ROYAL STATISTICAL SOCIETY

DATA | EVIDENCE | DECISIONS

ROYAL STATISTICAL SOCIETY RESPONSE TO PAC INQUIRY INTO INITIAL LESSONS FROM THE GOVERNMENT'S RESPONSE TO THE COVID-19 PANDEMIC

03 June 2021

Introduction

The Royal Statistical Society (RSS) is an academic, professional and membership organisation for statisticians and data scientists. Part of our role is to promote the proper use of data and evidence in decision-making.

The pandemic has highlighted the power of data and statistics both to understand and model the pandemic and evaluate the government response to it. This has been especially prominent in public-facing government communications – as statistics such as numbers of positive tests, of people vaccinated, and estimated reduction in symptomatic disease, hospitalisation and death have become part of public discourse – but statisticians and data scientists have also played a vital role behind the scenes tracking the spread of the virus, modelling and evaluating the effectiveness of various interventions.

At the start of 2021 we published a Covid Lessons Learned Memo, which highlights what we take to be the key lessons from a statistical perspective. Our response highlights the general statistical lessons that we think are applicable to the remit of the Public Accounts Committee, and draws on the National Audit Office's initial learning report to detail some ways in which data and statistics could be more effectively used to deliver more efficient public services.

There are three main lessons that we think are especially relevant in the context of this inquiry:

1. Invest in data and statistical infrastructure.
2. Data and statistics cited as evidence to support a decision must be published.
3. Evaluation should be at the heart of policy.

Our submission explains why we have drawn these conclusions and makes a series of recommendations, which are summarised at the end of the document.

Lesson 1: Invest in data and statistical infrastructure

1.1. The NAO report correctly emphasises the importance of high-quality data for enabling effective service delivery. Throughout the pandemic – faced with a variety of formidable challenges – the Government Statistical Service (GSS), the UK Statistics Authority (UKSA), Public Health England (PHE) and the Joint Biosecurity Centre have devoted a great deal of energy to adapting existing systems, introducing new systems to rapidly improve data infrastructure and producing new series of informative and detailed reports.

1.2. By the end of March 2021, the NAO's report estimated the lifetime cost of measures announced as part of the government's response to the pandemic to be £372 billion (p.9). Despite the fundamental role played by study-design, data-acquisition and analysis in this pandemic, we do not know what fraction has been spent on collecting data and designing policy evaluations to guide more effective disease surveillance strategies. Such information would reveal if the importance of rigorous data collection and state-of-the-art statistical infrastructure has been truly addressed.

1.3. It is clear that there were many instances – and the NAO reports identify a number of these – which suggest that the government's data and statistical infrastructure was not prepared to deal with the challenge of managing this type of pandemic. We are aware of a number of deep structural issues affecting health and social care data in particular:

1.3.1. In England, NHS England and its data collection function have been fragmented into multiple agencies. The Office for Statistics Regulation (OSR) published a systemic review of health and social care statistics in England in 2015 and concluded that "there was no single individual or organisation with clear leadership responsibility and this had led to problems with the coherence and accessibility of these statistics". While some progress has been made it is still the case that data collection is fragmented across multiple agencies.

1.3.2. As highlighted in the Office for Statistics Regulation (OSR) report into Adult Social Care Statistics in England (January 2020) there was an absence of adequate statistics and data around social care at the start of the pandemic. Several government departments are involved – DHSC is responsible for policy, MHCLG has oversight of the local authorities who hold most of the relevant data and DWP manages associated welfare payments. Data about the system is fragmented, and there is a resulting lack of well-marshalled data to help evaluate the outcome of policy interventions.

1.3.3. Because health and social care data in the UK is devolved and a variety of organisations produce data – each of the four nations of the UK has data collection split between its government, NHS, civil registration agency and public health body – coherent UK-wide data requires a level of collaboration and communication which is difficult at the best of times, and harder still in the pressure of a pandemic.

1.3.4. There was a lack of local level data at the start of the pandemic – and this would have had great value. Certainly in England, data infrastructure seems geared towards providing national-level data without providing local-level data that is helpful to local public health officials. While local data has improved over the past year, there remain issues – eg, there were recently reports that a software error meant that information around 700 people infected with the new delta variant first discovered in India (B.1.617.2) was not passed on to Blackburn with Darwen's local health team.

