die and Asian people three times more likely than white people to die from COVID-19 (Osama, Razai, & Majeed, 2021). This was argued to reflect socio-economic factors and the social determinants of health which were aspects that had been dismissed by

the JCVI. The type of work often done by people from these groups is in key worker and high-exposure occupations, and they also experience higher levels of deprivation and increased likelihood of comorbidities (see Hanif, Ali, Patel, & Khunti, 2020). In this regard, it was argued that the 'colour blind' COVID-19 vaccine prioritisation strategy was putting ethnic minorities at higher risk of serious illness and death (Osama et al., 2021)[2], although these arguments were ignored by the government and the JCVI as they emphasised that relative risk was higher with age.

The government aimed to offer the first of two initial COVID-19 vaccinations to individuals in the priority groups by 15 April, which the government stated they had achieved (BBC News, 2021b). Following the offer of the first dose of vaccine to the priority groups, phase II of the vaccination programme began. The aim of phase II was to offer the first dose of vaccine to all remaining 18 million adults by 31 July 2021. This was stated by the government to have been achieved in advance of the 19 July, or 'Freedom Day', when all social distancing restrictions were lifted in England (Shearing & Turner, 2021; see Calnan and Douglass, 2022).

In August 2021, the JCVI controversially recommended that COVID-19 vaccines should not be given to children aged 12–15 without underlying health conditions. Despite the approval by the MHRA for the use of the Pfizer and Moderna vaccines in children of this age, a precautionary approach was recommended by the JCVI due to the very low risk of serious disease and thus, at best marginal benefit when weighed against potential harms (JCVI, 2021c). Government ministers, however, believed vaccinating healthy children in this age group would be beneficial whilst demonstrating how they were acting to protect public health and combat the virus. As such, the Chief Medical Officer was asked to consider the wider utility of vaccinating this group including in terms of the spread of the virus (Iacobucci, 2021a). Vaccinating children aged 12-15 universally was ultimately the approach adopted based on the

[2] Ethnic minorities have, however, also displayed higher levels of vaccine hesitancy (see below).

alternative recommendations of the Chief Medical Officer rather than the vaccination experts on the JCVI.

The JCVI (see JCVI, 2021d) recommended that individuals in the nine priority groups should receive a third booster dose beginning in late September 2021 to protect the most vulnerable against serious disease, hospitalisation, and death from COVID-19. This reflected growing scientific understanding that the protection provided by the first two vaccinations began to wane after several months. The booster programme was incorporated within the government's Autumn and Winter Plan for 2021 (HM Government, 2021). Unlike the recommendation not to universally vaccinate 12–15-year-old children at a similar time, the government accepted the advice of the JCVI. This again indicates the emphasis and importance placed by the government on vaccination. The JCVI stated that this approach would ensure high levels of protection through the winter months in the most vulnerable. The third vaccination was to occur at least six months after the initial two vaccinations (later changed to three months). It was recommended that the original nine priority groups most vulnerable to serious outcomes from COVID-19 should be offered this third booster dose to maximise protection before the winter months (JCVI, 2021b). Towards the end of 2021 as the Omicron variant of the virus spread globally, the JCVI altered its recommendations, and the government subsequently revised its approach and committed to offering a booster vaccine to all adults.

Vaccine Nationalism

Along with other high-income countries, vaccine nationalism was adopted by Boris Johnson's government in its policy. The government signed agreements to prioritise the vaccination of people domestically. The WHO (and other charitable and non-profit organisations such as Oxfam, the Wellcome Trust, and the RAND Corporation) called on countries to share vaccine supplies after vaccinating their most vulnerable people and health and social care staff (Eaton,

2021). As well as being argued to be an ethical necessity, this was also claimed to be in the interest of wealthier countries because of the potential emergence of a virus variant resistant to vaccines the longer it circulates anywhere in the world.

