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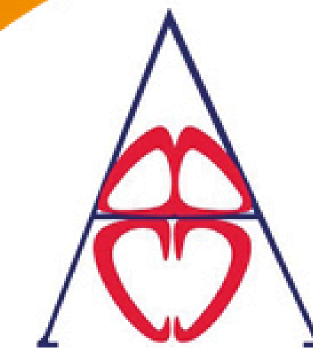
National Congenital Heart Disease Audit (NCHDA)

2025 Annual Report

2023/24 and 2021/24 data



Report at glance

All data for 2023/24 unless otherwise stated

11,812 congenital heart disease (CHD) procedures on adults and children

3% increase in overall procedures from 2022/23 (but still **7%** fewer than before the pandemic)

13% more adult procedures than in 2019/20, prior to COVID-19 pandemic

12% fewer paediatric procedures than in 2019/20, prior to COVID-19 pandemic

5% increase in paediatric surgical procedures from 2022/23 (10% lower than in 2019/20)

4% increase in interventional (catheter-based) procedures since 2019/20

1.1% unadjusted post-surgical mortality rate for children and **0.6%** for adults are amongst the best reported outcomes worldwide

52% antenatal diagnosis for all infants requiring a procedure in the first year of life has plateaued over the last five years

Data Quality Index (DQI) score indicator remains generally good.

Recommendations

1. Hospitals undertaking antenatal screening to diagnose conditions requiring intervention in the first year should improve their success rates by working with congenital heart disease (CHD) networks to review staffing, infrastructure, education and training.

2. All hospitals should consistently enter data to the audit in line with the new definitions of post-procedure complications released in 2024 for implementation in April 2025.

Introduction

The National Congenital Heart Disease Audit (NCHDA) is part of the National Cardiac Audit Programme (NCAP) which is run by the National Institute for Cardiovascular Outcomes and Research (NICOR).

Congenital heart disease (CHD) is a heart condition or defect that develops before a baby is born. It is a chronic, life-long condition with a spectrum of severity from mild to life-threatening. Approximately 1 in 100 births are affected by CHD and between 20% to 30% of patients will require an intervention during infancy, often as a matter of urgency, with procedural risks highest for neonates who present in poor condition. Encouragingly, the majority survive to adulthood, and improved survival has led to a rapidly growing population of adults with congenital heart disease (ACHD). Both paediatric and adult patients typically require regular and often lifelong follow-up with specialist CHD professionals and tests of cardiac function are a cornerstone of follow-up.

The report focuses on the activity and trends in the treatment of paediatric and adult patients with congenital heart disease in the UK and Ireland (not including Scotland which now has its own Scottish Cardiac Audit Programme). It compares performance against several quality improvement (QI) metrics derived from national and/or international standards and guidelines. The goal of congenital heart disease services is to make a diagnose as early as possible, ideally before birth, referred to as antenatal diagnosis, and provide excellent continuity of care as patients progress through childhood and into adulthood.

This report is of value to a wide range of stakeholders but more importantly it allows patients and their relatives to better understand CHD care and its outcomes in the UK. The slides in the report are interactive so you can select and explore the data that interests you. Additional information on the audit, including definitions and methodology, is available from the National Institute for Cardiovascular Research (NICOR) website.

The audit relies on the active contribution of participating hospitals. Detailed information about more than 11,812 procedures has been diligently entered by local clinicians and audit teams, queried and cleaned before analysis is undertaken by the NICOR team. We are very grateful to all these staff for their contributions. We will continue to work closely with hospitals, patients, and other stakeholders to improve the quality of audit data and how these are used to improve the delivery of high-quality CHD care in the UK.

The NCHDA NICOR Audit Team

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The appendix includes Activity and Outcome data:

Activity

Monthly activity trends (countable procedures) by procedure type

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NCHDA Specific Procedures

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Outcome

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Antenatal Diagnosis Rates by ICB

Data Quality Index (DQI)

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The total number of procedures for patients with congenital heart disease remains below the pre-pandemic level

In 2023/24, the audit recorded **11,812** congenital heart disease (CHD) submissions in children and adults.

This is 3% higher than in 2022/23 but remains 7% below the 2019/20 figure, prior to the COVID-19 pandemic.

Note: *The centres at Evelina and Royal Brompton Hospital have merged and are now reporting as a single unit (Guy's and St Thomas' Hospital NHS Foundation Trust or GSTT) so the data are from 10 paediatric centres. In subsequent slides showing ten year trends, their individual activity will be shown.*

Total congenital heart disease (CHD) procedures in NHS hospitals

While the number of cases for all paediatric age groups is below the pre-pandemic level, the number of adult cases has increased since 2019/20

The number of countable procedures in adults (16 years and above) in 2023/24 was 13% higher than the 2019/20 level prior to the COVID-19 pandemic. This also highlights the increasing ACHD population as many children with CHD transition from paediatric to adult services.

The number of countable procedures for the paediatric group (neonatal, infant and child) all remain below pre-pandemic levels.