1.3.5. Because of this fragmentation in England, statisticians and data analysts were spread throughout the health and social care system and, before the pandemic, there was a shortage of statisticians centrally in the Department for Health and Social Care (DHSC), where they were needed to pull together data from this disparate array of sources. Since it was established in 2020, the Joint Biosecurity Centre has centralised a large group of data scientists, but this had to be done at a fast pace – which increases the challenge of ensuring that the newly developing data infrastructure, data flows and data analytics is operationally fit for purpose, and will transition in a coherent way into a well-resourced, integrated and agile architecture of data acquisition, data governance and data analytics in the newly established UK Health Security Agency.

1.3.6. The situation has been better in Scotland, where the vast majority of health statistics relating to COVID-19 are produced by Public Health Scotland (formerly ISD (Information Services Division) Scotland and Health Protection Scotland).

1.4. Against this background, government statisticians, analysts and modellers performed well over the past year. However, their ability to support the pandemic response has clearly been hampered by a lack of investment and forward-planning in the UK's data infrastructure. While the situation is particularly marked in the case of health and social care statistics, the general problem – inadequate linkage between organisations and departments and a variety of different processes in place across the four nations, as well as among the local authorities within them – is wider, as is seen in the NAO's accounts of the difficulties faced by MHCLG in pulling together data from local authorities.

1.5. In 2016, the Bean Review of economic statistics recommended that the Office for National Statistics (ONS) should "move away from focusing largely on the production of statistics and become more of a service provider, helping users answer their questions about the economy" (p.10). While this review focused on economic statistics, many of its findings could equally have been applied to health statistics. We believe that a similar review into health and social care statistics, building on the OSR's review of English health data, is essential and urgent.

1.6. These issue link to a separate lesson that we highlight in our Lessons Learned Memo: health data is incomplete without social care data. A health data system without good social care data is inadequate, and will lead to poor decisions being made and lives lost. Throughout the Covid pandemic, there has been a lack of data regarding the situation in care homes in England. We do not know how many care home residents there are, there has been no data on the extent of testing in care homes and – although there have been claims that the targets for

vaccinations in care homes has been met – this has not been substantiated with data. As pointed out above the picture is complicated so it is understandably difficult to collect data. However, Public Health Scotland has shown that it is possible to do more than has been done in England.

Recommendation 1: *Public health data should be regarded as critical national infrastructure and supported by the required investment.*

Recommendation 2: *A review of health data should be conducted covering (i) the systems and organisational structures for gathering and publishing health and demographic data; (ii) levels of investment; (iii) how to join up data across nations and organisations; (iv) how to make sure that data at different level of geographical granularity from local to national are available to all the health partners; and, (v) how the infrastructure is aligned with the data analysis.*

Recommendation 3: *Improving social care data should be a central part of any review of the UK's health data as a whole.*

Lesson 2: Data and statistics cited as evidence to support a decision must be published

2.1. The NAO report says "Effective communication and public engagement are crucial to ensuring that COVID-19 response programmes succeed. Effective communication helps achieve policy objectives and strengthens public trust by helping the public understand what the government is doing, why, and what it means for them and their communities" (p18).

2.2. This is a crucial point – and there is an important statistical element. Throughout the pandemic, the government has been asking the public to make substantial sacrifices with reference to statistics, data and modelling. A key element of communicating evidence-based decisions effectively is being transparent about data, assumptions and uncertainty.[1] There have been several occasions throughout the pandemic where the government has fallen short of this standard:

2.2.1. At the start of the pandemic, too much prominence was given to daily figures which were artificially high or low on different days of the week and were either out of date – in the case of deaths – or biased by variable testing effort – in the case of incidence rates. There was little to no effort made in government communication to explain the uncertainties in this information or to be transparent around what information was missing from the figures.

2.2.2. Until 11 May 2020, the government was insistent that face masks were ineffective for stopping the spread of the virus. In truth, masks were thought likely to be effective but there was some uncertainty about how effective they would be. This is an area where the evidence has strengthened throughout the epidemic, but government advice did not respond in a timely manner: it is notable that the Royal Society's advice on mask-wearing was presented to SAGE in April 2020 but did not become policy until 14 July. By not being transparent about the evolving strength of evidence around face masks and expressing false confidence at an early stage that they were ineffective, the government made it harder at a later stage to persuade people who were reluctant to wear face masks.