Despite the efforts of the supranational organisations and charitable organisations discussed, the government prioritised vaccinating its own people to advance its own economic and political interests. At home, at the beginning of 2021 as vaccines were achieving regulatory approval, the government were eager to distract from criticism of the earlier non-pharmaceutical policy and a growing death toll (Hurley, 2021). Success domestically in the vaccination programme was highly important and the government, supported particularly by right-wing news media, consistently emphasised the successes of the vaccination programme (see Matthews, 2021). In contrast to the successes described in the previous section domestically in rolling out the vaccination programme domestically, 130 countries had not received a single dose by the spring of 2021 (Limb, 2021) meaning that their most vulnerable people and their health and social care workers were left unprotected. Only 2% of the population of the least wealthy 50 nations (who comprise 20% of the planet's population) by August 2021 had been fully vaccinated (Hassan et al., 2021). In England, the government ultimately offered every adult, including those at very low risk of severe COVID-19 outcomes, two vaccinations (and ultimately offered a third to the most vulnerable) domestically before it committed to sharing surplus vaccines in September 2021. Though the government had contributed £548 million by the beginning of 2021 to COVAX, providing funding could only ever be of limited importance in a context of limited supply. In this regard, the hoarding of vaccines domestically (and by wealthy countries generally), in combination with a profit driven approach and protection for intellectual property rights (leading to substantial profits for pharmaceutical companies), has been argued to have created 'vaccine apartheid'. This and the underpinning policy approach of vaccine nationalism was challenged by some sections of the

medical community, including in leading medical journal *the BMJ* (see Godlee, 2021b) but again to little demonstrable impact.

Vaccine Coverage

If substantial numbers of the public had rejected the offer of COVID-19 vaccination, the vaccination programme would have been unsuccessful and the political and economic interests of the government harmed. Data suggests that the government built considerable public trust in the vaccines and health authorities. In late-September it was estimated that only around five million people over the age of 16 (circa 11% of the population) were yet to receive a COVID-19 vaccine (Collinson, 2021). Data relating to the booster programme suggests that by the beginning of 2022 every adult had been offered the chance to receive a booster vaccination. In total, three in four adults had taken up this offer (DHSC, 2022). It has been estimated that the vaccination programme, by late June 2021, had prevented more than 27,000 deaths, more than 46,000 hospitalisations in people over 65, and over 7 million infections (PHE, 2021). Later analysis published in August 2021 suggested that, by this point, more than 84,000 deaths and 23 million infections had been prevented by the vaccination programme in England (Mahase, 2021). However, over the summer months of 2021 the vaccination programme did slow down. Despite the strong start and progress made in the early months of the vaccination programme and the achievements in protecting the most domestically vulnerable, England fell behind a number of other European countries (such as Malta, Portugal, Spain, Belgium, and Ireland) in terms of numbers of people double vaccinated (Henley, 2021). This reflected low take-up particularly amongst younger people. This was despite the fact that, as Davies (2021) shows, vaccine producing countries in the EU exported around a third of the doses they produced internationally – with the four UK countries the largest recipients. Displaying similar vaccine nationalism to that displayed by Boris Johnson's government would have undoubtedly

improved their own vaccination rollout and constrained the vaccination programme in England. Whilst the Conservative government emphasised nationalistically their vaccination triumphs, he EU, however, had accepted the need to contribute to global vaccine supply (Davies, 2021).

Research has shown that reasons for COVID-19 vaccine hesitancy include side effects and unknown future effects of the vaccine, that the vaccines are not effective, limitations in the supply of vaccines and the perception that other people need the vaccine more, perceptions that chances of catching the virus and becoming seriously unwell are low, that the impacts of COVID-19 have been exaggerated, and that herd immunity would offer protection without the vaccine (Robertson et al., 2021). Exposure to misinformation or disinformation, for example as produced and shared by anti-vaccination activists on social media, is an important factor that may relate to or induce COVID-19 vaccine hesitancy or rejection (Loomba, de Figueiredo, Piatek, de Graaf, & Larson, 2021) and, in this regard, had the potential to damage the government's vaccination programme. Beyond social media, anti-vaccination activists have also arranged protests at news media organisations (who were seen as promoting vaccine passports, see below) (Waterson, 2021) and stormed the headquarters of the MHRA when it was announced that the vaccination programme would be extended to include children (Quinn, 2021). Overall, though there have been persistent protests by a minority, considering the high levels of vaccine take-up, vaccine hesitancy and the influence of anti-vaccination activists has, however, been limited reach and impact.

