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The elective care backlog and ethnicity

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Foreword

It has become commonplace to point out that the Covid-19 pandemic shone a light on the stark inequalities that exist between ethnic and socioeconomic groups in this country. The vastly different outcomes experienced by people from ethnic minorities during the pandemic have been well-documented – and rightly so.

But what is less well understood is how the fallout from the pandemic has affected different ethnic groups – and whether the millions of hospital procedures cancelled due to Covid-19 impacted these groups equally. This research seeks to address that.

Our findings are as intriguing as they are enlightening, identifying wide variation between treatment rates for hospital care between ethnic groups prior to the pandemic, and a striking gap between the Asian group and other ethnic groups during the first two Covid-19 years.

This variation is not driven by a single cause. Some of it reflects known epidemiology – we know that people from Asian groups have higher health care needs for cardiac procedures, for example. We also know that there is a strong link between health need and deprivation, which has a disproportionate impact upon people from ethnic minorities.

Some of it may be to do with less tangible but important issues of how people feel about health care. Trust in health and other services is vitally important in making them effective, but we know that a lack of trust in the NHS and government amongst some people from ethnic minority groups can result in them accessing less help and fewer services.

Some may be down to rapid shifts to how care is organised, with the widespread use of remote consultations shutting out people who lack the digital or language skills to engage.

Some must surely be a reflection of institutionalised and structural racism across society.

But much of what lies behind this variation needs more analysis. Inconsistent, incorrect and incomplete coding of ethnicity in health records means that our understanding of this complex picture is limited.

Poor data, and the practical constraints of small volumes of activity, limited our ability to delve deeper into these variations, for example looking at particular ethnic groups within the broad categories examined in the research. Understanding how this variation maps across subgroups experiencing deprivation, like Bangladeshi and Pakistani people, would be illuminating.

More broadly, the lack of data also limits progress in understanding how to reduce health inequalities across health care – something the NHS has a legal obligation to do. Quite simply, patchy data means that the NHS is flying blind in its attempts to meet this legal, and moral, obligation.

Nevertheless, this research provides vital new insight into an under-explored area and should offer local systems a useful blueprint for understanding the variations that exist in their own elective care backlogs. We hope that analysts in integrated care systems and those working at NHS trusts will replicate the methodology to gain greater insight into their areas.

Covid-19 is far from over. And the elective backlog is just one part of the legacy left by the pandemic on the NHS: less high-profile backlogs of care in public health and prevention will leave equally serious challenges for both mental and physical health. As we approach another winter and face the continuing threat of Covid, we hope that this research provides a useful starting point for understanding this legacy.

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Director, NHS Race and Health Observatory

Key messages

In England there is a huge backlog in routine hospital care (known as the 'elective backlog'), with more than 7 million patients waiting to begin hospital treatment as of August 2022. The Covid-19 pandemic and associated lockdowns resulted in a large fall in hospital activity such as consultations, tests and operations. This had a disproportionate impact on people in more deprived areas, who already had higher levels of health care need than those in less deprived areas.

The NHS has a legal duty to have regard to reducing the discrepancies between the health status of people from different groups in society and their ability to access care, known as 'health inequalities'. It has specifically committed to taking account of inequalities in how it addresses the elective backlog. Analysing how treatment varies between different ethnic and socioeconomic groups is a first step to understanding why they exist and identifying potential solutions.

This research seeks to add to this understanding by exploring variation in the treatment rates for routine hospital care both before and during the Covid-19 pandemic, looking at changes in elective activity overall and specifically in relation to seven groups of common hospital procedures across five main ethnic groups (White, Mixed, Asian, Black and Other). Our focus in this report is primarily on ethnic variations, but we also consider variations by deprivation and region because the proportion of ethnic minority groups is higher in more deprived areas, in cities and in some regions.

We find that wide variations in age- and sex-standardised treatment rates for routine hospital care existed before the pandemic, and that there were also differences in how much hospital activity was 'lost' during the first two years of the pandemic. Our detailed analysis of hospital data from March 2019 to February 2022 reveals that:

- Before the pandemic, the White group had higher rates of elective procedures overall than the Black, Mixed and Asian groups, with the White

group having almost a fifth more procedures than the Asian group per head of population. Cardiac and cataract procedure rates were highest in the Asian group and dental procedure rates were highest in the Black group.

- Procedure rates during the first year of the pandemic fell in all groups, with the NHS carrying out around 2.7 million fewer operations and tests in that year compared with the year before.

- However, the falls in activity were not uniform across the different ethnic groups, with the Asian group experiencing the largest overall fall in the first year of the pandemic compared with the other groups (a fall of 49% for all procedures compared with 44% for the White and Black groups). This means that if the proportional fall in activity was the same for the Asian group as it was for the White group, we would have expected to see just over 17,000 more procedures for the Asian group.

- Although the gap narrowed in the second year of the pandemic, there was still a larger deficit of care among the Asian group, with the fall remaining 2% larger for the Asian group than for the White group – an estimated deficit of 6,640 procedures.

- Apart from the Asian group, consistent differences were not found across procedures for other ethnic minority groups. The Black group did have larger rate falls than the White group for cardiac and cataract procedures (the fall was 19% larger for cataract procedures) but otherwise saw similar changes to the White group, including for all procedures taken together.

- The most deprived groups in the population experienced larger rate falls overall and for most specific procedure groups. For hip and knee replacements, there was a 13% larger fall in the most deprived group compared with the national change, and a 7% lower fall in the least deprived group.

- There was no relationship between the fall in elective hospital activity and the local impact of Covid-19 by region (as measured by reported Covid-19 cases and Covid-19 admissions).

The quality of data available for analysis limited our findings. We renew our appeal for national and local organisations to act on the poor quality of ethnicity data and call on national policy-makers and local leaders for:

- Urgent action to address health care inequalities between socioeconomic and ethnic groups, including the large and unexplained falls in planned activity that occurred during the first year of the pandemic

- National and local monitoring of changes to patient pathways (such as more tests being carried out before a patient sees a specialist) that are introduced to manage the elective backlog, to ensure disadvantaged groups are not further disadvantaged

- Addressing the large and sustained deficit in cardiac care for the Asian group and action to understand the reasons for lower demand for elective care among the Asian population

- Further work to understand ethnic variation in elective pathways for specific procedure groups, including action by national clinical audits, which will require improved ethnicity data collection and analysis.

These actions are needed to ensure that learning from the first two years of the pandemic is taken on board, as we move into the next phase of the pandemic.

1 Introduction

Background

The NHS in England is facing a significant and growing backlog in elective care (planned hospital treatment), with more than 7 million patients waiting for such treatment in August 2022[1] – an increase from 4.5 million in February 2020.[2] The Covid-19 pandemic caused disruption to health services from the combined impact of various factors, including people avoiding using services due to a fear of getting infected with the virus or to 'protect the NHS', and pressures on the NHS leading to delays or restrictions in access to services. Many elective treatments stopped, patients' attendance at GP practices and Accident & Emergency (A&E) reduced, and there were fewer referrals from general practitioners (GPs) to secondary care. While these effects were most pronounced during the first wave of the pandemic in 2020, their effects persisted throughout 2020 and 2021.[3]

The NHS was not able to keep up with growing demand for care before the pandemic and is struggling to recover capacity even to pre-pandemic levels, due to ongoing pressures from Covid-19 in relation to demand for services, infection control measures and staff absences.[4] The backlog of treatment could still grow further as more people come forward for treatment for

1 QualityWatch (no date) 'NHS performance summary'. www.nuffieldtrust.org.uk/qualitywatch/nhs-performance-summary. Accessed 10 October 2022.

2 Davies J (2022) 'Combined performance summary: February – March 2020'. www.nuffieldtrust.org.uk/news-item/combined-performance-summary-february-march-2020#treatment-and-diagnostic-test-waiting-times. Accessed 26 August 2022.

3 Scobie S (2021) 'Will the third Covid-19 wave overwhelm the NHS?'. www.nuffieldtrust.org.uk/news-item/will-the-third-covid-19-wave-overwhelm-the-nhs. Accessed 26 August 2022.

4 Morris J and Reed S (2022), 'How much is Covid-19 to blame for growing NHS waiting times?' www.nuffieldtrust.org.uk/resource/how-much-is-covid-19-to-blame-for-growing-nhs-waiting-times Accessed 9 September 2022

non-Covid-19 conditions that have worsened over the course of the pandemic, as well as ongoing symptoms after Covid-19 infection.[5]

NHS England has a legal duty to have regard to the need to reduce inequalities in access to services, as do the newly created integrated care boards.[6] Further, NHS guidance requires organisations to consider inequalities in access to treatment as they address the backlog.[7] But there has been no published comprehensive analysis of ethnic differences in terms of access and waiting times that the pandemic has caused. In fact, there was limited analysis of ethnic differences in elective care even before the pandemic.

Covid-19 has led to worse outcomes for ethnic minority groups, due to a combination of risk factors that disproportionately impact some ethnic minority groups, including co-morbidities (having two or more health conditions at the same time), deprivation, occupation, household composition and living in cities where infection rates are higher.[8] Vaccination against the virus has reduced Covid-19 mortality rates in all ethnic groups, but uptake is lowest among groups with the highest Covid-19 mortality: Bangladeshis, Pakistanis, Black Caribbeans and Black Africans.[9] Meanwhile structural racism can have an impact on health by marginalising certain ethnic groups and creating barriers to accessing health information and health care

5 Comptroller and Auditor General (2021) *NHS Backlogs and Waiting Times in England*. National Audit Office. www.nao.org.uk/wp-content/uploads/2021/07/NHS-backlogs-and-waiting-times-in-England.pdf.

6 Section 13G of the National Health Service Act 2006. www.legislation.gov.uk/ukpga/2006/41/section/13G. Accessed 26 August 2022.

7 NHS (2022) *Elective Recovery Planning Supporting Guidance*. NHS England and NHS Improvement. www.england.nhs.uk/wp-content/uploads/2021/12/B1269-elective-recovery-planning-supporting-guidance.pdf.

8 Equality Hub and Race Equality Unit (2021) 'Final report on progress to address Covid-19 health inequalities'. www.gov.uk/government/publications/final-report-on-progress-to-address-covid-19-health-inequalities/final-report-on-progress-to-address-covid-19-health-inequalities. Accessed 26 August 2022.

9 UK Health Security Agency (2022) *Weekly National Influenza and Covid-19 Surveillance Report: Week 27 report (up to week 26 data)*. GOV.UK. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1088929/Weekly_Flu_and_COVID-19_report_w27.pdf.

services.[10] Understanding ethnic differences in planned care is essential for making sure that NHS organisations are able to meet their responsibilities to address the elective backlog inclusively.[11,12]

Evidence on ethnic differences in elective care before and during the pandemic

There is relatively little evidence about ethnic variations in access to elective care or waiting times before the pandemic. We know that ethnic minority populations are generally younger than the White population, have different health profiles and are more likely to live in deprived areas and in cities, particularly London.[13] There are also significant differences between ethnic minority groups. For example, people of Pakistani and Bangladeshi origin are more likely to live in the most deprived areas and have a worse health status than people of Indian origin.[14] These differences complicate the interpretation of ethnic disparities in access to health services. Furthermore, ethnicity data are not included in routine waiting-times data, the quality of ethnicity coding in hospital datasets is poor and population data by ethnic group are also limited (see Box 1 in the next chapter).

10 Raleigh V and Homes J (2021) 'The health of people from ethnic minority groups in England'. www.kingsfund.org.uk/publications/health-people-ethnic-minority-groups-england. Accessed 26 August 2022.

11 NHS (2021) 2021/22 *Priorities and Operational Planning Guidance: Implementation guidance*. NHS England and NHS Improvement. www.england.nhs.uk/wp-content/uploads/2021/03/B0468-implementation-guidance-21-22-priorities-and-operational-planning-guidance.pdf.

12 Health and Social Care Committee (2021) 'Oral evidence: clearing the backlog after the pandemic, HC 599'. https://committees.parliament.uk/oralevidence/2664/html. Accessed 26 August 2022.

13 GOV.UK (no date) 'UK population by ethnicity'. www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity. Accessed 26 August 2022.

14 GOV.UK (2020) 'People living in deprived neighbourhoods'. www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/people-living-in-deprived-neighbourhoods/latest. Accessed 26 August 2022.

Access to primary care health services is generally equitable for ethnic minority groups, but this is less consistently so across other health services.[15] Patterns of health and service use differ between ethnic minority groups and the White population, and between ethnic minority groups. But assessing whether ethnic differences in elective activity are commensurate with health care need is challenging. Similarly, higher levels of service use in deprived areas may be expected given greater levels of need, but may still not be equitable. Appendix A draws together evidence relating to ethnic differences in health, risk factors and care relevant to the groups of procedures included in this research.

There are many reasons why access to elective care may have varied between ethnic groups during the pandemic (see Table 1). Ethnic differences may reflect demand factors (such as the level of need or changes in health care-seeking behaviour) or supply factors (such as pressure on services), but the extent to which this is the case is unclear. The drivers for differences may also be related to the effects of factors such as deprivation, occupation and geography, rather than primarily ethnicity.

15 Raleigh V and Homes J (2021) 'The health of people from ethnic minority groups in England'. www.kingsfund.org.uk/publications/health-people-ethnic-minority-groups-england. Accessed 26 August 2022.

Table 1: Demand and supply factors that could result in differences in 'lost' activity between ethnic groups

Demand factors	• Greater health need, before the pandemic, as a result of deprivation and wider societal factors – as a result, reductions in activity have more of an impact on the health of ethnic minority groups than the White population. • Health problems following Covid-19 infection, including heart disease and stroke,[16] impacting ethnic minority groups differentially due to having higher rates of infection than the White group. • Greater concern about the risk of infection reducing help-seeking behaviour and attendance at appointments – surveys indicate that there is greater concern among ethnic minority groups than the White population and that some ethnic groups are less likely to have made a GP appointment due to Covid-19 concerns (see Appendix B). • Lower use of private health care in more deprived areas. Data on ethnic variations in the use of private health care are not available due to private providers' poor reporting of ethnicity.[17]
Supply factors	• NHS service pressures, as a result of higher rates of Covid-19 in areas with higher ethnic minority populations. • Differential access due to ethnicity – for example, the switch to more remote services may have resulted in barriers to access for some groups.[18] • Closer proximity to hospitals for ethnic minority groups who are more likely to live in cities and urban areas than the White population.

16 Katsoularis I, Fonseca-Rodríguez O, Farrington P, Lindmark K and Fors Connolly A-M (2021) 'Risk of acute myocardial infarction and ischaemic stroke following Covid-19 in Sweden: a self-controlled case series and matched cohort study', *The Lancet* 398(10300), 599–607. www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)00896-5/fulltext. Accessed 26 August 2022.

17 Scobie S (2022) 'Chart of the week: how does the quality of patient ethnicity data vary between private and public health care providers?'. www.nuffieldtrust.org.uk/resource/chart-of-the-week-how-does-the-quality-of-patient-ethnicity-data-vary-between-private-and-public-health-care-providers. Accessed 26 August 2022

18 Morris J, Georghiou T and Appleby J (2021) 'Changes in English NHS outpatient activity during the early Covid-19 period'. www.medrxiv.org/content/10.1101/2021.04.28.21256176v1. Accessed 26 August 2022.

Evidence of ethnic differences in the use of services during the pandemic is limited. In April 2020, the Office for National Statistics found no ethnic differences in the use of health services by people with a health condition.[19] Surveys conducted in May 2020 found no differences between White and ethnic minority respondents in cancelled surgery, medical procedures or other medical appointments during the first lockdown.[20] This is consistent with analysis of outpatient activity for March to October 2020, which found few ethnic differences in the reductions in activity.[21] Ethnic differences in emergency care have been reported, with areas with higher ethnic minority populations showing the largest reductions in non-Covid-19 emergency activity.[22] The same was not found for elective care, and the authors conclude that the patterns suggest demand-side changes rather than reduced access. Analysis of admissions for selected diseases (cancer, respiratory disease and cardiovascular disease) found that the fall in planned admissions at the time of the first lockdown was greatest for Black groups and higher in more deprived areas, based on data covering parts of England, and Wales and Scotland.[23]

19 Office for National Statistics (2020) 'Coronavirus and the social impacts on different ethnic groups in the UK: 2020'. www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/articles/coronavirusandthesocialimpactsondifferentethnicgroupsintheuk/2020. Accessed 26 August 2022.

20 Topriceanu C-C, Wong A, Moon JC, Hughes AD, Bann D, Chaturvedi N, Patalay P, Conti G and Captur G (2021) 'Evaluating health and care services during lockdown by the Covid-19 survey in five UK national longitudinal studies', *BMJ Open* 11, e045813. https://bmjopen.bmj.com/content/bmjopen/11/3/e045813.full.pdf.