2.2.3. It was only on 26 November that the government explained which data would be considered when allocating local regions of England to a specific tier – months after the tiering system was introduced. The lack of a clear data-informed framework for assigning regions to tiers led to engagements with local decision-makers (notably in the case of Manchester) becoming more politicised than necessary,

[1] This has been set out in detail by the co-chair of the RSS Covid-19 Task Force, David Spiegelhalter, and colleagues in an article for Nature, Five rules for evidence communication.

dramatically reducing trust – to the extent that it is now difficult to reintroduce local restrictions to help manage new variants.

2.2.4. When making the case for a second lockdown, a slide showing projections of deaths from different models was not only based on reports by SPI-M that were not available on October 31, but also used working analyses and scenarios dating from the week beginning October 9th without explaining their context and intended purpose. This was especially problematic since more recent data-driven forecasts were available at the time to describe the upward trend supporting the decision of a second lockdown. This misleading presentation of modelling results was repeated in the briefing pack given to MPs ahead of the vote on new regulations on 4 November. By presenting the results in this way, the government left room for people who were sceptical of a second lockdown to – justifiably – criticise the models that were claimed to be informing its decision. This problem was recognised by Number 10 and led to the creation of a Public Data Advisory Committee – an expert group composed of statisticians from ONS and the RSS, which reviews the presentations at press conferences.

2.2.5. When introducing the roadmap out of lockdown, the government introduced four tests: one of these was that "our assessment of the risks is not fundamentally changed by new Variants of Concern". However no criteria for passing this test – even what data would be considered in assessing it – was ever set out. So, when we moved to stage three of the roadmap on May 17, it was without the assurance of any evidence being presented to show that the delta variant did not change the assessment of the risks. The public had no way of judging whether the policy change was justified.

2.2.6. A similar issue is already emerging with the plan to remove all restrictions on June 21: on 27 May the Prime Minister said "I don't see anything currently in the data to suggest that we have to deviate from the roadmap". There should be clear sign posting what information is being looked for in the data – eg, are thresholds which, if crossed would cause a delay to the roadmap? – to guide these decisions.

2.3. Public confidence is ultimately built on trust – and for the public to trust government communication of statistics, government spokespeople must demonstrate trustworthiness. Key to this is that when the government announces new or changing rules, it should present information that is intended to inform rather than to persuade. This means, among other things:

2.3.1. Publishing all relevant data whenever a decision is made, clearly signposting this to the public and enabling people to explore it for themselves.

2.3.2. Being transparent in presenting the balance of evidence and, crucially, avoiding partial presentation of evidence.

2.3.3. Being clear on the quality of evidence supporting a decision and open about its associated uncertainty.

2.4. The model of communication that Lord Krebs adopted when appointed as head of the Food Standards Agency was: say what you know; what you don't know; what you are doing to find out; what people can do in the meantime to be on the safe side; and that advice will change. Combined with publishing all the data and models that have been produced to enable government decision-making, this forms a sound basis for clearly and transparently communicating information in a manner that is likely to build trust.

2.5. Communicating in this way is difficult and requires a detailed understanding of the evidence and well-informed confidence in responding to questioning. It is difficult to expect politicians to be able to do this. We recommend that a mechanism is introduced to ensure independent and non-political communication of data – such as a weekly briefing to journalists by the national statistician, chief medical officer or chief scientific officer or their colleagues.

2.6. The situation would also be improved by greater statistical literacy among politicians and journalists. For politicians, statistical literacy is important because it helps them to understand and interpret the advice they are given. An understanding of how mathematical and statistical models are generated, what is the difference between a random sample and observational data, what is meant by underlying prevalence, and how uncertainty is measured are important first steps before political judgement can be applied and decisions made. And it is essential in enabling politicians to communicate a public health message clearly and confidently – especially when risk and uncertainty are at the heart of the message.

2.7. Statistically literate journalists have played an important role in the pandemic, helped hugely by the Science Media Centre. A number of RSS Fellows have engaged regularly and successfully with journalists, helping them to understand the data well enough to offer accurate explanations to the public. Specialist journalists – health or science and technology correspondents – have been generally very good at reporting data accurately, including graphically and helping to communicate issues clearly to the public.