It is also important to focus on any differences in vaccine take-up between social groups because inequalities in protection against COVID-19 can be argued to represent a failing of the vaccination programme and resistance and challenge to government policy and power by sections of the public. On the 19 July 2021, or Freedom Day, when all adults had been offered the first dose, 35% of 18–30-year-olds were unvaccinated. In comparison, 93% of those aged over 70 in England had received their first dose by 15 March, and by nine May 96% of those

in this age group who had received this first dose also received their second dose (ONS, 2021a). The risk of serious illness or death from COVID-19 increases with age. Robertson et al. (2021) in longitudinal survey research conducted before the start of the vaccination programme connected increased age (and higher risk of death from COVID-19) with lower levels of vaccine hesitancy. This suggests that one salient factor in a high proportion of young adults not taking up the offer of a vaccine by 19 July is perception of age-related risk.

There has also been lower take-up of vaccines by ethnic minority groups. ONS (2021) data suggest that in spring 2021 between 21% and 30% of black or black British adults were vaccine hesitant. Analysis of vaccine coverage data later suggested that, across those aged 50 and over, black and black British people were the least likely to have been vaccinated (OpenSAFELY, 2021). Vaccine hesitancy amongst black people (and other ethnic minority groups) reflects a web of factors. A lack of trust in both vaccines and health authorities exist because of discrimination and systemic racism, negative past experiences in a culturally hostile health system, unethical research historically in black populations and the under-representation of ethnic minorities in vaccine and wider health research (Razai, Osama, McKechnie, & Majeed, 2021). The evidence indicates that the government has been unable to overcome these perspectives and effectively build trust in black and ethnic minority populations.

Moreover, there have been regional differences in vaccine coverage across England. Government data from shortly before Freedom Day (when every adult was eligible had become eligible for at least the first dose) show that London had significantly lower percentages of people who had been vaccinated than other regions (see BBC News, 2021a). Only 65% had received the first dose and 47% the second dose. The South West of England had rates of 84% and 67% for first and second dose. The West Midlands had the second worst rates of vaccination coverage but had still much higher levels than London. 78% had received their first dose and 62% both doses. Survey research indicates that vaccine hesitancy is higher in deprived

areas with as many as 10% of adults from deprived areas reporting vaccine hesitancy compared with 3% in the least deprived areas (ONS, 2021). Importantly, in vaccine coverage data available up Freedom Day the most deprived areas had lower rates of vaccine coverage than the least deprived areas in all age groups comprising the nine vaccine priority groups said to be most at risk from COVID-19 (OpenSAFELY, 2021). Lower levels or slower take-up of vaccination in deprived areas can be argued to reflect a lack of trust in vaccines and health authorities along with high levels of belief in misinformation about the safety and regulation of the vaccine.

Discussion

Influenced by Calnan's (2020) approach to the analysis of health policy analysis and incorporating the theory of countervailing powers into our approach (see Gabe et al. 2012), we began from the premise that groups (or subgroups) might work to reshape, constrain, challenge, or reject policy and policy decision-making, or potentially collaborate or develop alliances and allegiances that create, support, and facilitate policy. Overall, though there were certainly examples of actors working to constrain, challenge, or reject policy and policy decision-making in the development and delivery of the vaccination programme there were limited impacts on or changes to policy. Additionally, groups have to a greater extent acted and collaborated in a manner that has been supportive and facilitative of policy. In this regard, as exemplified by high levels of vaccine coverage, compared to the non-pharmaceutical policy established in response to the pandemic by the government in the first year, which was widely criticised (see Humphreys and Lorne, 2021; see also Calnan and Douglass, 2022) the vaccination programme, has been much more successful (though not without its own tensions and issues).