21 Morris J, Georghiou T and Appleby J (2021) 'Changes in English NHS outpatient activity during the early Covid-19 period'. www.medrxiv.org/content/10.1101/2021.04.28.21256176v1. Accessed 26 August 2022

22 Warner M, Burn S, Stoye G, Aylin PP, Bottle A and Propper C (2021) 'Socioeconomic deprivation and ethnicity inequalities in disruption to NHS hospital admissions during the Covid-19 pandemic: a national observational study', *BMJ Quality & Safety* 31(8), 590–8. https://qualitysafety.bmj.com/content/early/2021/11/24/bmjqs-2021-013942. Accessed 26 August 2022.

23 Shah SA, Brophy S, Kennedy J, Fisher L, Walker A, Mackenna B, Curtis H, Inglesby P, Davy S, Bacon S, Goldacre B, Agrawal U, Moore E, Simpson CR, Macleod J, Cooksey R, Sheikh A and Katikireddi SV (2022) 'Impact of first UK Covid-19 lockdown on hospital admissions: interrupted time series study of 32 million people', *eClinicalMedicine* 49, 101462. www.sciencedirect.com/science/article/pii/S2589537022001924. Accessed 27 August 2022.

2 Aims of the report

This report examines, for all procedures, and for groups of common elective procedures, how rates of NHS-funded treatment varied between ethnic groups before the pandemic, and whether there were subsequent ethnic differences in the levels of 'lost' activity during the pandemic.

The focus of our analysis is ethnicity, but deprivation, region and Covid-19 are confounders in interpreting ethnic differences, and so these are also examined to inform our interpretation of the results. We focus on elective activity only, to inform action to address the backlog, but it should be noted that some activity may have been undertaken via emergency care pathways, as delays in planned treatment led to urgent care needs.

The report is based on a detailed analysis of hospital data from March 2019 to February 2022. While we used a novel approach to analyse differences in lost activity, there are significant challenges with data collection[24] and the quality of data available available when analysing ethnic variations (see Box 1) and this can make interpretation of the results complex. Local NHS organisations (including NHS trusts), integrated care boards and regions could apply the methods we have developed.

24 Office for National Statistics (2023, forthcoming) 'Understanding methods and systems used to collect ethnicity information in health administrative data sources, England: 2022'. www.ons.gov.uk/releases/understandingmethodsandsystemsusedtocollectethnicityinformationinhealthadministrativedatasourcesengland2022

Box 1: Challenges with the analysis of ethnic variations in health care using data from hospital records

Hospital records are coded using 2001 Census categories for ethnicity, which do not match the latest population denominators.

Population denominators are estimates based on the 2011 Census results, 'aged on' and with other adjustments. But they come with considerable uncertainty, particularly at a local level, and do not take account of the migration effects of Brexit or the Covid-19 pandemic. In addition, granular population data by combinations of age, sex, ethnicity, geography and deprivation are not available, which means we cannot undertake multivariate analysis of the combined effect of these variables.

There are known inconsistencies in recording ethnicity that affect ethnic minority groups more than the White group:[25]

- There are particular challenges with the overuse of 'Other' ethnic group codes and 'Mixed' ethnic group codes, where there is very poor alignment between Census records and hospital data.
- This results in an overestimation of rates of activity for these groups relative to their populations – and therefore an underestimation of rates for other ethnic categories.
- There are also other data quality issues such as an inconsistency in the use of ethnic codes for repeat hospital visits.

There is a trade-off between using granular ethnic groups in analysis – such as the 18 Census categories, with a risk of spurious results due to data quality issues – and using broader ethnic groups, where important differences between groups are lost. Adjustments to ethnic codes to reduce the impact of coding biases can partly address data quality issues (see the next chapter).

25 Scobie S, Spencer J and Raleigh V (2021) *Ethnicity Coding in English Health Service Datasets*. Nuffield Trust. www.nuffieldtrust.org.uk/research/ethnicity-coding-in-english-health-service-datasets. Accessed 27 August 2022.

3 Methods

Summary

For this research we selected a set of common elective hospital procedures (in seven groups), which together accounted for more than four in every 10 NHS-funded elective procedures in England (see Chapter 4). We calculated rates of these procedures for different ethnic groups before and during the first two years of the pandemic, standardising for age and gender differences in population structures. For all procedures, and each selected procedure group, we analysed the scale of the falls in the pandemic-related procedure rates for ethnic minority groups and compared these with the scale of the falls for the White ethnic group.

While our primary goal was to examine ethnic differences, we also conducted similar analyses by region and deciles of deprivation, to try to triangulate the data with existing literature on the relationship between these factors and ethnicity. The regional analyses were interpreted with regard to how severely the pandemic had impacted on different areas of England. For a small number of procedure groups, we also looked in more detail at differences in how ethnic group procedure rates changed within the regions of England.

Hospital data, procedure groups and analysis time periods

We obtained counts of procedures from Hospital Episode Statistics Admitted Patient Care (HES APC) data covering the three years from March 2019 to February 2022. We selected episodes of care for inclusion where the admission method was elective (admissions and day case activity) and the primary procedure code related to a valid, known procedure. We included all NHS-funded activity, whether in public or private hospitals. We excluded episodes where the patient's age or gender was unknown, the patient's place

of residence was not in England or where the admission was categorised as a regular day or night attendance.[26]

We defined a set of seven high-volume elective procedures for our analyses (see Appendix C). We selected these procedures with the goal of covering a substantial proportion of all inpatient elective activity and to have a range of procedures used by different patient groups. These procedures groups are:

- cardiac – diagnostic[27]
- cardiac – therapeutic
- cataract
- dental
- gastrointestinal endoscopy – diagnostic
- gastrointestinal endoscopy – therapeutic
- hips and knees.

For context, our analyses also included all other procedure codes in an 'other procedures' group, and all procedures together.

26 We also excluded all episodes – whether regular day or night attendances, or not – of a small selection of procedure codes (see Appendix C). For these procedures we identified that there had been a coding practice change between the first and second years of the pandemic that made results for 'other procedures' and 'all procedures' inconsistent across years.

27 The main sets of procedures within each group are as follows: cardiac (diagnostic) – contrast radiology of heart; cardiac (therapeutic) – cardiac pacemaker implantation, angioplasty and stent insertion, and others; cataract – prosthesis of lens, and others; dental – removal/extraction of tooth, and others; gastrointestinal endoscopy (diagnostic) – fibre-optic endoscopic examination of upper gastrointestinal tract, colon, lower bowel; gastrointestinal endoscopy (therapeutic) – endoscopic extirpation of lesion of colon, of lower bowel, of upper gastrointestinal tract, and other upper gastrointestinal tract; hips and knees – total prosthetic replacement of knee joint, of hip joint.

We split the data into three year-long analysis periods, running from March to February each year, as follows:

- pre-Covid year: 1 March 2019 to 29 February 2020
- first Covid year: 1 March 2020 to 28 February 2021
- second Covid year: 1 March 2021 to 28 February 2022.

We took patients' ethnic group from the HES APC data (but note that we also used data from April 2016 to February 2019 to reallocate ethnic category codes – see further below), and did the same for NHS regions and deciles of deprivation. We mapped out regions and deprivation deciles (the latter using the 2019 Index of Multiple Deprivation[28]) via the Lower-layer Super Output Area (LSOA) of residence recorded against each patient admission.

Population data

We used population projections from the ETHPOP Database,[29] which provides estimates of populations by ethnic group, local authority district, age and sex. We used three years of data – 2019, 2020 and 2021 – to correspond to each of the three analysis period years.

28 Ministry of Housing, Communities and Local Government (2019) 'English indices of deprivation 2019'. www.gov.uk/government/statistics/english-indices-of-deprivation-2019. Accessed 27 August 2022.

29 Wohland P, Phil R, Paul N, Nikolas L and Stephen C (2018) 'NEWETHPOP – ethnic population projections for UK local areas 2011–2061'. https://reshare.ukdataservice.ac.uk/852508. Accessed 27 August 2022. We used Leeds2.

Use of ethnicity codes

Ethnicity records in HES APC data use the coding framework from the 2001 Census, while the ETHPOP population data use 2011 Census codes. For our analysis we mapped both sets of codes to the five-category ethnic groups that the Office for National Statistics uses:[30]

- White
- Mixed
- Asian
- Black
- Other.

The code mapping is shown in Appendix D.

Table 2 shows ethnic group populations for the pre-Covid year (2019), according to the ETHPOP data. An important point is how, even with very few categories of ethnic groups, some groups – notably Other and Mixed groups – are small in size. The White group, meanwhile, makes up more than 80% of the total population, and the next largest group – the Asian group – makes up just under 10%. The ethnic minority groups have very different age structures compared with the White group: they are typically much younger.

30 For example, see Office for National Statistics (2022) 'Producing admin-based ethnicity statistics for England: changes to data and methods'. www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/datasets/producingadminbasedethnicitystatisticsforenglandchangestodataandmethods. Accessed 27 August 2022.

Table 2: Population counts for the ethnic groups analysed and age structure for the pre-Covid year, 2019

Ethnic group	Count (% of all)	% of group aged	
		under 20	70 and over
White	46,699,463 (82.5%)	21.3%	15.5%
Mixed	1,544,964 (2.7%)	50.0%	2.0%
Asian	5,502,134 (9.7%)	29.6%	4.2%
Black	2,181,740 (3.9%)	31.2%	4.6%
Other	699,478 (1.2%)	23.8%	3.8%
All	*56,627,779 (100%)*	*23.3%*	*13.5%*

In the HES APC data, an ethnic code is assigned to each patient contact with the service, but there is evidence of some miscoding of ethnicity. For example, multiple ethnicities are assigned to some patients who have repeat contacts with the service, and the 'any other' ethnic group is often systematically overstated.[24]

While 16 ethnic categories were available in the HES data, we mapped to the five groups noted above to overcome problems with the small size of some of these ethnic categories/groups and potential data quality issues.

We followed the approach of the Office for Health Improvement and Disparities (OHID) in reallocating some ethnicity codes to maximise the numbers with a useable code.[31] The full method is described in the OHID paper referenced, but the most important elements are described in Box 2.

31 Office for Health Improvement and Disparities (2022) 'Method for assigning ethnic group in the COVID-19 Health Inequalities Monitoring for England (CHIME) tool'. www.gov.uk/government/statistics/covid-19-health-inequalities-monitoring-in-england-tool-chime/method-for-assigning-ethnic-group-in-the-covid-19-health-inequalities-monitoring-for-england-chime-tool. Accessed 27 August 2022.

Box 2: Reallocating ethnic category codes – key steps

As a result of incomplete and inconsistent ethnicity coding within HES, we used ethnic category codes from multiple years of inpatient data to determine the most appropriate ethnic category. The reallocation process and its impact are discussed in more detail in Appendix E.

The first part of the reallocation process was to move from one ethnic category per event to one ethnic category per person (each patient having a unique, pseudonymised ID). For patients with multiple service contacts, we allocated them their most frequently recorded ethnic category, excluding 'not stated' and 'not known'. We used inpatient episode data from April 2016 to February 2022 to calculate these person-specific frequencies.

The second part of the reallocation process aimed to reduce the overstating of 'any other' ethnic group. Patients with this recorded as their most frequently used ethnic category who also had activity recorded under other ethnic categories were allocated their second most frequent ethnic category.

People who were consistently recorded as 'not known' were redistributed to an ethnic category at random, in line with the population distribution reported at the 2011 Census. Those who were consistently recorded as 'not stated' remained as 'not stated'. As we could not use these records in the analysis, the procedure rates we report are likely to be slight underestimates of the true rates. This is the case with all rates reported by ethnic category, with the exception of the Other category, which may still be over-reported in the data. This method is a compromise to reduce the coding biases and gives us the most plausible rates for our analysis.

We ran the reallocation process on the full list of ethnic category codes and aggregated to the five broad ethnic category groups afterwards.

Analysis of procedure rates

We calculated indirectly standardised procedure rates per 100,000 people, using 10-year age bands (0 to 9, 10 to 19 and so on, up to 90+) and sex.

We carried out three sets of analysis: by ethnic group, by region and by decile of deprivation.

For the analysis by ethnic group, we used the White group as the reference population.[32] In the analysis by region and deprivation, we used all ethnic groups pooled together (that is, the population of England) as the reference population. We used the White group as the reference population for ethnic group analyses because this group made up approximately 80% of the population analysed. As such, White group procedure rates (and changes in rates) would always appear very close to the national average, and we took a view that the interpretation of our findings would be simplified by analysing ethnic minority groups relative to the White group.

For each analysis, we calculated age- and sex-standardised rates for each of the procedure groups (seven selected groups, all other procedures and all elective procedures together), and for each of the three time periods (pre-Covid year, first Covid year and second Covid year).

Appendix F gives further information about our calculation of the indirectly standardised rates.

Analysis of changes over time

For all analyses (by ethnic group, region and deprivation) we calculated falls in age- and sex-standardised procedure rates, expressed as a percentage, by comparing the rates in the first Covid year to those in the pre-Covid year.

32 In indirect standardisation, the reference population is the group used to create estimates of expected numbers of procedures in other, or sub-group, populations.

In addition, for the analysis by ethnic group we calculated values which expressed each ethnic group's procedure rate falls relative to those of the White group's rate falls. For the region and deprivation analyses, we did similar, but instead compared each group's rate falls to the national procedure rate falls.

For the analysis by ethnic group, we also looked at changes in the second Covid year, compared with the pre-Covid year.

We used Poisson regression modelling to provide us with equivalent estimates of the relative rate fall values, including an assessment of the statistical significance of the differences between groups. Where we found statistically significant differences in rate falls (between ethnic minority groups and the White group, and regions and deprivation decile groups and national rate falls) beyond 95% confidence levels, these are labelled. A wider range of numeric estimates and corresponding confidence intervals are supplied in the supplementary material.

See Appendix G for a more detailed discussion of these methods.

Analysis by region and ethnicity

For cardiac and cataract procedures, and for all elective procedures, we repeated the above analyses by region to test whether region-specific responses to, or impacts of, the Covid-19 pandemic were driving national patterns.

We selected cardiac procedures (combining diagnostic and therapeutic procedures to reduce small numbers at the regional level) and cataract procedures as these conditions showed significant variation between ethnic groups and regions nationally.

4 Findings

Overview

Table 3 shows total counts of elective procedures in each of the three analysis years. Total elective activity fell by 2.7 million procedures, or 44%, in the first Covid year compared with the pre-Covid year and was still lower by 18% in the second Covid year.

The selected procedures (which made up 44% of all elective procedures in the pre-Covid year) collectively fell by 46% and 16%, respectively, in the first and second Covid years.

There were substantial differences between the procedures in how much activity fell by in the first Covid year. For example, dental and hip and knee procedure counts fell by between 63% and 65%, while therapeutic cardiac procedures fell by 29%.

Table 3: Counts of the selected elective procedures (and other and all procedures) in the three analysis years

	Counts of elective procedures (fall in activity versus pre-Covid year)					
	Pre-Covid year (March 2019 – February 2020)	First Covid year (March 2020 – February 2021)		Second Covid year (March 2021 – February 2022)	
Cardiac – diagnostic	75,101	43,977	(41.4%)	52,614	(29.9%)
Cardiac – therapeutic	86,997	61,907	(28.8%)	70,849	(18.6%)
Cataract	560,297	318,785	(43.1%)	555,930	(0.8%)
Dental	165,636	60,658	(63.4%)	107,047	(35.4%)
Gastrointestinal endoscopy – diagnostic	1,297,919	701,909	(45.9%)	1,032,142	(20.5%)
Gastrointestinal endoscopy – therapeutic	296,484	176,389	(40.5%)	274,536	(7.4%)
Hips and knees	131,386	46,314	(64.7%)	96,289	(26.7%)
Selected procedures	*2,613,820*	*1,409,939*	*(46.1%)*	*2,189,407*	*(16.2%)*
Other procedures	*3,360,580*	*1,908,676*	*(43.2%)*	*2,728,228*	*(18.8%)*
All procedures	*5,974,400*	*3,318,615*	*(44.5%)*	*4,917,635*	*(17.7%)*

How did procedure rates vary before the pandemic?