A number of factors may be driving the slight reduction in paediatric cases:

- Falling birth rate in the UK
- Change to the number of patients requiring procedures
- Shift in the mix of case by type, risk and other factors
- Use of different treatment strategies (e.g. undertaking a complex procedure earlier rather than having an initial simpler procedure followed by another later)
- The impact of developments in paediatric interventional practice which replaces the need for surgical procedures (e.g. percutaneous balloon dilation of valves).

Note: 'countable procedure' were delineated by an NHS England-led subcommittee of congenital heart disease specialists in 2017 (see *here*).

CHD procedures by age group

8,000
6,000
4,000
2,000
0

2014/15 2015/16 2016/17 2017/18 2018/19 2019/20 2020/21 2021/22 2022/23 2023/24

All paediatric
Adult
Child
Infant
Neonate

There is a rise in paediatric surgical procedures compared to 2022/23 but activity is still around 10% lower than prior to the pandemic

Surgical procedure numbers have increased by 3% compared to 2022/23 but are 7% lower than the pre-pandemic year 2019/20.

Interventional (catheter-based) procedures were 4% higher than in 2019/20.

Procedures involving electrophysiology (EP) and device implantation - either pacemaker or implantable cardioverter defibrillators (ICDs) - were broadly the same in number to 2019/20.

The changes seen may reflect a number of different factors including:

- Case mix and patient requirements
- Changing treatment strategies
- Infrastructure challenges and availability of resources following the pandemic (e.g. staffing issues).

Note: Not all hospitals reported data on certain procedures (e.g. diagnostic catheters) from 2012/2013

CHD procedures by category

6,000
5,000
4,000
3,000
2,000
1,000

2014/15 2015/16 2016/17 2017/18 2018/19 2019/20 2020/21 2021/22 2022/23 2023/24

Surgical
Intervention
EP/PACING/ICD
Diagnostic Catheter

Monthly activity data highlight trends and variation before and after the pandemic, especially for surgical procedures

Monthly data highlight the substantial falls in procedures during the first two waves of the COVID-19 pandemic in 2020/21.

The monthly volumes of surgical and diagnostic catheter procedures both remain below the pre-pandemic levels.

There has been a steady rise in interventional (catheter-based) procedures.

A growth in EP and device implant procedures was seen prior to the pandemic and current activity is similar to recorded numbers in 2019/20.

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Surgical procedures have failed to climb to pre-pandemic levels at most paediatric centres

Surgical procedures include patients requiring:

- Bypass
- Non-bypass including EP procedures undertaken by surgeons
- Primary ECMO (Extracorporeal Membranous
- Oxygenation) when this procedure is undertaken in isolation and not as a support operation after another congenital heart procedure (these are considered post-procedural complications)
- Lung transplant
- Ventricular assist devices (VADs)
- Hybrid procedures (those with a combination of surgical or transluminal catheter interventions undertaken at the same time in the operating theatre).

Selecting a hospital below shows the number of procedures by category performed over time.

Select hospital

All

CHD procedures by category

5,000
4,000
3,000
2,000
1,000
0

2014/15
2015/16
2016/17
2017/18
2018/19
2019/20
2020/21
2021/22
2022/23
2023/24

Surgical
Intervention
EP/PACING/ICD
Diagnostic catheter

Overall procedural activity has increased in most centres, but there is important inter-centre variability on procedure type

11,471	4,466	3,881	1707	1,417	↑4%
Total	Surgical	Intervention	EP/PACING/ICD	Diagnostic Catheter	Change on previous year