2.8. Political journalists, who tended to be the ones invited to ask questions at the daily briefings, often did not ask the sort of question about data that could have been helpful (though the format of the briefings did not really lend itself to that in any case). This is perhaps in part because they are less comfortable in quickly identifying issues in the presentation of data but may also have been because they were more interested in political issues. For example, in the early stages of the pandemic the death figures that were being reported in the daily briefings were actually the number of deaths reported on a given day in a hospital setting. It would have been beneficial to have this clearly brought out through questioning.

2.9. Improving statistical literacy is fundamentally an educational issue. Statistics impacts on almost every subject and we believe statistical skills should be taught in a wide range of subjects at school level rather than restricted solely to mathematics. A similar problem is evident at university level, where students of, for example, social science subjects and journalism receive very little statistical training. In part, the problem is that teachers of non-science subject lack the confidence to teach statistical aspects of their courses. A potential intervention is to upskill these teachers at university and school level to enable statistical skills to be taught more widely.

2.10. That sort of intervention would help future politicians and journalists more effectively communicate in a trustworthy and effective manner. In the meantime, the situation would be helped by providing statistical training to politicians and journalists.

Recommendation 4: *All evidence considered by governments and their advisers must be published in a timely manner.*

Recommendation 5: *A mechanism should be introduced to ensure independent and non-political communication of data – such as a weekly briefing to journalists by the national statistician, chief medical officer or chief scientific officer.*

Recommendation 6: *Statistics and data skills should be taught more widely, reaching beyond mathematics at school, college and university level – especially in social sciences and journalism. Current politicians and journalists should be encouraged to undertake statistical training.*

Lesson 3: Evaluation should be at the heart of policy:

3.1. The NAO report sets out a number of ways in which on-going evaluation can improve policy outcomes and the efficiency of public service delivery – especially in the context of collecting feedback from end-users and frontline staff. We support their recommendations as far they go, but would propose that a bolder use of evaluation in policy rollout could further improve performance of key programmes. Wherever possible, new programmes and projects should incorporate rapid, cost-effective evaluations within their roll out, so that they can continually improve and we can learn what works. This is especially important in the context of a pandemic – but would benefit programmes and projects more generally.

3.2. The potential benefit of this is most clear in the case of NHS Test and Trace, which – as the NAO points out – is a hugely expensive programme but has not been nearly as effective as it could have been because “levels of non-compliance with self-isolation were high” (p.18). As early as July 2020, the RSS released a statement suggesting ways that Test and Trace could use two key statistical methods to gleam additional evidence, which included a recommendation that the government should use Test and Trace to monitor levels of compliance with the order to self-isolate so that we could understand if people needed additional support to self-isolate. The failure to collect early data on the number of people contacted by Test and Trace who properly isolated meant that the

economic difficulties that prevented some people from isolating were not identified and adequately addressed until very recently.[2] This ultimately undermined the effectiveness of the programme in its first year.

3.3. Given that Test and Trace was entirely rebuilt after it stopped functioning mid-March, the new system had the potential to be a great asset in tackling Covid-19: the programme gave the Department of Health and Social Care (DHSC) access to a rich source of information that, properly utilised, could have dramatically improved our understanding of how to reduce transmission of the virus.

3.4. The statistician team at DHSC, who were charged with producing official statistics on Test and Trace, did not have sufficient input into the design or inter-operability of the data-collection systems used. There was little thought given as to how data could be used to help answer important infection control questions. Instead, a commercial-style operational design was favoured. As a result, Test and Trace failed the most basic requirements of any infection control operation, namely to learn about: who is infected; how early they became antigen-positive; whether this is with or without symptoms; and whether quarantining asymptomatic close contacts of people who have tested antigen-positive is necessary and effective.

3.5. In our July statement we also suggested way that Test and Trace could use two key statistical methods – record-linkage and random sampling – to learn about transmission of the virus. In this context record-linkage means Test and Trace using its records to find out how many of the quarantined persons in each high-risk group tested positive for the virus during (or soon after) their quarantine period. Random sampling ensures that sub-samples are representative of the whole. These methods would have allowed the government to establish the proportion of high-risk individuals who developed symptoms and tested positive for the virus during or soon after the end of their quarantine period and to assess the level of infection, with or without prior symptoms, among those who are self-isolating, both of which would have provided vital information for controlling the virus. The record-linkage step was accomplished in September 2020, yet it was not until January 2021 that we were given some clues on Test and Trace's effectiveness in in stopping chains of transmission.