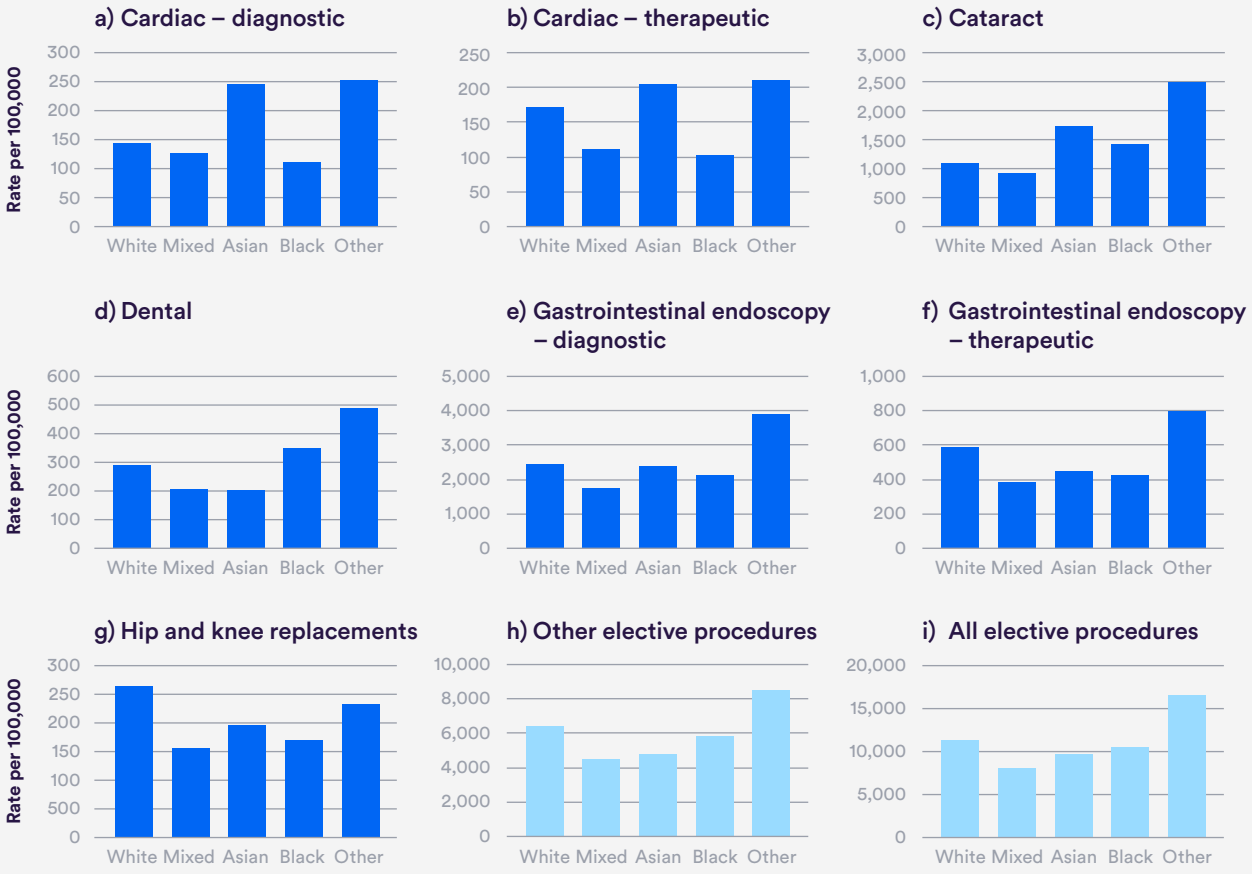
By ethnicity

Our analysis shows large ethnic differences in rates of elective procedures before the pandemic (see Figure 1). The Mixed, Asian and Black groups had lower rates of all procedures than the White group (at 8,033, 9,661 and 10,433 per 100,000 people respectively, versus 11,366 per 100,000 in the White group),

while the Other group had the highest rates overall (at 16,450 per 100,000). Note that crude and standardised procedure rates (and confidence limits for the latter) can be found in Appendix H. In addition, all data related to other findings in the section can be found in the supplementary material.

There were also large ethnic differences in rates for all the selected procedure groups. For example, the White group had a diagnostic cardiac procedure rate of 143 per 100,000 people, while those in the Asian and Other categories had 245 and 253 procedures per 100,000 people, respectively. The Black and Mixed groups had the lowest rates – 110 and 125 procedures per 100,000 people, respectively.

Figure 1: Rates of elective procedures, by ethnic group, in the pre-Covid year, March 2019 to February 2020



Notes: These figures show indirectly age- and sex-standardised procedure rates per 100,000 population (with the White group as the reference population). Note individual charts' very different Y axis (rate) scales.

There are a number of observations to highlight:

- The Asian group had higher age- and sex-standardised rates of cardiac and cataract procedures than the White group.
- The Black group had higher standardised rates of cataract and dental procedures than the White group.
- However, the Asian and Black groups had lower standardised rates of gastrointestinal and hip and knee procedures than the White group.
- The Mixed ethnic group had consistently low standardised rates of all types of procedure compared with the White group.
- As noted earlier, the consistently higher standardised rates for the Other group are likely to reflect some overestimation because of coding issues. Also, the rates for some ethnic groups and procedures are based on small numbers of procedures (see the supplementary material) and need to be interpreted with caution.

Some of these variations are consistent with recognised differences in the health needs of ethnic groups. In particular, South Asian groups (which comprise the bulk of the Asian analysis group) have a higher prevalence of heart disease, while Black groups have a lower prevalence.[33] Previous studies have also found higher rates of cataract in South Asian groups, associated with higher rates of diabetes.[34] Higher rates of cataract in Black groups in the UK have not been reported before but would be consistent with higher rates of diabetes in this group. Lower rates of joint replacement in Black and Asian

33 Raleigh V and Holmes J (2021) 'The health of people from minority ethnicity groups in England'. www.kingsfund.org.uk/publications/health-people-ethnic-minority-groups-england. Accessed 27 August 2022.

34 Rauf A, Malik R, Bunce C and Wormald R (2013) 'The British Asian community eye study: outline of results on the prevalence of eye disease in British Asians with origins from the Indian subcontinent', *Indian Journal of Ophthalmology* 61(2), 53–8.

groups in the UK have previously been reported,[35] although there are no UK data on the prevalence of underlying risk factors, such as osteoarthritis.

Ethnic differences in dental procedures may reflect a combination of poorer access to a general dentist for Black and Asian groups, and differences in oral health, although the evidence on this by ethnic group is unclear (see Appendix A).

We found limited evidence on reasons for the variation in gastrointestinal procedures, although there are geographic variations in referral rates, related to the distribution of trained endoscopists.[36]

By region and deprivation

Figure 2 shows standardised rates of procedures by region of England for the pre-Covid year (March 2019 to February 2020). In presenting region results, we order the regions from high to low in terms of the impact that Covid-19 has had on them, as measured by positive Covid-19 cases and Covid-19 admissions during the first Covid year (see Appendix I).[37]

In terms of all elective procedures, the North West had the highest standardised rate of all the regions at 12,936 procedures per 100,000 people, while the East of England had the lowest standardised rate at 10,617 per 100,000.

There were large variations in the rates of the selected procedures by region. Some procedures showed larger variation than others. For example, dental

35 Smith MC, Ben-Shlomo Y, Dieppe P, Beswick AD, Adebajo AO and Wilkinson JM (2017) 'Rates of hip and knee joint replacement amongst different ethnic groups in England: an analysis of National Joint Registry data', *Osteoarthritis and Cartilage* 25(4), 448–54. www.oarsijournal.com/article/S1063-4584(17)30043-2/fulltext. Accessed 27 August 2022.

36 Endoscopy services' in Public Health England (2017) *The Second Atlas of Variation in NHS Diagnostic Services in England*. Public Health England. https://fingertips.phe.org.uk/documents/Diag_2016_EndoscopyServices.pdf.

37 Note that for both positive Covid-19 cases and Covid-19 admissions, there was a more than two-fold difference in rates between the most heavily impacted areas (the North West and London) and the least (the South West).

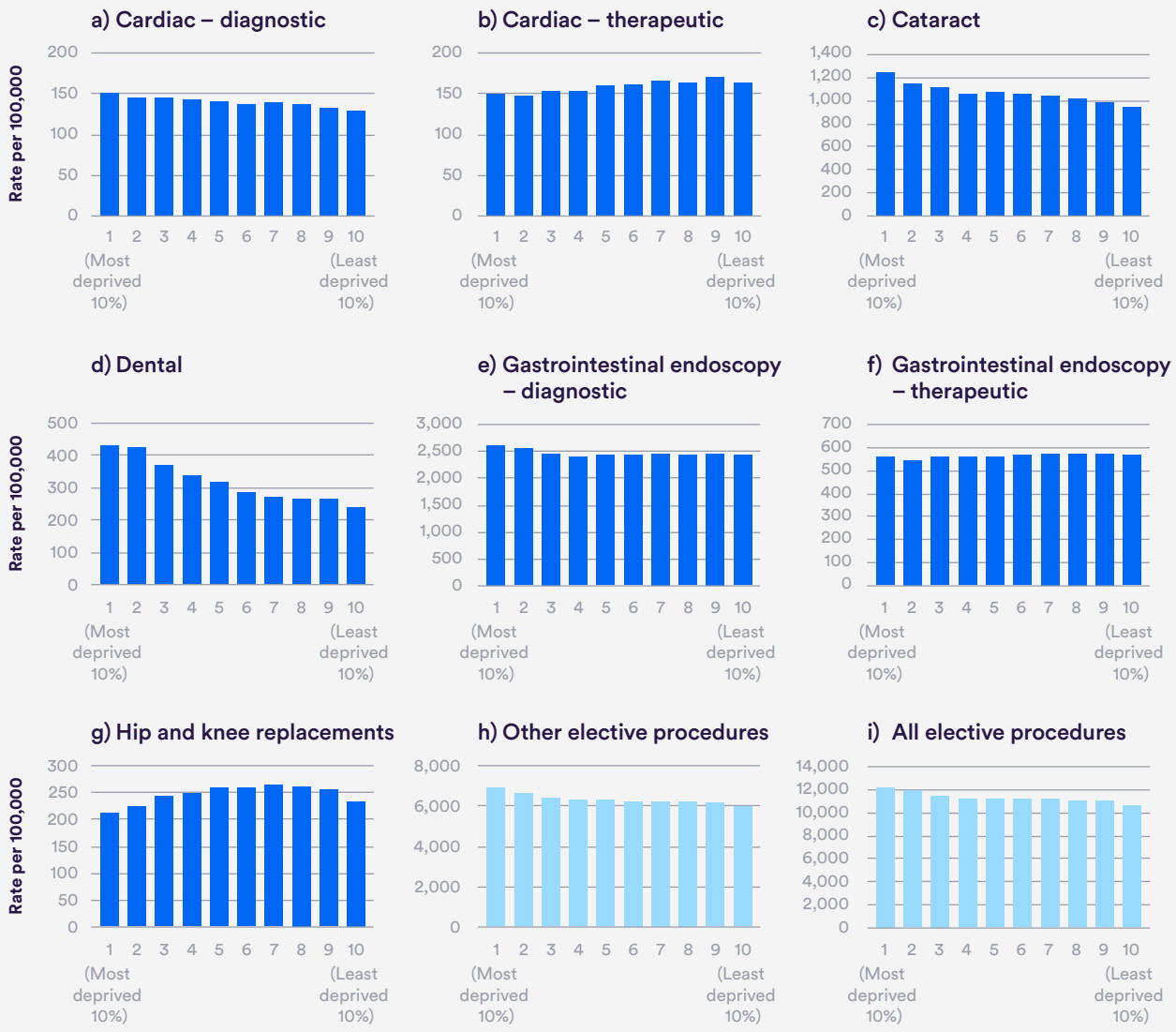
procedures had a greater than two-fold difference in standardised rates between the maximum and minimum rate regions, while for both cardiac and therapeutic gastrointestinal procedures, the differences were more modest, with 20% to 25% variation between the maximum and minimum rate regions.

Figure 2: Rates of elective procedures, by region, in the pre-Covid year, March 2019 to February 2020

Notes: These figures show indirectly age- and sex-standardised rates per 100,000 people. Regions are ordered from high to low Covid-19 impact (see Appendix I). Note individual charts' very different Y axis (rate) scales.

Figure 3 shows the gradient in standardised procedure rates by deprivation decile for the pre-Covid year. For all elective procedures, there were 12,240 procedures per 100,000 people in the most deprived decile areas, and 10,680 per 100,000 in the least deprived decile areas, with a consistent fall in rates from more to less deprived areas.

Figure 3: Rates of elective procedures, by deprivation decile, in the pre-Covid year, March 2019 to February 2020



Notes: These figures show indirectly age- and sex-standardised rates per 100,000 people. Note individual charts' very different Y axis (rate).

In terms of the selected procedure groups, we observed generally higher standardised rates for the most deprived areas for diagnostic cardiac, cataract and dental procedures. This pattern was reversed for therapeutic cardiac and hip and knee replacement procedures.

Regional differences and variation by deprivation decile may reflect a number of factors, including:

- variation in population need
- historic patterns of service provision
- rates of privately funded activity.

For example, rates of elective dental procedures will reflect access to general dentist provision and deprivation – both worse access to general dentists and higher levels of need will increase rates of elective hospital dentistry. And for a number of conditions, including cataracts and the need for joint replacement, privately funded activity may reduce rates of NHS-funded care in the least deprived areas, and where private service use is highest – in London and the South East of England.[38] Indeed for all elective procedures (both the seven selected procedure groups and other elective procedures), the most affluent decile areas had consistently lower standardised procedure rates than the next most deprived group, which is likely to reflect this greater access to privately funded care .The extent to which regional variations in health care are warranted, on the basis of differences in need and the availability of private care, is a complex issue.[39]

38 PHIN (2022) 'Private market update'. https://www.phin.org.uk/news/private-market-update-july-2022. Accessed 27 August 2022.

39 Appleby J, Raleigh V, Frosini F, Bevan G, Gao H and Lyscom T (2011) *Variations in Health Care: The good, the bad and the inexplicable*. The King's Fund. www.kingsfund.org.uk/sites/default/files/Variations-in-health-care-good-bad-inexplicable-report-The-Kings-Fund-April-2011.pdf.

Was the fall in activity in the first year of the pandemic consistent across ethnic groups, by region and by level of deprivation?

By ethnic group

Figure 4 summarises the changes in the first Covid year procedure rates relative to the pre-Covid year across all the procedure groups. Appendix G includes an explanation of the form of Figure 4 (and similar figures), including how we calculated the relative rate fall values.

There are several key findings:

- In terms of all elective activity, age- and sex-standardised procedure rates fell by 44% in the White group, and by a similar amount in the Mixed and Black groups. Elective procedure rates fell by 49% in the Asian group; this was equivalent to an additional 8% drop in procedures compared to the White group. The Other group's rate fell by a smaller 42%, but as noted elsewhere this may be due to overestimation because of coding issues.

- With a couple of exceptions, the fall in the rate of selected procedures was consistently larger in the Asian group than in the White group and other ethnic minority groups. The largest difference we found between the White group and an ethnic minority group was for therapeutic cardiac procedures for the Asian group. Therapeutic cardiac therapeutic procedure rates fell by 45% in the Asian group compared to 28% in the White group, equivalent to 23% fewer procedures in the Asian group.

- For cardiac procedures (both diagnostic and therapeutic), all ethnic minority groups trended towards larger rate falls than the White group (although some differences were not statistically significant).

- Dental procedures showed a unique pattern, with generally smaller falls in rates for ethnic minority groups compared with the White group.

The rate falls presented in Figure 4, and the corresponding relative falls compared to the White group are key findings of this report.

Figure 4: Falls in age- and sex-standardised procedure rates in the first Covid year relative to the pre-Covid year, by ethnic group

	Fall in rate compared to pre-Covid year					Change in rate expressed relative to White group change			
	White	Mixed	Asian	Black	Other	Mixed	Asian	Black	Other
Cardiac – diagnostic	41%	45%	52%	48%	50%	-7%	**-19%**	**-12%**	**-15%**
Cardiac – therapeutic	28%	32%	45%	35%	30%	-6%	**-23%**	**-10%**	-3%
Cataract	43%	49%	53%	53%	39%	**-11%**	**-17%**	**-19%**	**7%**
Dental	64%	62%	62%	63%	61%	**6%**	**6%**	2%	**8%**
GI Endoscopy – diagnostic	46%	45%	52%	46%	45%	1%	**-11%**	0%	1%
GI Endoscopy – therapeutic	40%	38%	48%	40%	40%	4%	**-13%**	1%	0%
Hip and knee replacements	65%	67%	72%	63%	66%	-7%	**-19%**	5%	-4%
Other elective procedures	43%	43%	47%	42%	39%	1%	**-6%**	**3%**	**7%**
All elective procedures	44%	44%	49%	44%	42%	1%	**-8%**	0%	**5%**

Notes: For the ethnic minority groups, the rate changes are expressed relative to White group rate changes, with negative numbers and red bars signifying a larger rate fall than the White group, and positive numbers and green bars signifying the opposite. Bold figures denote statistically significant differences versus the White group rate changes, at 95% confidence levels.