We have demonstrated the unique approach to and relationships between the government, regulators, the pharmaceutical industry, and scientists underpinning the development, manufacture, and regulation of COVID-19 vaccines. The government has played a substantial role both in the development of COVID-19 vaccines, particularly the Oxford-AstraZeneca vaccine, through provision of funding both for research and for manufacturing despite the chance vaccine candidates may not have ultimately proven safe or to hold efficacy. It is true that the pharmaceutical industry exerted its substantial power, influence, and the need for its manufacturing expertise and capacity to agree favourable terms with the government particularly in terms of establishing a financially de-risked role in development and manufacturing. However, the government and the pharmaceutical industry's interests and objectives aligned in the development and manufacture of a safe and effective vaccine and the pharmaceutical industry certainly facilitated the government's vaccination programme. The interests of both have been served and neither can be said to have constrained the interests or power of the other. The financial risk of development and manufacturing was substantially greater for the government than for the pharmaceutical industry. However, the crisis circumstances meant that the government was willing to accept the risk to protect public health and the economy, and it ultimately served the government's objectives and interests as intended as well as leading to financial and reputational gains for pharmaceutical companies (see Calnan and Douglass, 2020).[3] The MHRA worked to facilitate the speedy development and deployment of the vaccines taking an expedited and flexible approach. There were concerns about the unblinding of participants in clinical trials, but the MHRA did not act in a way that can be said to have constrained the vaccination programme or countered or challenged the interests or power of the government or pharmaceutical industry.

[3] It is perhaps ideologically unsurprising that the right wing, libertarian Conservative government worked successfully with the pharmaceutical industry, but comparatively struggled with the social model of health underpinning non-pharmaceutical interventions in place during the earlier stages of the pandemic. This social model was nevertheless much more successful in New Zealand and in Asia.

Medical scientific experts have held a central role in developing and analysing the prioritisation order the government and NHS should follow when offering vaccines to the public in a context of limited resources and capacity. However, where voices have been critical and dissenting from the medical scientific community and medical profession, they have had a largely negligible impact on policy (for example, calls for ethnic minorities to be prioritised for vaccination were ignored). This said, the government has largely followed the advice of its own scientific experts on the JCVI throughout much of the vaccination programme. However, in the case of the booster programme, advice offered by the JCVI was ignored when it demonstrably did not align with the government's own preferences to vaccinate children. Meanwhile there were moral and economic arguments made by intergovernmental, charitable organisations and sections of the medical science community about vaccine supply and technology sharing. Again, this was ignored, and the government was able to prioritise its own interests in vaccinating the domestic population.

Vaccine coverage is a central issue in terms of controlling the pandemic and in evaluating the associated success of the vaccination programme (though we do not know how many people require vaccination to prevent the virus spreading and it seems that COVID-19 may become endemic regardless of the level of vaccine coverage achieved). Though a proportion of people from specific socio-economic groups are vaccine hesitant or have rejected COVID-19 vaccines, and the government has struggled to build trust in the vaccines in ethnic minority communities, millions of people have been vaccinated three times totalling more than 75% of the population (with the booster programme continuing at the time of writing). Vaccine hesitancy or rejection, particularly if these phenomena had occurred on a more substantial level, would have had constraining effects on the success of policy and undermined the government's attempt to control the pandemic. However, high levels of vaccine take-up suggest that most of the public trust COVID-19 vaccines and the actors associated with the vaccination programme.

This has meant that government has been able to remove all restrictions on social and economic life (including mandating masks in public spaces). Importantly, there is no sense in the early spring of 2022 that COVID-19 restrictions will again be necessary (though time will tell) indicating a high level of confidence by both the government and public in COVID-19 vaccination.

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