3.6. In February 2021 RSS president and co-chair of our Covid-19 Task Force, Sylvia Richardson, set out two other ways in which smart, focused evaluations could help us learn what works best alongside the rollout of control measures.[3] The Joint Committee on Vaccination and Immunisation advised delaying the second dose of vaccines for up to twelve weeks in order to prioritise getting more people vaccinated with their first dose. This proved to be an effective strategy – however when the plan was devised it would also have benefited from a randomised assessment of the effect of extending the interval.

3.7. This could have been done cheaply and efficiently while rolling out the vaccination programme, by giving a relatively small fraction of people the second dose after three weeks. As most people would still be assigned to the 12-week interval, this experimental design would still achieve the aim of large coverage with the first dose but, in just a few weeks, would have brought solid statistical evidence on the comparative effectiveness of different dose intervals for a new MRNA based type of vaccine. This would have provided either good reasons for other countries to adopt the UK's approach and have helped to minimise global cases, or it may have shown that some vulnerable people would have benefited from a shorter gap between doses and allowed us to modify our strategy.

3.8. The second example regards rapid testing in schools. At the start of 2021the planned strategy for controlling the spread of Covid-19 in schools in England was to test close contacts of confirmed cases every day for seven days using rapid tests, and sending home only those who tested positive. However, given the limited accuracy of some of the rapid tests it was not clear that this would be an effective strategy. There is now an effort to test the effectiveness of daily contact testing versus self-isolation – which is welcome and will allow an evaluation of the different approaches in terms of days lost from school and primary and secondary attack rates

[2] A new pilot to extend support for people to isolate was announced on 24 May 2021.
[3] *Vaccine rollouts, school testing and contact tracing could all be improved – here's how,* The Conversation, February 2021

(tracked together with genomic analysis of putative transmission routes based on PCR tests). There are other types of evaluation that could have been built in earlier: volunteering schools could also have been randomly allocated to different testing strategies. These could have included pooled testing – in which samples are grouped and tested together – or a combination of PCR tests – which detect the virus's genetic material – and rapid tests – which give results in 15 minutes but are less accurate. The prime outcomes of interest would have been the number of confirmed cases over a set period as well as average days of school lost per pupil.

3.9. With more than 30,000 schools in the UK, 152 local education authorities and four national systems, such comparative evaluation study could have been started quickly allowing us to learn what works, rather than guessing.

3.10. As the situation evolved, the Medicines and Healthcare Products Regulatory Agency (MHRA) ultimately expressed concerns about the use of rapid tests in a school setting. Embedding evaluation into the rollout of rapid testing in schools at the start of the programme could have provided the evidence to allay these concerns – or, alternatively, have pointed to a more effective strategy. This emphasises the importance of including evaluations as policies are rolled out.

3.11. There are reasons to be optimistic that government as a whole is learning lessons from this: eg, the recent announcement of the PHE STOP randomised study is a welcome development towards rigorous comparative evaluations of different infection control policies.

3.12. These examples demonstrate the importance of involving people with statistical skills in the decision-making process and in the design of programmes that rely heavily on data – these skills are required to identify opportunities for evaluating the effectiveness of policies as they are rolled out. Programmes would then be more likely to achieve their aims and do so more cost-effectively. Statistical innovations that can improve the quality of information available are also more likely to be used if people with statistical skills, who understand the potential power of the information, are better represented in the most senior ranks of government – and beyond the Government Statistics Service.

3.13. It is important that expert panels which advise government can harness the additional benefits from statistical study-designs. Currently, the way that expert groups are composed is opaque. In general, there is a need for greater transparency around the role of expert groups, their responsibilities and how representativeness of the skills that are needed is ensured in an open process.

Recommendation 7: *Efficient evaluations or experiments should be incorporated into any intervention to combat a pandemic from the start.*

Recommendation 8: *Producers of official statistics and those with understanding of experimental design should have input into the design of data collection for evaluation.*

Recommendation 9: *People with data and statistical skills should be given more support to move to leadership positions within the civil service – particularly to positions outside the Government Statistics Service.*

Summary of recommendations

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