However, it can be instructive to translate these findings back into numbers of procedures that would make up the difference in pandemic-related rate changes between the ethnic minority groups and the White group. These are shown in Table 4, expressed as numbers of procedures missed (where there was a larger rate fall than in the White group), or additional procedures (where there was a smaller rate fall). Table 4 also shows, for context, the actual number of procedures that took place in the first year of the pandemic.

Table 4: Relative to White group rate changes, additional number of procedures, or number of procedures missed in the first Covid year, by ethnic group

Procedure group	Relative to White group changes, estimates of additional, or missed numbers of procedures				Observed number of procedures in first Covid year			
	Mixed	Asian	Black	Other	Mixed	Asian	Black	Other
Cardiac – diagnostic	-20	**-700**	**-90**	**-80**	277	3,039	674	450
Cardiac – therapeutic	-20	**-860**	**-80**	-10	308	2,836	735	499
Cataract	**-170**	**-3,450**	**-1,380**	**230**	1,367	16,710	6,071	3,780
Dental	**100**	**310**	50	**110**	1,707	5,101	3,271	1,524
Gastrointestinal endoscopy – diagnostic	80	**-5,290**	50	110	6,711	43,375	18,648	10,784
Gastrointestinal endoscopy – therapeutic	50	**-1,000**	30	10	1,159	6,898	3,330	1,926
Hip and knee replacements	-10	**-330**	40	-10	185	1,363	712	244
Other elective procedures	330	**-7,200**	**1,550**	**1,770**	24,364	106,184	58,167	27,560
All elective procedures	360	**-17,010**	-60	**2,150**	36,078	185,506	91,608	46,767

Notes: Estimates (rounded to nearest 10) of additional procedures where positive, and missed numbers of procedures where negative. Bold for groups with statistically significant differences relative to the White group.

Table 4 shows, for example, that the -8% relative difference for the Asian group for all elective procedures (that is, the difference between the Asian group rate fall of 49% and the smaller White group fall of 44%) was equivalent to around 17,000 fewer elective procedures in the Asian group.

While we see other examples of large numbers of missed procedures (for example 3,450 and 1,380 potentially missed cataract procedures for the Asian and Black groups, respectively, and 5,290 missed diagnostic gastrointestinal endoscopy procedures for the Asian group), Table 4 helps to put other findings into context. For instance, the large 19% relative rate fall in hip and knee procedures in the Asian group was equivalent to 330 procedures, while

the 15% relative fall in diagnostic cardiac procedures for the Other group represented only 80 procedures.

Three important points should be highlighted. First, it should be remembered that all ethnic groups – including the White group – experienced significant falls in activity in the first year of the pandemic. Second, for some ethnic groups and procedures, the absolute number of procedures involved was small – for example, the change in cardiac procedures for the Black group. Third, additional care should be taken with the interpretation of the numbers we set out here, given the often large pre-existing (that is, pre-Covid) differences in procedure rates we have outlined.

As an example of this latter point, we found that cataract procedures in the first Covid year for the Asian group were 17% lower than we might have expected, given White group rate changes – equivalent to 3,450 missed procedures. But in terms of *numbers* of procedures, the difference in rates between the Asian and White groups in the pre-Covid year was very much larger than this. In the pre-Covid year, the Asian group had a 59% higher than expected number of cataract procedures (estimated using rates for the White group) and this was equivalent to 12,255 extra procedures.

By region

Figure 5 summarises age- and sex-standardised procedure rate changes in the first Covid year by region, with changes in rates for all regions also shown relative to the national average rate falls. The regions are shown ordered from left to right by those most to least affected by Covid-19 in the first year of the pandemic (as measured by Covid cases and admissions; see Appendix I).

The interpretation of this figure is more complex than that for ethnic groups, with few consistent patterns. We can make some observations:

- There was no clear correlation between the regional impacts of Covid-19 (as measured by the number of cases and admissions per head of population) and changes in rates of all elective procedures. That is, we did not see the largest falls in rates in the regions most impacted by Covid (for example, the North West and London), and the most modest falls in the regions least impacted (for example, the South West).

- London residents had larger falls in standardised rates of cardiac and cataract procedures than the national average (for diagnostic cardiac procedures, for example, a 54% rate fall compared to a 42% national average fall), while hip and knee procedure rates fell more modestly than might have been anticipated (a 58% rate fall against a 64% national fall).

- North East residents experienced smaller falls in rates for all procedure groups, except for cardiac procedures, which were similar to the national average.

- Residents in the East Midlands had larger rate falls than those experienced nationally for cataract procedures (a 55% fall, compared to 43% nationally), and therapeutic gastrointestinal procedures (a 44% fall compared to 41% nationally).

- All other regions had some procedure groups with rate falls both larger and smaller than the national average (on a scale of up to +/-16% in terms of relative changes).

As with the ethnic group analysis in the previous subsection, we can restate these differences in terms of equivalent numbers of procedures. For example, London's large relative difference in rate changes for diagnostic and therapeutic cardiac procedures (22% and 21% lower than anticipated, respectively) were equivalent to 1,750 and 2,210 fewer procedures, respectively. The difference in cataracts (16% lower than anticipated) was equivalent to 6,890 fewer procedures.

The North East region's procedure rates were typically higher than anticipated, equivalent to an additional 3,230 diagnostic gastrointestinal procedures, 1,310 cataract procedures and 530 hip and knee procedures. The large relative fall in cataract procedures in the East Midlands region was equivalent to 8,300 fewer procedures.

Figure 5: Falls in age- and sex-standardised procedure rates in the first Covid year relative to the pre-Covid year, by region

	Fall in rate compared to pre-Covid year									
	National	North West	London	West Midlands	North East	Yorkshire and The Humber	East Midlands	South East	East of England	South West
Cardiac – diagnostic	42%	39%	54%	38%	43%	45%	41%	38%	40%	37%
Cardiac – therapeutic	29%	26%	44%	28%	29%	29%	28%	29%	25%	22%
Cataract	43%	38%	52%	35%	38%	35%	55%	45%	45%	51%
Dental	64%	65%	61%	69%	58%	61%	65%	66%	60%	67%
GI Endoscopy – diagnostic	46%	46%	49%	46%	40%	49%	46%	45%	48%	44%
GI Endoscopy – therapeutic	41%	41%	42%	41%	36%	43%	44%	39%	41%	37%
Hip and knee replacements	64%	66%	58%	70%	57%	67%	65%	60%	64%	69%
Other elective procedures	43%	45%	44%	49%	39%	46%	45%	40%	46%	36%
All elective procedures	45%	45%	47%	47%	40%	46%	47%	42%	46%	41%

	Change in rate expressed relative to national change								
	North West	London	West Midlands	North East	Yorkshire and The Humber	East Midlands	South East	East of England	South West
Cardiac – diagnostic	**4%**	**-22%**	**6%**	-3%	**-7%**	0%	**5%**	3%	**8%**
Cardiac – therapeutic	**4%**	**-21%**	2%	0%	0%	2%	0%	**6%**	**9%**
Cataract	**9%**	**-16%**	**15%**	**9%**	**15%**	**-21%**	**-3%**	**-3%**	**-13%**
Dental	**-5%**	**7%**	**-14%**	**16%**	**7%**	-3%	**-6%**	**10%**	**-10%**
GI Endoscopy – diagnostic	**1%**	**-4%**	0%	**11%**	**-6%**	**1%**	**3%**	**-3%**	**3%**
GI Endoscopy – therapeutic	-1%	**-3%**	-1%	**8%**	**-3%**	**-6%**	**3%**	0%	**6%**
Hip and knee replacements	**-4%**	**18%**	**-16%**	**20%**	**-8%**	-1%	**13%**	1%	**-12%**
Other elective procedures	**-3%**	**-1%**	**-10%**	**8%**	**-4%**	**-4%**	**7%**	**-5%**	**13%**
All elective procedures	**0%**	**-4%**	**-4%**	**8%**	**-2%**	**-4%**	**5%**	**-3%**	**7%**

Notes: The rate changes expressed relative to national rate changes have negative numbers and red bars signifying a larger rate fall than nationally, and positive numbers and green bars signifying the opposite. Bold figures denote statistically significant differences versus national rate changes, at 95% confidence levels. Regions are ordered from high to low Covid-19 impact.

By decile of deprivation

Figure 6 shows differences in age- and sex-standardised procedure rate changes by decile of deprivation – from the most deprived areas to the most affluent areas. As with the regional analysis, all changes are shown relative to the national average fall in rates.

While individual decile rate falls were often not significantly different from national average rate falls, the overall trend was for the most deprived areas to have larger than average rate falls (with the more affluent areas having lower than average falls). This applied to all elective procedures overall and to diagnostic cardiac, cataract and hip and knee procedures. The last of these showed the largest gradient in terms of relative rate changes, with a 13% larger rate fall in the most deprived area compared with the national rate fall and a 7% smaller rate fall in the least deprived decile. The pattern was less clear for therapeutic gastrointestinal, dental and therapeutic cardiac procedures. The most affluent areas appeared to have the largest rate falls in diagnostic gastrointestinal procedures.

In terms of the numbers of procedures, the two most deprived decile areas had equivalent to 1,670 fewer cataract procedures, 740 fewer hip and knee procedures, and 270 fewer diagnostic cardiac procedures than they otherwise might have, had rates changed the same as nationally. There were 2,740 more gastrointestinal endoscopy procedures in the two most deprived decile areas, but 2,170 fewer in the two most affluent decile areas.

Figure 6: Falls in age- and sex-standardised procedure rates in the first Covid year relative to the pre-Covid year, by deprivation decile

	Fall in rate compared to pre-Covid year										
	National	1 (most deprived)	2	3	4	5	6	7	8	9	10 (least deprived)
Cardiac – diagnostic	42%	43%	44%	45%	43%	41%	39%	40%	40%	41%	40%
Cardiac – therapeutic	29%	28%	29%	29%	30%	28%	28%	28%	28%	29%	31%
Cataract	43%	44%	45%	45%	43%	43%	43%	41%	43%	42%	42%
Dental	64%	63%	64%	63%	63%	63%	64%	63%	63%	65%	62%
GI Endoscopy – diagnostic	46%	45%	45%	45%	46%	46%	46%	47%	47%	47%	47%
GI Endoscopy – therapeutic	41%	40%	38%	40%	40%	41%	40%	41%	42%	42%	41%
Hip and knee replacements	64%	69%	67%	66%	67%	65%	64%	63%	63%	63%	62%
Other elective procedures	43%	45%	45%	44%	44%	43%	43%	43%	43%	42%	42%
All elective procedures	45%	46%	45%	45%	45%	45%	45%	44%	44%	44%	44%

	Change in rate expressed relative to national change									
	1 (most deprived)	2	3	4	5	6	7	8	9	10 (least deprived)
Cardiac – diagnostic	-3%	**-4%**	**-6%**	-3%	1%	**4%**	3%	2%	1%	2%
Cardiac – therapeutic	2%	-1%	0%	-2%	1%	1%	1%	2%	-1%	-3%
Cataract	**-2%**	**-4%**	**-4%**	-1%	-1%	1%	**3%**	1%	**2%**	**2%**
Dental	1%	**-2%**	1%	2%	0%	-1%	2%	0%	**-4%**	3%
GI Endoscopy – diagnostic	**2%**	**2%**	**2%**	0%	0%	-1%	**-2%**	**-1%**	-1%	**-2%**
GI Endoscopy – therapeutic	0%	**4%**	1%	1%	-1%	1%	-1%	-2%	-2%	-1%
Hip and knee replacements	**-13%**	**-6%**	-3%	**-6%**	0%	1%	**3%**	**4%**	**4%**	**7%**
Other elective procedures	**-4%**	**-2%**	**-1%**	0%	0%	0%	**1%**	**1%**	**2%**	**2%**
All elective procedures	**-2%**	**-1%**	**-1%**	0%	0%	0%	**1%**	**1%**	**2%**	**1%**

Notes: The rate changes expressed relative to national rate changes have negative numbers and red bars signifying a larger rate fall than nationally, and positive numbers and green bars signifying the opposite. Bold figures denote statistically significant differences versus national rate changes, at 95% confidence levels.

Were ethnic variations consistent within the regions?

Ideally, we would have liked to have analysed ethnic differences having adjusted for deprivation and region, and possibly other factors. However, underlying population data of the kind needed for such analyses do not currently exist. Nevertheless, we were able to analyse changes in elective activity by ethnicity and region.

Figure 7 shows the changes in age- and sex-standardised procedure rates for ethnic minority groups in the first Covid year relative to the pre-Covid year, for each region separately. Part (a) shows cardiac procedures (with both diagnostic and therapeutic procedure groups merged), part (b) shows cataract procedures and part (c) shows all elective procedures.

Figure 4 showed that for all procedures, and for cardiac and cataract procedures, the Asian group had significantly larger falls in rates nationally than the White group in the first Covid year. This regional analysis shows that the same was true within almost every region of England; that is, this was not a localised effect caused by the impacts of the pandemic in specific regions. Differences between regions for the Black group were more mixed, but the numbers of procedures at the regional level for Black, Mixed and Other groups were small in many cases.

Figure 7: Falls in age- and sex-standardised procedure rates for selected and all procedures in the first Covid year relative to the pre-Covid year, by ethnic group and region

a) Cardiac

	Fall in rate compared to pre-Covid year					Change in rate expressed relative to White group change			
	White	Mixed	Asian	Black	Other	Mixed	Asian	Black	Other
North West	32%	37%	40%	29%	14%	-8%	**-11%**	4%	27%
London	47%	50%	55%	48%	49%	-6%	**-14%**	-1%	-4%
West Midlands	32%	40%	43%	26%	40%	-11%	**-16%**	9%	-12%
North East	36%	27%	39%	61%	48%	13%	-5%	-39%	-19%
Yorkshire and The Humber	37%	32%	45%	37%	56%	7%	**-14%**	0%	-30%
East Midlands	33%	33%	57%	14%	35%	1%	**-35%**	28%	-2%
South East	33%	33%	40%	37%	30%	0%	**-9%**	-5%	5%
East of England	31%	35%	50%	47%	23%	-6%	**-28%**	**-23%**	11%
South West	29%	12%	49%	47%	26%	24%	**-28%**	-25%	5%

b) Cataract

	Fall in rate compared to pre-Covid year					Change in rate expressed relative to White group change			
	White	Mixed	Asian	Black	Other	Mixed	Asian	Black	Other
North West	38%	51%	48%	41%	31%	**-20%**	**-16%**	-5%	11%
London	51%	53%	57%	57%	52%	-2%	**-11%**	**-11%**	-1%
West Midlands	34%	54%	45%	43%	35%	**-31%**	**-17%**	**-14%**	-2%
North East	38%	34%	47%	76%	-180%	6%	-15%	**-61%**	**348%**
Yorkshire and The Humber	34%	38%	48%	42%	32%	-5%	**-21%**	-12%	4%
East Midlands	55%	42%	63%	57%	61%	**28%**	**-18%**	-6%	-13%
South East	46%	50%	50%	53%	34%	-7%	**-8%**	**-13%**	**22%**
East of England	45%	46%	49%	53%	49%	-2%	**-8%**	**-15%**	-7%
South West	51%	51%	56%	56%	-8%	-1%	-10%	-11%	**119%**

c) All elective procedures

	Fall in rate compared to pre-Covid year					Change in rate expressed relative to White group change			
	White	Mixed	Asian	Black	Other	Mixed	Asian	Black	Other
North West	45%	48%	47%	43%	45%	**-6%**	**-4%**	3%	-1%
London	47%	45%	51%	45%	45%	**4%**	**-8%**	**4%**	**5%**
West Midlands	47%	48%	48%	46%	44%	-3%	**-3%**	0%	**6%**
North East	40%	36%	44%	48%	29%	6%	**-8%**	**-14%**	**18%**
Yorkshire and The Humber	46%	43%	51%	47%	46%	4%	**-10%**	-2%	-1%
East Midlands	46%	45%	50%	44%	45%	3%	**-7%**	**4%**	3%
South East	42%	39%	46%	39%	33%	**6%**	**-6%**	**5%**	**17%**
East of England	46%	44%	49%	47%	43%	**5%**	**-6%**	-1%	**6%**
South West	41%	39%	45%	44%	32%	3%	**-6%**	-5%	**15%**

Notes: Negative rate fall numbers represent increases in rates. For the ethnic minority groups, the rate changes are expressed relative to White group rate changes, with negative numbers and red bars signifying a larger rate fall than the White group, and positive numbers and green bars signifying the opposite. Bar lengths have been capped at a maximum of 60% (in either direction) for presentational reasons. Bold figures denote statistically significant differences versus the White group rate changes, at 95% confidence levels. Regions are ordered in descending order from high to low Covid-19 impact.

Were procedure rate changes in the second year of the pandemic consistent across ethnic groups?

Table 3 earlier in this chapter outlined the counts of elective procedures in the second year of the pandemic (March 2021 to February 2022) compared with the pre-Covid year (March 2019 to February 2020). It showed that there was a partial recovery in the second year – with all elective procedures down in volume by 18% on the pre-Covid year, compared with 45% during the first year. Hip and knee, cataract and dental procedures increased in volume the most between the first and second years (with the number of hip and knee procedures more than doubling). During the second year, cataract procedures were only 1% lower than in the pre-Covid year, but numbers of diagnostic cardiac and dental procedures were still 30% or more lower than in the pre-Covid year.

We analysed age- and sex-standardised procedure rates in the second year of the pandemic to find out whether the patterns of ethnic differences seen in the first year were also seen in the second year.

Figure 8 summarises the changes in the second Covid year across ethnic groups for selected and all procedures, in a similar way to Figure 4 for the first year. The changes in rates noted here are all relative to the pre-Covid year.

Many of the trends observed in the first year of the pandemic persisted into the second year. Some key observations are as follows:

- In terms of all elective procedures, the Asian group showed a larger fall in age- and sex-standardised procedure rates relative to the White group in the second Covid year (20% versus 19% in the White group), although this was a more modest relative fall than in the first year (a 2% relative difference, versus 8% in the first year – see Figure 4). The other ethnic minority groups (Mixed, Black and Other) had smaller rate falls in the second year than the White group (at 16%, 15% and 13% respectively); that is, their recovery was slightly more pronounced than the White and Asian groups.

- The Asian group showed a larger fall in rates relative to the White group for all selected procedures except for dental procedures. For other ethnic minority groups the fall in rates was generally either not statistically significantly different from the White group's fall in rates, or was smaller. Cataract procedures in the Black group were the exception to this: they fell by 7%, more than the rate fall of 2% in the White group.

- For diagnostic gastrointestinal procedures, the Mixed, Black and Other groups showed higher rates of recovery than the White group, and the Mixed and Asian groups had higher rates of recovery than the White group for dental procedures.

Figure 8: Falls in age- and sex-standardised procedure rates in the second Covid year relative to the pre-Covid year, by ethnic group

	Fall in rate compared to pre-Covid year					Change in rate expressed relative to White group change			
	White	Mixed	Asian	Black	Other	Mixed	Asian	Black	Other
Cardiac – diagnostic	31%	34%	36%	30%	31%	-5%	**-8%**	1%	0%
Cardiac – therapeutic	19%	13%	27%	24%	15%	7%	**-10%**	-6%	5%
Cataract	2%	-1%	6%	7%	2%	3%	**-4%**	**-6%**	0%
Dental	36%	32%	34%	35%	38%	**6%**	**3%**	2%	-2%
GI Endoscopy – diagnostic	21%	19%	24%	18%	17%	**3%**	**-4%**	**4%**	**5%**
GI Endoscopy – therapeutic	8%	3%	11%	7%	1%	5%	**-3%**	1%	**8%**
Hip and knee replacements	27%	26%	35%	25%	32%	1%	**-10%**	3%	-6%
Other elective procedures	20%	17%	22%	15%	13%	**3%**	**-3%**	**6%**	**9%**
All elective procedures	19%	16%	20%	15%	13%	**4%**	**-2%**	**5%**	**7%**

Notes: Negative rate fall numbers represent increases in rates. For the ethnic minority groups, the rate changes are expressed relative to White group rate changes, with negative numbers and red bars signifying a larger rate fall than the White group, and positive numbers and green bars signifying the opposite. Bold figures denote statistically significant differences versus the White group rate changes, at 95% confidence levels.

The Asian group's relatively large fall in rates of all elective procedures (compared to the White group) was equivalent to a deficit of 6,640 procedures in the second year. The Black and Mixed groups' more modest rate falls during this period were equivalent to 6,270 and 1,960 additional procedures, respectively.

5 Discussion and implications

What did we find?

Our analysis shows ethnic variations in both the rates of elective activity before the Covid-19 pandemic and falls in activity during the first two years of the pandemic. Before the pandemic, the White group had the highest overall rate for elective procedures,[40] although this was not the case for certain procedure groups, notably cardiac and cataract procedures.

In the first year of the pandemic, the Asian group experienced larger falls in all elective activity than the other ethnic minority groups and the White group, and also for most of the seven selected procedure groups. The Black group showed larger falls than the White group for cardiac and cataract procedures, although there was no difference overall for all elective procedures.

By the second year of the pandemic, overall activity was still below pre-pandemic levels but less so for ethnic minority groups compared with the White group, with the exception of the Asian group, which still experienced a greater deficit across all procedures except in dentistry.

We also examined differences by region and deprivation, although we were only able to look at the interaction between ethnicity and region and not ethnicity and deprivation.

40 Discounting the Other group since as, outlined earlier in this report, high rates for this group were likely to be overestimates due to known data coding problems.

Before the pandemic, rates of all elective procedures were higher in the most deprived decile, reflecting higher morbidity,[41] but this pattern was not the case for hip and knee replacements or for therapeutic cardiac or gastrointestinal endoscopy procedures. There was a clear deprivation gradient in lost activity due to the pandemic, with larger falls in the most deprived deciles for all activity, and most procedure groups.

Regional variations in rates did not relate to regional differences in Covid-19 impacts. For cataract procedures, cardiac procedures and all procedures, we examined ethnic differences within regions. The Asian group showed a large fall relative to other groups across all regions.

What do our findings mean?

Our analysis of elective procedures for the first two years of the pandemic adds to what is already known about ethnic variations in elective care and the impact of Covid-19:

- While the pre-pandemic ethnic variations in some procedure groups, notably cardiac procedures, are consistent with known epidemiology, we have identified variation in other areas that requires further investigation to understand whether there are differences in risk factors, disease prevalence, severity, access to care or uptake of care.

41 Office for National Statistics (2022) 'Health state life expectancies by national deprivation deciles, England: 2018 to 2020'. www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthinequalities/bulletins/healthstatelifeexpectanciesbyindexofmultipledeprivationimd/2018to2020#:~:text=In%202018%20to%202020%2C%20male,deprived%20areas%20(70.7%20years). Accessed 27 August 2022

- Previous studies on the early part of the pandemic did not find clear evidence of ethnic differences in reductions in planned care.[42,43,44] Due to differences in time periods, patient cohorts, population data and methods used, our results are not directly comparable to the results of those studies.

- Our analysis found typically larger falls in activity in more deprived areas, confirming that service disruption during the pandemic impacted the most deprived groups the most. Before the pandemic, the most deprived areas had higher rates of elective procedures overall, although this was not the case for certain procedure groups. However, we were unable to assess the extent to which ethnic differences reflect deprivation effects, as we could not adjust for deprivation using the population data available.

- Specific procedure groups recovered towards pre-Covid-19 levels to varying degrees in the second year of the pandemic, with cataract procedures almost fully recovered, but only 73% of hip and knee replacements, 70% of diagnostic cardiac procedures and 65% of dental procedures being undertaken. These differences will reflect a range of service delivery factors, from the extent to which activity can be undertaken in elective centres (whether in the NHS or independent providers), to the need for inpatient beds, or intensive care unit bed back-up, and prioritisation decisions and capacity in different specialties. For no procedure groups did the recovery in the second year of the pandemic fully address the deficit in care from the first year.

42 Warner M, Burn S, Stoye G, Aylin PP, Bottle A and Propper C (2021) 'Socioeconomic deprivation and ethnicity inequalities in disruption to NHS hospital admissions during the Covid-19 pandemic: a national observational study', *BMJ Quality & Safety* 31(8), 590–8. https://qualitysafety.bmj.com/content/early/2021/11/24/bmjqs-2021-013942. Accessed 27 August 2022.

43 Burn S, Propper C, Stoye G and Warner M with Aylin P and Bottle A (2021) *What Happened to English NHS Hospital Activity during the Covid-19 Pandemic?* Institute for Fiscal Studies. https://ifs.org.uk/uploads/BN328-What-happened-to-English-NHS-hospital-activity-during-the-COVID-19-pandemic.pdf.

44 Shah SA, Brophy S, Kennedy J, Fisher L, Walker A, Mackenna B, Curtis H, Inglesby P, Davy S, Bacon S, Goldacre B, Agrawal U, Moore E, Simpson CR, Macleod J, Cooksey R, Sheikh A and Katikireddi SV (2022) 'Impact of first UK Covid-19 lockdown on hospital admissions: interrupted time series study of 32 million people', *eClinicalMedicine* 49, 101462. www.sciencedirect.com/science/article/pii/S2589537022001924. Accessed 27 August 2022.

We found significant pre-pandemic differences in procedure rates between ethnic groups. Higher cardiac procedure rates in Asian groups and lower rates in Black groups are consistent with known epidemiology, providing confirmation of our analysis and suggesting equity of access. Higher rates of cataract procedures among Asian and Black groups are also consistent with a higher prevalence of diabetes in these populations. The extent to which variations in other procedure groups reflect differences in need, access to care or other factors is unclear. For example, we found lower rates of hip and knee replacements and therapeutic gastrointestinal procedures for all ethnic minority groups.

Falls in elective activity occurred across all ethnic groups, but they were largest and most persistent for the Asian group. The larger falls in activity for the Asian group occurred irrespective of regional differences in the impact of Covid-19. We conclude that the falls for the Asian group were largely related to changes in demand, rather than being a result of service pressures.

Several factors could explain changes in demand from the Asian group, and these require further investigation. Greater exposure to Covid-19[45] may lead to greater concern about coronavirus risks, which would be consistent with survey data on attitudes to help-seeking and concern about the virus (Appendix B) . The shift towards remote consultations for many services may have impacted some Asian communities more, through such communities being less able to engage with digital modes of service delivery for which language can be a barrier.[46,47] Action is needed to address the deficit in care

45 Office for National Statistics (2021) 'Updating ethnic contrasts in deaths involving the coronavirus (Covid-19), England: 24 January 2020 to 31 March 2021'. www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/updatingethniccontrastsindeathsinvolvingthecoronaviruscovid19englandandwales/24january2020to31march2021. Accessed 27 August 2022.

46 Hutchings R and Sherlaw-Johnson C (2022) *Supporting Patient Engagement with Digital Health Care Interventions: Lessons from the Care City test bed*. Nuffield Trust. www.nuffieldtrust.org.uk/files/2022-04/1651161363_supporting-patient-engagement-web.pdf.

47 GOV.UK (2018) 'English language skills: by ethnicity'. www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/english-language-skills/latest#by-ethnicity. Accessed 27 August 2022.

for this group, particularly for cardiac procedures, where activity has not resumed to pre-pandemic levels, and where there is significantly greater need in the Asian group. Our analysis unavoidably grouped Asian ethnic groups together and could not take account of variations among Asian sub-groups, for example between Pakistani and Bangladeshi communities, who experience more deprivation and worse health than Indian or Chinese communities. Interventions to address unmet need will need to take account of the specific circumstances of local communities and differences between the Asian ethnic groups.

While our focus in this research was on ethnic variations, we also considered regional variation and variation by deprivation. These dimensions are closely linked to ethnicity, because ethnic minority groups are disproportionately represented in more deprived areas and in cities and some regions.

Falls in elective activity in the first and second years of the pandemic were not related to Covid-19 rates at a regional level, although elective care is but one part of overall health care delivery. This could reflect a combination of variation in capacity and resilience before the pandemic, as well as variation between regions in terms of action to address elective backlogs. For example, in London, recovery has focused on using specialised hubs for the treatment of high-volume conditions, which has been credited with reducing the backlog there more quickly than in other regions.[48] There is also variation in waiting times within regions, which we were not able to examine at a more granular level.[49] Ethnic variations within regions were consistent with the national picture.

We also found variation by deprivation. Higher rates of many procedure groups in the most deprived areas before the pandemic are consistent with worse health and higher levels of need in these areas, although in some cases

48 Krelle H, Barclay C and Tallack C (2021) 'Understanding the pandemic's effects on people's health and quality of life'. www.health.org.uk/publications/long-reads/waiting-for-care. Accessed 27 August 2022.

49 Flinders S (2022) 'How do waiting times for NHS planned care vary across England?'. www.nuffieldtrust.org.uk/news-item/how-do-waiting-times-for-nhs-planned-care-vary-across-england. Accessed 27 August 2022.

activity rates were lower, which could reflect worse access to elective care.[50] Overall, and across most procedure groups, activity fell more in the most deprived areas and should be a priority for recovery plans, especially given evidence that waiting lists and times are longer in more deprived areas.[51] Action to ensure health service provision in the most deprived areas is not a blanket approach, but meets the needs of the population in those areas will also be key to improving health care for all ethnic groups.

For procedure groups such as hip and knee replacements, for which there is significant privately funded activity, rates of activity were lowest in the most deprived areas, but also dipped in the least deprived decile – the latter most likely reflecting more activity in these areas being privately funded. As of the end of April 2022, there were nearly three-quarters of a million people waiting for trauma and orthopaedic treatment.[52] And with more people being prepared to pay for private treatment,[53] this could be a further factor that is likely to result in a widening difference in access between socioeconomic groups and a risk of inequalities growing further. Ethnicity data on privately funded activity are extremely limited, due to very incomplete coding.[54]

50 Wyatt S and Parsons J (2021) *Socio-economic Inequalities in Access to Planned Hospital Care: Causes and consequences*. The Strategy Unit. www.strategyunitwm.nhs.uk/sites/default/files/2021-05/socio-economic%20inequalities%20in%20access%20to%20planned%20hospital%20care%20-%20210513.pdf.

51 Holmes J and Jefferies D (2021) 'Elective backlog deprivation waiting times'. www.kingsfund.org.uk/blog/2021/09/elective-backlog-deprivation-waiting-times. Accessed 28 August 2022.

52 NHS England (no date) 'Consultant-led referral to treatment waiting times data 2022–23'. www.england.nhs.uk/statistics/statistical-work-areas/rtt-waiting-times/rtt-data-2022-23. Accessed 28 August 2022.

53 PHIN (2022) 'Private market update'. https://www.phin.org.uk/news/private-market-update-july-2022. Accessed 28 August 2022.

54 Scobie S (2022) 'Chart of the week: how does the quality of patient ethnicity data vary between private and public health care providers?'. www.nuffieldtrust.org.uk/resource/chart-of-the-week-how-does-the-quality-of-patient-ethnicity-data-vary-between-private-and-public-health-care-providers. Accessed 28 August 2022.

While the size of the deficit in the second year of the pandemic was smaller than that in the first year, it is important to note that, across the board, activity was still lower than pre-pandemic levels, with more activity to catch up on in recovery, by the end of the second year.

In our analysis we took a number of steps to address gaps and inconsistencies in ethnicity coding. However, we cannot easily evaluate the impact of data-quality problems or missing data on our results – for example the 5% of activity with unknown ethnicity that we nevertheless assigned to an ethnic group, or the 6% of activity we could not include in our analyses due to patients choosing not to state an ethnicity. The available population estimates for ethnic groups also limited our analysis. However, our findings on pre-pandemic variations are consistent with known epidemiology, where this is available. We used broad ethnic groups to reduce the uncertainty that small numbers of events at the procedure group level in some ethnic groups cause, and to address variation in coding quality. As a result, our analysis could not consider important potential differences between Asian sub-groups (such as Indian, Pakistani, Bangladeshi and Other Asian groups) and between Black sub-groups (Black Caribbean, Black African and Black Other) in terms of socioeconomic characteristics, health status and level of need.

Future work on ethnicity will be able to use updated ethnic population estimates from the 2021 Census, which will become available during 2022. Further, work that the Office for National Statistics has carried out on ethnic inequalities in Covid-19 mortality has shown the potential for data linkage to enable robust analysis of ethnic differences.[55] Access to linkable Census records is necessarily limited because of data protection reasons but there is an opportunity for the 2021 Census to provide cross-validation with health records, and potentially a one-time cleanse of health and other records. The Census will also provide updated information on key socioeconomic characteristics that are essential for robust epidemiological analyses.

55 Office for National Statistics (2022) 'Updating ethnic contrasts in deaths involving the coronavirus (COVID-19), England: 10 January 2022 to 16 February 2022'. www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/updatingethniccontrastsindeathsinvolvingthecoronaviruscovid19englandandwales/10january2022to16february2022#:~:text=Between%2010%20January%202022%20and,the%20third%20wave%20of%20the Accessed 20 October 2022

While we did not include procedures carried out during an emergency admission in our analysis, some of the 'lost' elective activity may have taken place as emergency activity. Emergency admissions did not drop as sharply as planned admissions, and there is emerging evidence of a shift whereby some activity that would have previously been planned is occurring as an emergency, for example there has been an increase in unscheduled diagnostic tests and more cancers being diagnosed via emergency services.[56] Meanwhile, referrals to secondary care from GPs have not increased to the level that would be needed to address the gap in activity. As a result of both these factors, the increase in the waiting list in the recovery period is lower than the 'lost' activity during the Covid-19 pandemic. This will have implications for inequalities in access to and quality of care.

What needs to happen next?

We found that the pandemic resulted in a deficit in elective care, which disproportionately impacted people in deprived areas, who had higher health care needs. This unequal impact of the pandemic could lead to later diagnosis and worse outcomes for more deprived populations[57] and widen health inequalities further – especially as deprived groups were also disproportionately impacted directly by Covid-19.[58]

As NHS England and ICSs seek to address the backlog in care, it is vital that planned action to address inequalities in access is reinforced and prioritised, even though there will be pressure to reduce waiting lists overall. NHS England and ICSs must monitor and evaluate the impact of changes to patient

56 Davies J (2021) 'Chart of the week: the pathway to cancer diagnosis'. www.nuffieldtrust.org.uk/resource/chart-of-the-week-the-pathway-to-cancer-diagnosis. Accessed 28 August 2022.

57 Holmes and Jefferies (2021) 'Tackling the elective backlog – exploring the relationship between deprivation and waiting times', King's Fund blog, 27 September. www.kingsfund.org.uk/blog/2021/09/elective-backlog-deprivation-waiting-times

58 ONS (2022) Updating ethnic contrasts in deaths involving the coronavirus (COVID-19), England: 10 January 2022 to 16 February 2022. www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/updatingethniccontrastsindeathsinvolvingthecoronaviruscovid19englandandwales/10january2022to16february2022

pathways introduced to manage the backlog in elective care, as there is evidence that disadvantaged groups may be further disadvantaged by needing to navigate an increasingly complex health system.[59,60]

ICSs and NHS providers must address the large and sustained deficit in cardiac care for Asian groups, who have the highest prevalence of and mortality from heart disease of all ethnic groups. Hospital activity for both therapeutic and diagnostic cardiac procedures activity fell more sharply and has recovered less quickly than activity for other procedure groups. As these patterns appear to be demand-led, they could reflect a wider issue of lower uptake among Asian groups of preventative and therapeutic cardiac care across primary, community and outpatient services, also resulting in significant unmet need.

Commissioners and service providers should engage with communities to understand and address the reasons for lower uptake of elective care among Asian groups across all clinical areas. NHS England should examine the reasons for regional differences in delivery of elective care. Regional falls in activity were not related to differing Covid-19 rates but may reflect pre-pandemic capacity and resilience, differences in addressing the elective backlog, or differences in workforce and resources in specific clinical areas.

Further work is needed by policy makers and professionals to understand the reasons for pre-pandemic variations in elective hospital care between ethnic groups and whether they are commensurate with need: while some differences reflect known epidemiological patterns, we found some variations where evidence on underlying risk factors or levels of need is not available. More research is also needed to understand differences in expectations, access, and barriers to care, between socioeconomic and ethnic groups.

59 Ip A and others (2022) 'Socioeconomic differences in help seeking for colorectal cancer symptoms during COVID-19: a UK-wide qualitative interview study', *British Journal of General Practice* 72 (720): e472-e482 https://bjgp.org/content/72/720/e472

60 Ip A and others (2022) 'Healthcare professional and patient perceptions of changes in colorectal cancer care delivery during the COVID-19 pandemic and impact on health inequalities', *Cancer Control*, Online First. https://journals.sagepub.com/doi/10.1177/10732748221114615

Good quality data is the cornerstone of a high-quality and equitable health care system. However, action planned by NHS England and integrated care boards to monitor ethnic inequalities is hampered by inconsistent, incorrect and incomplete coding of ethnicity in health records. Despite numerous recommendations to address this, we see little progress. The ongoing inaction with regard to addressing poor quality data may be seen to reflect a lack of purpose and leadership by national bodies. Urgent action is needed by the Department of Health and Social Care to publish updated guidance for the NHS, GPs and social care, and set out how the new standards for ethnicity data[61] will be implemented across health and social care. This is essential if NHS England, integrated care boards and other NHS organisations are to meet their statutory obligations to tackle health inequalities, and take account of ethnicity in their elective recovery work.[62] Within the Health and Care Act 2022 there is provision for NHS England to set out the powers of NHS bodies to collect data relating to inequalities in access and how those powers should be used.

National clinical audits have a role to play in providing a better understanding of ethnic variation in case mix, access to and uptake of care, and outcomes, and there is an urgent need to improve ethnicity coding to enable such analyses. The Healthcare Quality Improvement Partnership should take a lead on this.

Our work emphasises the importance of integrated care boards taking steps to understand and address socio-economic and ethnic inequalities. This will need improved data quality and recording of ethnicity for all users of GP, hospital and community services, in order to track patients through the health care system. Integrated Care Boards need to own the data and analysis, but national organisations can support local analysis through addressing previous recommendations to improve coding.

61 www.gov.uk/government/consultations/standards-for-ethnicity-data/standards-for-ethnicity-data

62 www.england.nhs.uk/wp-content/uploads/2021/12/B1269-elective-recovery-planning-supporting-guidance.pdf

Finally, although improvements in data quality are needed, limitations with data should not be an excuse for inaction. Much more can be done now with currently available data to understand and address ethnic and other inequalities in health care, as was demonstrated during the Covid-19 pandemic.

Appendix A: Evidence of ethnic differences in risk factors, disease prevalence and health care relevant to the procedure groups

Table A1 highlights evidence we identified about ethnic differences in risk factors, disease prevalence and health care relevant to the groups of procedures included in this research.

Table A1: Risk factors, disease prevalence and health care relevant to the procedure groups

Condition	Evidence relating to ethnicity
Cataracts	Diabetes, which is more common in South Asian groups, is a risk factor for cataracts[63] and higher rates have been reported in people with a South Asian origin.[64] Diabetes prevalence is also higher in Black groups. Rates of cataract procedures vary across England, with slightly higher rates in more deprived areas.[65]
Cardiac conditions	South Asian groups have a higher prevalence of heart disease, while Black groups have a lower prevalence. Mortality from heart disease is also higher in Asians (ref ONS report on ethnic diffs in cause-specific mortality). Research has found that South Asian groups have equitable access to care for heart disease and better survival rates from it, while Black groups have lower than expected rates of access to and use of cardiovascular care.[66]

63 Day AC, Wormald R, Coronini-Cronberg S, Smith R and Royal College of Ophthalmologists Cataract Surgery Commissioning Guidance Development Group (2016) 'The Royal College of Ophthalmologists' cataract surgery commissioning guidance: executive summary', *Eye* 30(3), 498–502.

64 Rauf A, Malik R, Bunce C and Wormald R (2013) 'The British Asian community eye study: outline of results on the prevalence of eye disease in British Asians with origins from the Indian subcontinent', *Indian Journal of Ophthalmology* 61(2), 53–8

65 Quick user guide' in Public Health England (2021) *Atlas of Variation in Risk Factors and Healthcare for Vision in England*. Public Health England. https://fingertips.phe.org.uk/documents/Cataract_Surgery_20210817.pdf.

66 Raleigh V and Holmes J (2021) 'The health of people from ethnic minority groups in England'. www.kingsfund.org.uk/publications/health-people-ethnic-minority-groups-england#CVD. Accessed 28 August 2022.

Condition	Evidence relating to ethnicity
Hip and knee replacements	The main underlying condition leading to joint replacement is osteoarthritis, for which risk factors are age, obesity and previous injury. Ethnic differences in the prevalence of osteoarthritis have been found in the US, but in the UK no data on this are available. The National Joint Registry does not collect data on ethnicity. Higher rates of arthritis and joint problems have been found in more deprived areas, which may be related to higher rates of obesity.[67] Yet there are lower rates of hip and knee replacement in more deprived areas.[68] Lower rates have also been found in Black and Asian groups.[69]

67 Office for Health Improvement and Disparities (no date) 'Public health profiles'. https://fingertips.phe.org.uk/search/arthritis#page/7/gid/1/ati/15/iid/384/age/168/sex/4/cat/-1/ctp/-1/yrr/1/cid/4/tbm/1/page-options/ine-ao-1_ine-yo-1:2016:-1:-1_ine-ct-113_ine-pt-0. Accessed 28 August 2022.

68 Wyatt S and Parsons J (2021) *Socio-economic Inequalities in Access to Planned Hospital Care: Causes and consequences*. The Strategy Unit. www.strategyunitwm.nhs.uk/sites/default/files/2021-05/socio-economic%20inequalities%20in%20access%20to%20planned%20hospital%20care%20-%20210513.pdf.

69 Smith MC, Ben-Shlomo Y, Dieppe P, Beswick AD, Adebajo AO and Wilkinson JM (2017) 'Rates of hip and knee joint replacement amongst different ethnic groups in England: an analysis of National Joint Registry data'. *Osteoarthritis and Cartilage* 25(4), 448–54. www.oarsijournal.com/article/S1063-4584(17)30043-2/fulltext. Accessed 27 August 2022.

Condition	Evidence relating to ethnicity
Dental health	There is a strong socioeconomic gradient in oral health, with adults and children in more deprived groups more likely to have poor oral health and higher risk factors (such as consumption of sugary drinks and less frequent tooth brushing) than less deprived groups.[70] Analysis of the 2009 Adult Dental Health Survey by ethnic group found that minority ethnic groups generally had better oral health than the White population.[71] Higher rates of oral health problems in children aged under five have been found for Asian groups than for others.[72] Access to an NHS dentist is worst for Black and Asian ethnic groups.[73]

70 Public Health England (2021) *Inequalities in Oral Health in England*. Public Health England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970380/Inequalities_in_oral_health_in_England.pdf.

71 Arora G, Mackay DF, Conway DI and Pell JP (2017) 'Ethnic differences in oral health and use of dental services: cross-sectional study using the 2009 Adult Dental Health Survey', *BMC Oral Health* 17, 1. https://doi.org/10.1186/s12903-016-0228-6. Accessed 28 August 2022.

72 Public Health England (2020) *National Dental Epidemiology Programme for England: Oral health survey of 5-year-olds 2019: A report on the variations in prevalence and severity of dental decay*. Public Health England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/873492/NDEP_for_England_OH_Survey_5yr_2019_v1.0.pdf.

73 Public Health England (2021) *Inequalities in Oral Health in England*. Public Health England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970380/Inequalities_in_oral_health_in_England.pdf.

Condition	Evidence relating to ethnicity
Gastrointestinal conditions	We identified limited evidence relating to ethnic variations in gastrointestinal conditions. One study found lower rates of GP referral for gastroscopy from practices with a higher proportion of South Asian patients.[74] Geographical variation in referral rates may be related to the distribution of trained endoscopists.[75]

74 Mendonca SC, Abel GA, Gildea C, McPhail S, Peake MD, Rubin G, Singh H, Hamilton W, Walter FM, Roland MO and Lyratzopoulos G (2019) 'Associations between general practice characteristics with use of urgent referrals for suspected cancer and endoscopies: a cross-sectional ecological study', *Family Practice* 36(5), 573–80.

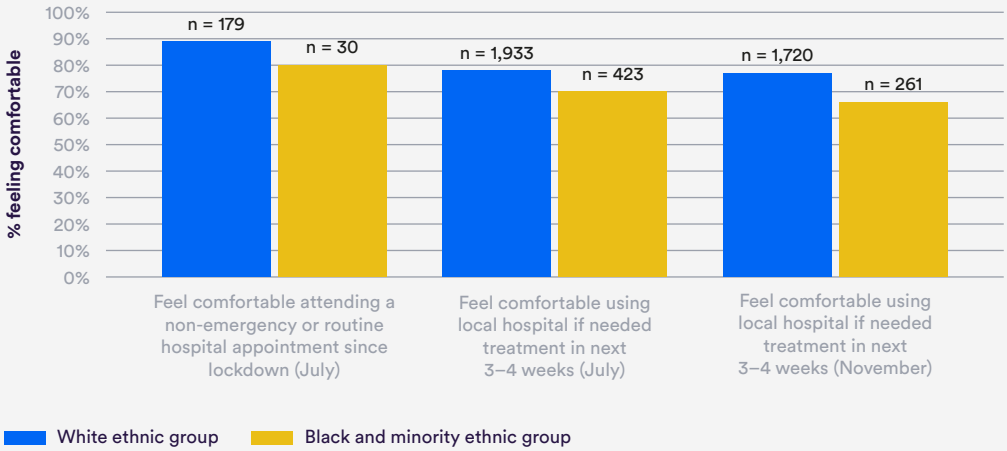
75 'Endoscopy services' in Public Health England (2017) *The Second Atlas of Variation in NHS Diagnostic Services in England*. Public Health England. https://fingertips.phe.org.uk/documents/Diag_2016_EndoscopyServices.pdf.

Appendix B: Evidence of ethnic differences in help-seeking

There is some evidence of ethnic differences in health behaviour and confidence in using health services. An Ipsos MORI survey for The Health Foundation, conducted in July and November 2020, found that people from White backgrounds were significantly more likely than people from ethnic minority backgrounds to feel comfortable using their local hospital services (see Figure B1).[76] This difference was consistent at both time periods, and also among people who had used services since lockdown, although this group reported higher levels of confidence than those who had not. Among respondents who were not comfortable using health services in the following three to four weeks, concerns about catching Covid-19 accounted for the reason in more than half of cases at both time periods. At the time of the November survey, different levels of lockdown were in place across England. Respondents in areas with more stringent restrictions were more likely than others to be concerned about catching Covid-19 in health care settings.

76 Health Foundation (2021) 'Public perceptions of health and social care in light of COVID-19' www.health.org.uk/publications/public-perceptions-of-health-and-social-care-in-light-of-covid-19-november-2020. Accessed 2 September 2022.

Figure B1: Differences between ethnic groups in feeling comfortable using hospital services, July and November 2020



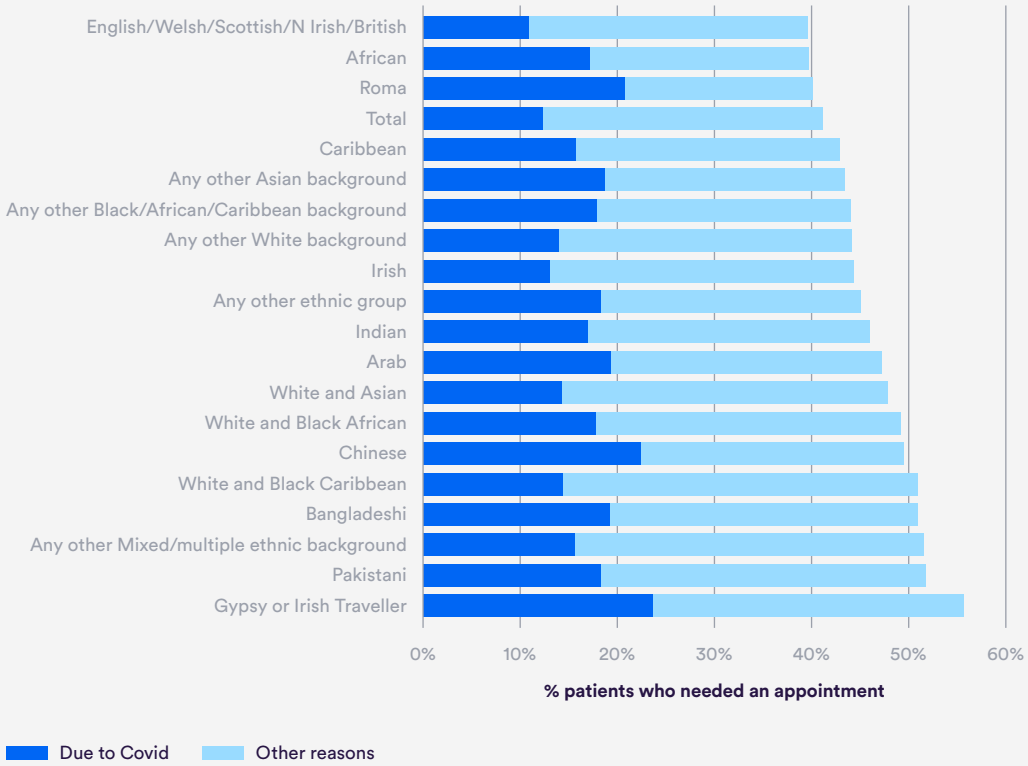
Source: Nuffield Trust analysis of Ipsos MORI poll conducted for The Health Foundation.

In terms of primary care, the GP Patient Survey, conducted between January and April 2021, found differences in whether patients had avoided making a general practice appointment in the previous 12 months and the reasons for this (see Figure B2).[77] There were substantial differences between ethnic groups, with Pakistani and Bangladeshi patients in particular avoiding care. However, separate analysis of GP consultation data found higher consultation rates among Pakistani and Bangladeshi ethnic groups before the pandemic and this has continued.[78]

77 NHS GP patient survey results (2022) www.gp-patient.co.uk/surveysandreports. Accessed 2 September 2022.

78 Watt T, Kelly E and Fisher R (2021) 'Use of primary care during the Covid-19 pandemic: May 2021 update'. www.health.org.uk/news-and-comment/charts-and-infographics/use-of-primary-care-during-the-covid-19-pandemic-may-2021. Accessed 28 August 2022.

Figure B2: Percentage of patients avoiding making a general practice appointment in the previous 12 months due to Covid-19 or other reasons



Notes: Respondents were given the option of ticking the following answer, the results of which are shown here: 'Yes, because I was worried about the risk of catching Covid-19'. The denominator excludes patients who did not need an appointment.

Source: Nuffield Trust analysis of GP Patient Survey 2021, question 50.

There is also consistent evidence of higher uptake of Covid-19 vaccines among White groups, with the lowest uptake among Black, Pakistani and Bangladeshi ethnic groups.[79] It is unclear whether the factors that contribute to vaccine hesitancy,[80] such as distrust in the vaccine and lack of communication from trusted providers, may also contribute to attitudes to accessing other health services.

79 NHS (2021) 'Covid-19 vaccinations'. NHS England and NHS Improvement. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.england.nhs.uk%2Fstatistics%2Fwp-content%2Fuploads%2Fsites%2F2%2F2021%2F12%2FCOVID-19-monthly-announced-vaccinations-09-December-2021.xlsx&wdOrigin=BROWSELINK. Accessed 30 August 2022.

80 Scientific Advisory Group for Emergencies (2021) 'Factors influencing Covid-19 vaccine uptake among minority ethnic groups'. www.gov.uk/government/publications/factors-influencing-covid-19-vaccine-uptake-among-minority-ethnic-groups-17-december-2020. Accessed 30 August 2022

Appendix C: Selection of elective procedure groups for analysis

For our analysis, to understand a broad range of elective activity, we selected a set of common procedures with different features, outlined in Table C1. Table C2 lists the OPCS Classification of Interventions and Procedures (OPCS-4) procedure codes we used to identify elective inpatient activity belonging to each of the procedure groups.

Table C1: Procedure groups included in the analysis

Procedure group	Features/rationale for selection
Cardiac – diagnostic	High-volume diagnostic group, but principally radiology. Higher prevalence of cardiac conditions in some ethnic groups.
Cardiac – therapeutic	High volume and high prevalence in some ethnic groups. Possible gender differences.
Cataracts	High-volume procedures, especially among older adults. Long waiting times.
Dental	Impacts on children and young adults.
Gastrointestinal endoscopy – diagnostic	High-volume diagnostic group, impacted because of concerns about aerosol-generating procedures.
Gastrointestinal endoscopy – therapeutic	High volume, impacted because of concerns about aerosol-generating procedures.
Hip and knee replacements (including revisions)	High volume. Trauma and orthopaedics is the specialty with the longest waiting times.

Table C2: Procedure codes used to identify activity in each procedure group and activity for other elective procedures

Procedure group	Features/rationale for selection
Cardiac – diagnostic	K63
Cardiac – therapeutic	K26, K45, K57, K59–K62, K75
Cataracts	C71–C75, C79
Dental	F09–F17
Gastrointestinal endoscopy – diagnostic	G45, H22, H25
Gastrointestinal endoscopy – therapeutic	G43, G44, H20, H23
Hip and knee replacements (including revisions)	W37–W42
Other elective procedures	All other codes, except L91, M49, R37, S12, S57, W36, X29, X33, X36–X38, X40, X65, X67, X70–X72, X89, X90, X92, X96

Notes: We excluded a small set of procedure codes from the 'other elective procedures' group (and hence also from the 'all procedures' group). For these procedures we found that there had been a coding practice change (related to whether activity was coded as an ordinary or day case admission or a 'regular attender') between the first and second years of the pandemic. This made results for 'other procedures' and 'all procedures' inconsistent across years.

Table C3 shows the number of procedures by group in the pre-Covid year (March 2019 to February 2020), with some statistics on the type of elective procedure and the age and sex profile of patients.

Table C3: Number of elective procedures by group in the pre-Covid year and characteristics of the cases, March 2019 to February 2020

Procedure group	Count of procedures	Proportion that are day cases	Proportion of patients who are female	Proportion of patients aged under 20	Proportion of patients aged 70 and over
Cardiac – diagnostic	75,101	89%	35%	0%	47%
Cardiac – therapeutic	86,997	51%	32%	1%	54%
Cataracts	560,297	99%	57%	0%	73%
Dental	165,636	96%	56%	36%	7%
Gastrointestinal endoscopy – diagnostic	1,297,919	98%	55%	2%	29%
Gastrointestinal endoscopy – therapeutic	296,484	96%	41%	1%	35%
Hip and knee replacements	131,386	0%	58%	0%	53%
Other elective procedures	3,360,580	73%	53%	10%	28%
All elective procedures	5,974,400	81%	53%	7%	33%

The seven selected procedure groups made up 44% of all elective procedures. The most common out of the seven were diagnostic gastrointestinal endoscopies (making up 50% of the selected procedures and 22% of all elective procedures), with cataracts in second place (21% of the selected procedures and 9% of all elective procedures). A large majority of the procedures were carried out as day cases (81% overall, but approaching 100% for several of the selected groups), but hip and knees replacements were 100% (to the nearest decimal place) 'ordinary' admissions, as were 49% of therapeutic cardiac procedures. More than half of therapeutic cardiac procedures, hip and knee replacements, and cataract procedures were for those aged 70 and over, while more than a third of dental procedures were for patients aged under 20. Male patients were more common than female patients for cardiac and therapeutic gastrointestinal procedures.

Appendix D: Mapping ethnic category codes from HES and ETHPOP data

Table D1 shows how we mapped ethnic code categories available in HES and ETHPOP data to the five category groups used in our analysis.

Table D1: Ethnic code mappings

Broad (five category) ethnic group	Ethnic categories available in HES (2001 Census based)	Ethnic categories available in ETHPOP (aggregations of 2011 Census categories)
White	British (White) Irish (White) Any other White background	White: British, Irish, Gypsy, Irish Traveller Any other White background
Mixed	White and Black Caribbean (Mixed) White and Black African (Mixed) White and Asian (Mixed) Any other Mixed background	Mixed/multiple ethnic groups
Asian	Indian (Asian or Asian British) Pakistani (Asian or Asian British) Bangladeshi (Asian or Asian British) Any other Asian background Chinese (other ethnic group)	Indian (Asian or Asian British) Pakistani (Asian or Asian British) Bangladeshi (Asian or Asian British) Any other Asian background Chinese (Asian or Asian British)
Black	Caribbean (Black or Black British) African (Black or Black British) Any other Black background	Caribbean (Black or Black British) African (Black or Black British) Any other Black background
Other	Any other ethnic group	Any other ethnic group
Not stated	Not stated	
Not known	Not known	

Appendix E: Reallocation of ethnic category codes

This appendix contains more detail on the reallocation of ethnic category codes as carried out for our analysis.

Why do we reallocate ethnicity codes?

In previous work we found inconsistencies with ethnicity coding in English hospital datasets.[24] For example, 13% of inpatient records had an ethnic category of 'not known' or 'not stated', and 16% of people who had multiple inpatient records had more than one ethnic category recorded. Furthermore, we know that 'any other ethnic group' is over-reported in the data. Some of these problems can be mitigated using the data that we have. We can improve the overall quality of ethnicity coding in specific analyses by using ethnicity codes from earlier or later health records for an individual. The key elements of the reallocation process, making use of multiple records for individuals, are described in Chapter 3, Box 2.

Approach to reallocation

There are five main issues to address when reallocating ethnic category codes:

- choosing what data to use to complete the reallocation
- how to allocate a single ethnicity code to an individual
- how to minimise known coding bias for those recording an ethnicity of 'any other ethnic group'

- how to approach reallocation for those people who have chosen not to state their ethnicity
- how to reallocate the records of those who have no known ethnicity.

On three of these issues, our approach was the same as that of the Office for Health Improvement and Disparities (OHID).[81] When allocating a single ethnicity code to individuals, we typically selected the most frequently recorded ethnicity code. Where the most frequently recorded code was 'any other ethnic group', we allocated the second most frequent code if there was one (if not, this was allocated to the 'Other' group). Consistent with the OHID's method, where 'not stated' was consistently recorded in an individual's history we did not allocate an ethnic group category (and so these individuals were not included in our analysis). But where there was at least one other ethnicity code recorded, we allocated based on the other code(s).

Where our approach differed from the OHID's was in the choice of data used to complete the reallocation and how 'not known' records were handled. We used the ethnicity records for all inpatient episodes from April 2016 to February 2022 to reallocate ethnic categories. For people with no known ethnicity, we allocated an ethnic category randomly, but according to the population distribution of ethnic categories from the 2011 Census.

Table E1 outlines the ruleset of our reallocated methods, with examples showing how combinations of ethnic codes for an individual were allocated a single broad ethnic code for use in our analysis.

81 Office for Health Improvement and Disparities (2022) 'Method for assigning ethnic group in the COVID-19 Health Inequalities Monitoring for England (CHIME) tool'. www.gov.uk/government/statistics/covid-19-health-inequalities-monitoring-in-england-tool-chime/method-for-assigning-ethnic-group-in-the-covid-19-health-inequalities-monitoring-for-england-chime-tool. Accessed 28 August 2022.

Table E1: Ruleset highlighting the reallocation of ethnicity codes, with individual examples

Person ID	Activity ID	Original recorded ethnicity	Reallocated ethnicity	Approach to ethnicity reallocation
One record, one ethnicity				
1	1	Indian (Asian or Asian British)	Indian (Asian or Asian British)	No change – consistent coding
Multiple records, one ethnicity				
2	1	Pakistani (Asian or Asian British)	Pakistani (Asian or Asian British)	No change – consistent coding
	2	Pakistani (Asian or Asian British)	Pakistani (Asian or Asian British)	
Multiple records, multiple ethnicities				
3	1	Caribbean (Black or Black British)	Caribbean (Black or Black British)	Assign most frequently used code (most recent if tied)
	2	Caribbean (Black or Black British)	Caribbean (Black or Black British)	
	3	Any other Black background	Caribbean (Black or Black British)	
Multiple records, multiple ethnicities, 'any other ethnic group' most common				
4	1	White and Asian (Mixed)	White and Asian (Mixed)	Assign the second most frequent category where 'any other ethnic' group is most common
	2	Any other ethnic group	White and Asian (Mixed)	
	3	Any other ethnic group	White and Asian (Mixed)	
Only not stated ethnicities (one or multiple records)				
5	1	Not stated	Not stated	No change – people explicitly (and consistently) have not stated their ethnicity
Only not known ethnicities (one or multiple records)				
6	1	Not known	Random ethnicity	Assign a random ethnic code, with distribution weighted by the 2011 Census populations
Multiple records, a mixture of known and not known ethnicities				
7	1	Chinese (other ethnic group)	Chinese (other ethnic group)	Assign the known ethnic category to all records (and following all other rules)
	2	Not known	Chinese (other ethnic group)	
Multiple records, a mixture of known and not stated ethnicities				
8	1	British (White)	British (White)	Assign the known ethnic category to all records (and following all other rules)
	2	Not stated	British (White)	

We conducted the reallocation at the level of the 18-category ethnic codes available in HES data (listed in Appendix D). After the reallocation, these detailed ethnic categories were aggregated to the five category groups used in our analysis (see Appendix D) to improve our chances of finding robust results. While it would have been preferable to conduct the analysis using the most detailed set of codes, first, we were concerned about using these disaggregated groups, primarily because of the small size of some groups and uncertainty about the population of these groups. For example, even the aggregated Mixed group made up only 1.1% of the population. Second, there were concerns about whether the multiple 'Any other … background' groups included in HES would be subject to similar overcoding as 'Any other ethnic group'.

Table E2 shows the impact of reallocating ethnicity on the number of episodes recorded in each category. Note that our approach increased the number of records in all of the ethnic categories except 'any other ethnic group', 'not known' and 'not stated'. Among the groups that increased in volume, the British (White) and Irish (White) groups increased by the smallest percentage.

We have tried to use the data available to us to improve the quality of coding for our analysis. All approaches to resolve the issues stemming from poor-quality ethnicity coding have limitations. The best solution is to improve the quality of ethnicity coding at source.

Table E2: Impact of reallocating ethnicity codes

Broad (five category) ethnic group	Ethnic categories available in HES	Before reallocation		After reallocation		Change due to reallocation		After reallocation	
		Episodes	% of episodes	Episodes	% of episodes	Episodes	% of episodes	People	% of episodes
White	British (White)	4,438,201	69.8%	4,987,348	78.4%	549,147	12%	3,737,052	77.4%
	Irish (White)	43,728	0.7%	49,183	0.8%	5,455	12%	35,218	0.7%
	Any other White background	228,059	3.6%	272,302	4.3%	44,243	19%	211,353	4.4%
Mixed	White and Black Caribbean (Mixed)	13,669	0.2%	16,901	0.3%	3,232	24%	13,465	0.3%
	White and Black African (Mixed)	6,883	0.1%	8,352	0.1%	1,469	21%	6,647	0.1%
	White and Asian (Mixed)	10,594	0.2%	13,382	0.2%	2,788	26%	10,434	0.2%
	Any other Mixed background	20,580	0.3%	25,485	0.4%	4,905	24%	20,141	0.4%
Asian	Indian (Asian or Asian British)	108,182	1.7%	127,430	2.0%	19,248	18%	96,908	2.0%
	Pakistani (Asian or Asian British)	84,422	1.3%	98,634	1.6%	14,212	17%	76,740	1.6%
	Bangladeshi (Asian or Asian British)	28,115	0.4%	32,899	0.5%	4,784	17%	26,052	0.5%
	Any other Asian background	64,189	1.0%	80,134	1.3%	15,945	25%	61,781	1.3%
	Chinese (other ethnic group)	16,106	0.3%	19,465	0.3%	3,359	21%	15,292	0.3%
Black	Caribbean (Black or Black British)	51,475	0.8%	60,983	1.0%	9,508	18%	45,603	0.9%
	African (Black or Black British)	59,360	0.9%	72,585	1.1%	13,225	22%	55,266	1.1%
	Any other Black background	26,129	0.4%	31,596	0.5%	5,467	21%	24,403	0.5%
Other	Any other ethnic group	99,160	1.6%	78,995	1.2%	-20,165	-20%	64,582	1.3%
Not known	Not known	333,132	5.2%	0	0.0%	-333,132	-100%	0	0.0%
Not stated	Not stated	726,495	11.4%	382,805	6.0%	-343,690	-47%	325,837	6.8%

Notes: This table shows counts and percentages of inpatient elective episodes with a procedure in the pre-Covid year (March 2019 to February 2020), by ethnic group, before and after reallocation, and the percentage change. In addition, it shows counts and percentages of people by ethnic group after reallocation.

Appendix F: Calculating indirectly standardised procedure rates

Standardisation can be used to improve the comparison of rates of events in dissimilar population groups (that is, ones with different age and sex structures).

There are two common approaches to standardisation. The first is direct standardisation, where the object is to calculate the rate of an event in various sub-group populations, as if they each had a standard population (which might be based, for example, on that of the national population). The second – indirect standardisation – applies national (or other reference) rates to sub-group populations to create an expected number of events, which we can compare with the actual, observed number of events.

Direct standardisation can be unreliable where there are small numbers of events in sub-group bands (that is, in individual age and sex bands) and this was likely to be the case with some of our analyses of procedure rates by ethnic group.

We therefore chose to calculate indirectly standardised rates. While the outputs of indirect standardisation are frequently expressed as standardised ratios (the observed number of events divided by the expected number of events), we converted them back into rates per 100,000 people by multiplying the ratios by the crude event rates per 100,000 people.

Calculating the indirectly standardised rates

- Indirectly standardised ratio (ISR) = $\frac{O}{E} = \frac{\sum_i O_i}{\sum_i E_i}$, where $E_i = \frac{O_i^{ref}}{P_i^{ref}} P_i$
- Indirectly standardised rate (ISRt) = ISR x reference crude rate

O_i is the observed number of elective procedures in age and sex group i. E_i is the expected number of elective procedures in age and sex group i given the crude rates in the reference population. P_i is the subject population in age and sex group i.

O_i^{ref} and P_i^{ref} are the observed and population numbers in age and sex group i for the reference group ref.

We used the White group as the reference group for the ethnic group analyses and for the deprivation and regional analyses we used the national population as the reference group.

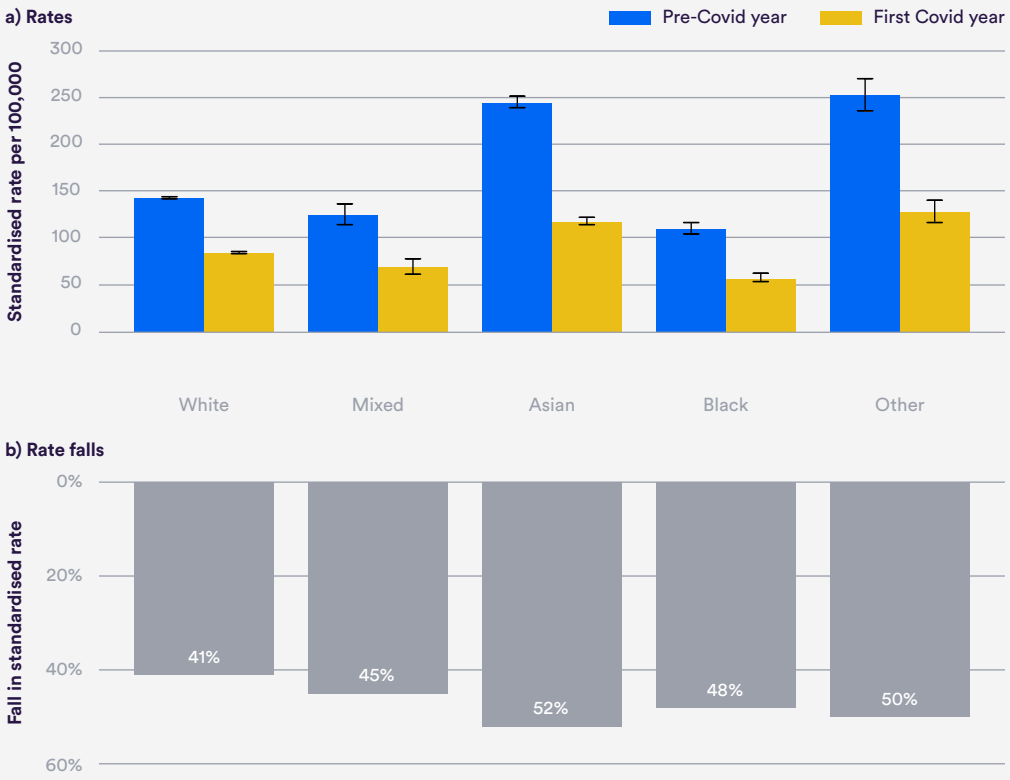
Appendix G: Analysis of changes in procedure rates over time

In Chapter 4 we presented our findings on the size of Covid-related falls in procedure rates for ethnic groups, and reported on relative differences between the groups. We also presented similar analyses for regions, and areas by levels of deprivation.

We present here a worked example to explain how we calculated the rate falls and relative rate falls, and to outline how these are presented in Chapter 4. We will focus on ethnic group rate changes and relative differences, for one set of procedures: diagnostic cardiac procedures.

Figure G1(a) shows, for each ethnic group, pre-Covid year and first Covid year age- and sex-standardised procedure rates per 100,000 people, and Figure G1(b) shows these as a percentage fall between the two years.

Figure G1: Rates of diagnostic cardiac procedures, by ethnic group, in the pre-Covid year and first Covid year, also expressed as percentage falls in rates



Notes: Rate figures are indirectly age- and sex-standardised rates per 100,000 population, with 95% confidence limits.

The percentage rate falls in Figure G1(b) are easily explained. The Asian group, for example, in the pre-Covid year had 245 diagnostic cardiac procedures per 100,000 people. This fell to 118 per 100,000 in the first Covid year, which was a drop of 52%: calculated as ((245-118)/245).

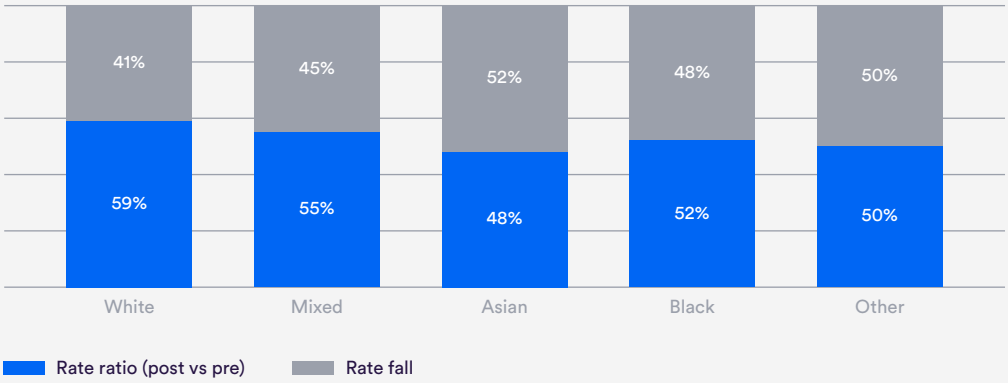
Our next step was to express each ethnic minority group's rate change relative to that of the White group rate change.

It would not be correct to compare these rate falls with one another directly. Rather, we can compare a set of figures intrinsically linked to the falls: the ratios of the procedure rates in the first Covid year versus those in the pre-Covid year. We see from Figure G2 that these rate ratios have values which are 100% minus the rate falls. For example:

- the White group rate fell by 41%, which is the same as saying that the first Covid year rate was 59% of the pre-Covid year rate (84/143).

- the Asian group rate fell by 52%; the first Covid year rate was 48% of the pre-Covid year rate (118/245).

Figure G2: Changes in rates of diagnostic cardiac procedures in the first Covid year, versus the pre-Covid year, by ethnic group, expressed as both falls in rates, and rate ratios



We have shown (Figure 1) that there were large pre-pandemic differences in diagnostic cardiac procedure rates by ethnic group. These have been relatively stable for several pre-pandemic years,[82] and a key proposition that we make in this study is the following:

Had the pandemic impacted all groups equally, we ought to have seen the same relative difference in rates between ethnic groups in the pandemic years as in the pre-Covid year.

Another way of saying this is that all groups should have had the same rate falls – in terms of rate fall percentage, or rate ratios.

82 Data not presented here, but two additional pre-Covid years are available in the supplementary material.

Figure G1 makes it clear that diagnostic cardiac procedure rates did not fall equally for all ethnic groups. The rate ratios are helpful because they tell us, for example, that – if we stripped out (or equalised) the pre-pandemic differences between the groups, that the unequal impact of the pandemic was such that for every 59 diagnostic cardiac procedures in the White group in the first Covid year, there were 55 in the Mixed group, 48 in the Asian group, 52 in the Black group and 50 in the Other group.[83,84]

These figures allow us to express the relative changes in rates between each minority ethnic group and the White group as a percentage:

- The Mixed group had 7% fewer diagnostic cardiac procedures ((59 – 55)/59)...
- The Asian group had 19% fewer procedures ((59 – 48)/59)...
- The Black group had 12% fewer procedures ((59 – 52)/59)...
- The Other group had 15% fewer procedures ((59 – 50)/59)...

...than they otherwise would have had, had the pandemic reduced their rates the same as the White group.

These relative rate changes are shown alongside the rate falls in Figure G3.

Figure G3: Falls in age- and sex-standardised diagnostic cardiac procedure rates in the first Covid year relative to the pre-Covid year, by ethnic group

	Fall in rate compared to pre-Covid year					Change in rate expressed relative to White group change			
	White	Mixed	Asian	Black	Other	Mixed	Asian	Black	Other
Cardiac – diagnostic	41%	45%	52%	48%	50%	-7%	**-19%**	**-12%**	**-15%**

Notes: For the ethnic minority groups, the rate changes are expressed relative to White group rate changes, with negative numbers and red bars signifying a larger rate fall than the White group, and positive numbers and green bars signifying the opposite. Bold figures denote statistically significant differences versus the White group rate changes, at 95% confidence levels.

83 For simplicity, here we've rounded to the nearest whole number, having expressed each ratio as a percentage figure.

84 The equal COVID impact situation would have been that for every 59 procedures in the White group, there were 59 in each of the ethnic minority groups.

We used Poisson regression modelling (see below) to give us estimates of the level of statistical confidence in the differences between the ethnic minority group rate falls and those of the White group. In this case we found that the rate fall in the Mixed group (of 45%) was not statistically significantly different from the fall in the White group (of 41%). All other ethnic minority groups, however, had statistically significantly larger rate falls than the White group.

It's important to appreciate that the relative percentage values in Figure G3 do not mean that in the first Covid year the Asian group, for example, had 19% fewer procedures than the White group - the age- and sex-standardised rate of diagnostic cardiac procedures in the first Covid year was still higher in the Asian group than in the White group (see Figure G1a).

But it does signify that the pandemic appeared to impact the Asian group more substantially than the White group: the Asian group suffered the 59% fall in procedures as did the White group, as well as an additional relative fall of 19%.

For region and deprivation analyses, we carried out similar analyses to those outlined above, but we compared individual group rate falls to national procedure rate falls.

Regression modelling approach

Calculating the relative rate falls between groups was also undertaken with a simple Poisson regression model, using methods developed to analyse standardised mortality ratios.[85] We used this method to provide us with statistical confidence estimates in the relative rate fall differences.

For each procedure group and time period analysis we prepared a dataset containing two rows of data for each analysis group – one for the pre-Covid year and one for the Covid year. We included the following data fields:

85 Breslow NE and Day NE (1987) 'Statistical methods in cancer research: volume II – the design and analysis of cohort studies', *IARC Scientific Publications* (82), 1–406.

- the analysis group category ('Asian', 'Black' and so on for ethnic group analyses)
- a time period indicator (year 1 or 2)
- the observed number of procedures for the analysis group, for the relevant year
- the expected number of procedures for the analysis group, for the relevant year (see Appendix F).

In the Poisson model, the dependent variable was the observed number of events and we included three sets of independent variables: analysis group, time period, and an interaction term of analysis group and time period. As we were modelling rates, we used the log of the expected number of events as an offset.

We were able to use the parameter estimate outputs of these models (and the reference crude rates) to calculate all sets of rates of interest to us: year 1 and year 2 actual standardised rates and the modelled year 2 rates. Moreover, from the model estimates we were able to calculate the percentage differences between the modelled and actual standardised rates for year 2. Importantly, while all these estimates were directly comparable to those we could work out by manual methods, the regression approach gave us estimates of the statistical significance of differences for each analysis group.

Appendix H: Crude and standardised procedure rates in the pre-Covid year, March 2019 to February 2020

Table H1 compares crude and age- and sex-standardised procedure rates per 100,000 people for the five ethnic groups. Note that relevant population figures are given in Table 2. Figures for other analyses (for example, by region and deprivation) and other years are provided in the supplementary material.

Table H1: Crude and standardised procedure rates per 100,000 people in the pre-Covid year, March 2019 to February 2020

Procedure group	Broad ethnic group	Count of procedures[1]	Crude rate per 100,000 people	Standardised rate per 100,000 people[2] (95% confidence limits)	
Cardiac – diagnostic	White	66,590	142.6	142.6	(141.5, 143.7)
	Mixed	470	30.3	125.0	(114, 136.9)
	Asian	5,980	108.8	245.1	(239, 251.4)
	Black	1,230	56.2	110.1	(104, 116.4)
	Other	830	119.1	252.9	(236, 270.7)
Cardiac – therapeutic	White	79,680	170.6	170.6	(169.4, 171.8)
	Mixed	450	29.1	111.6	(101.6, 122.4)
	Asian	5,050	91.7	205.1	(199.5, 210.9)
	Black	1,120	51.3	102.1	(96.2, 108.3)
	Other	700	99.5	210.8	(195.5, 227.1)
Cataracts	White	506,720	1085.1	1085.1	(1082.1, 1088.1)
	Mixed	2,490	161.2	914.4	(878.8, 951.1)
	Asian	33,050	600.7	1724.2	(1705.6, 1742.9)
	Black	12,320	564.6	1413.3	(1388.4, 1438.5)
	Other	5,710	816.8	2493.6	(2429.3, 2559.1)
Dental	White	135,640	290.5	290.5	(288.9, 292)
	Mixed	4,290	277.6	206.4	(200.3, 212.7)
	Asian	13,020	236.5	199.8	(196.4, 203.2)
	Black	8,790	402.8	349.3	(342, 356.7)
Gastrointestinal endoscopy – diagnostic	White	1,145,870	2453.7	2453.7	(2449.2, 2458.2)
	Mixed	11,850	767.3	1740.0	(1708.9, 1771.7)
	Asian	86,580	1573.5	2390.7	(2374.8, 2406.7)
	Black	34,570	1584.3	2144.0	(2121.5, 2166.7)
	Other	19,050	2724.0	3894.5	(3839.4, 3950.2)
Gastrointestinal endoscopy – therapeutic	White	272,750	584.0	584.0	(581.9, 586.2)
	Mixed	1,870	120.8	380.7	(363.6, 398.4)
	Asian	12,960	235.5	445.4	(437.8, 453.1)
	Black	5,730	262.5	423.3	(412.4, 434.4)
	Other	3,190	455.3	799.0	(771.5, 827.2)
Hip and knee replacements (including revisions)	White	123,940	265.4	265.4	(263.9, 266.9)
	Mixed	520	33.4	154.8	(141.7, 168.8)
	Asian	4,490	81.5	195.6	(189.9, 201.4)
	Black	1,790	81.8	169.9	(162.1, 178)
	Other	660	94.9	231.2	(213.9, 249.4)
All other procedures	White	2,976,510	6373.8	6373.8	(6366.5, 6381)
	Mixed	42,170	2729.2	4478.2	(4435.6, 4521.1)
	Asian	197,360	3587.0	4793.7	(4772.6, 4814.9)
	Black	99,610	4565.6	5801.8	(5765.8, 5838)
	Other	44,930	6423.8	8510.1	(8431.6, 8589.1)
All procedures	White	5,307,700	11365.7	11365.7	(11356, 11375.3)
	Mixed	64,100	4148.9	8033.3	(7971.2, 8095.7)
	Asian	358,480	6515.2	9660.6	(9629, 9692.2)
	Black	165,140	7569.2	10433.1	(10382.8, 10483.5)
	Other	78,980	11291.4	16449.8	(16335.2, 16564.9)

Notes: [1] Rounded to the nearest 10. [2] Age- and sex-standardised rates using the White group as the reference group.

Appendix I: Regional variations in Covid-19 hospitalisations and cases

Table I1 shows, for the first year of the pandemic (March 2020 to February 2021), the number of hospital admissions for Covid-19 per 100,000 people and the number of reported cases of Covid-19 per 100,000 people, by region. We derived the number of admissions from analysis of HES inpatient data and we determined the number of cases from the UK Covid-19 dashboard (cumulative cases by specimen date).[86]

The regions are ordered from high Covid-19 impact to lower Covid-19 impact. We primarily used admission rates to do this, but modified the ordering based on case rates for three regions (the North East, Yorkshire and the Humber, and the East Midlands) with very similar rates of admissions (all between 746 and 755 admissions per 100,000 people).

On both sets of measures, the difference between the rates for the lowest and highest Covid-19 impact regions was a factor of two or more.

86 GOV.UK (no date) 'Coronavirus (Covid-19) in the UK'. https://coronavirus.data.gov.uk/details/download. Accessed 28 August 2022.

Table I1: Covid-19 hospitalisations and cases reported in the first Covid year, March 2020 to February 2021

Region	Admissions per 100,000 people	Cases reported per 100,000 people
North West	929	8,004
London	863	7,897
West Midlands	833	7,006
North East	755	6,926
Yorkshire and the Humber	746	6,602
East Midlands	753	6,432
South East	655	5,745
East of England	605	6,037
South West	422	3,811

Source: Admissions – Nuffield Trust analysis of Hospital Episode Statistics 2019/20 and 2020/21. Cases – Nuffield Trust analysis of ONS infection survey data, downloaded from UK Government Covid Dashboard, 11 March 2022.

Nuffield Trust is an independent health think tank. We aim to improve the quality of health care in the UK by providing evidence-based research and policy analysis and informing and generating debate.

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