Financial Year

2023

Hospital

All

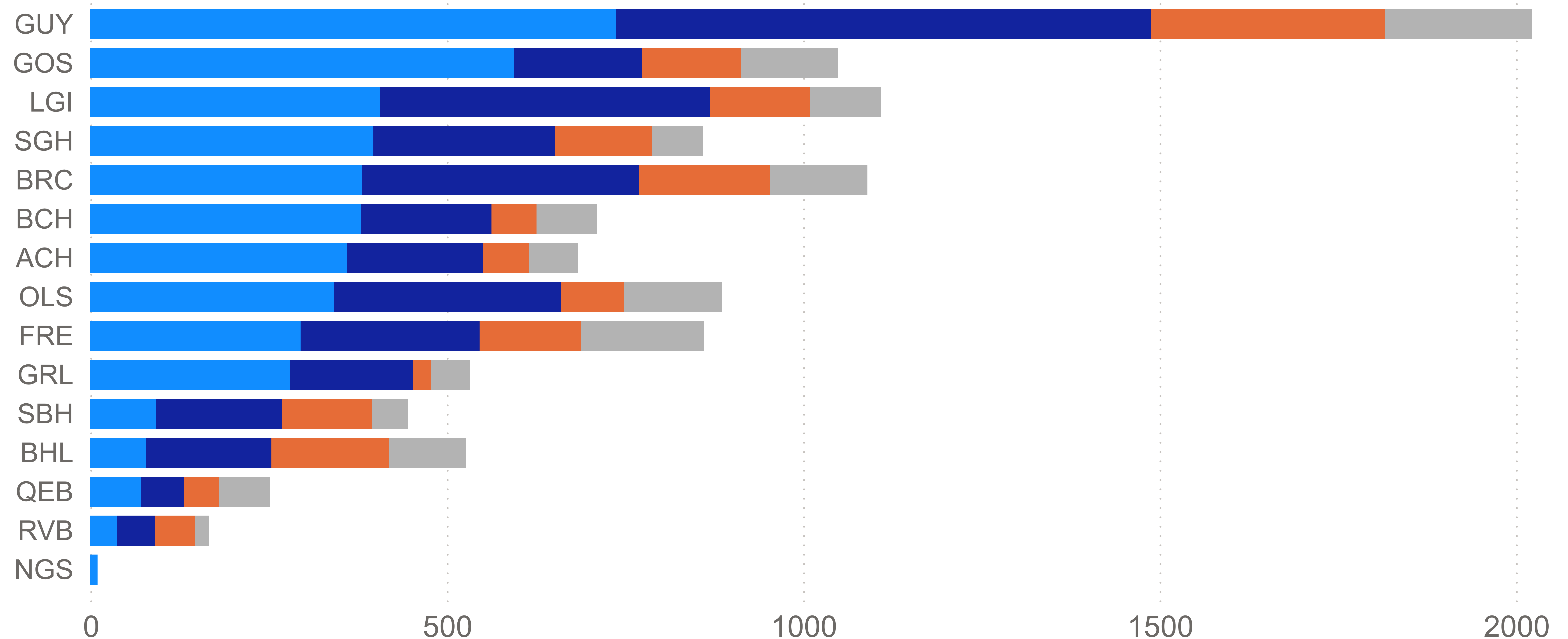
Age Group

All

Procedure Type

All

Note: *Some hospitals with small volumes may perform fewer than three cases in some categories. To comply with small number suppression, numbers <3 are not shown and the totals for these centres will therefore be slightly lower than their actual activity. 'x' in totals means a number between 0 and 9 has been deleted.*



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The unadjusted 30-day surgical mortality for cases involving children with congenital heart disease is the lowest seen in the last 10 years

In 2023/24, the overall unadjusted 30-day mortality was 1.09%.

This is based on **3,197** surgical procedures undertaken in children under 16 years old.

Unadjusted 30-day surgical mortality (%) in children under 16 years

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Risk-adjusted mortality based on VLAD charts shows that the outcomes for children with congenital heart disease are better than predicted

Specialist centres monitor the outcomes of their own services using Variable Life Adjusted Display (VLAD) plots.

These show the predicted number of deaths minus the actual number at 30 days post-surgery, along with the number of re-interventions.

Over the three years from April 2021 to March 2024, there was a continuing improving trend in outcomes for all centres compared with the predictions from the PRAiS2 risk model.

This underlines how surgical teams continue to deliver high quality outcomes for children undergoing CHD procedures.

VLAD chart
Surgical reinterventions
Catheter reinterventions
Surgical and catheter reinterventions

(Expected - Actual) Deaths within 30 Days

46
26
6
-14
-34
-54

01-Apr-21
30-Sep-21
01-Apr-22
30-Sep-22
01-Apr-23
01-Oct-23
01-Apr-24

Total number of 30-day survivors = 8941
Total number of 30-day deaths = 130

Overall risk-adjusted 3-year results for children under 16 years of age showed better than predicted survival rates

To compare mortality outcomes across centres, it is necessary to adjust for the relative complexity of the cases that are being undertaking.

This is done using the PRAiS2 model which reports the ratio of the actual versus the predicted survival of patients (calculated over the **9,071** paediatric patients operated upon during the 3-year 2021/24 period).

Over the last three years, the overall survival ratio of 98.6% was slightly higher than the survival predicted by the PRAiS2 model (98.0%).

The total number of deaths has fallen as a result of a significant drop in mortality at some centres and all centres had survival rates that were equal to or better than predicted.

There is though noticeable variance between centres in the average predicted mortality per case, from 1.8% for Great Ormond Street to 2.3% for Leeds, highlighting their different CHD risk profiles and case-mixes.

Note: A description of the PRAiS2 model can be found [here](#) along with the relevant alert and alarm control limits to warn where performance may be of concern.

Key:
GSTT = Guy's and St Thomas' NHS Foundation Trust

Actual and predicted average survival rates for paediatric CHD cases using the PRAiS2 model (2021/22 to 2023/24)

Hospital	Code	Surgical Episodes	Survivors	Deaths	Actual Survival	Pre Su
Birmingham Children's Hospital	BCH	1049	1026	23	97.8%	
Bristol Royal Hospital For Children	BRC	694	683	11	98.4%	
Dublin Our Lady's Children's Hospital	OLS	861	850	11	98.7%	
Leeds General Infirmary	LGI	741	722	19	97.4%	
Leicester Glenfield Hospital	GRL	586	581	5	99.1%	
Liverpool Alder Hey Hospital	ACH	913	894	19	97.9%	
London Evelina London Children's Hospital	GUY/GSTT	1536	1517	19	98.8%	
London Great Ormond Street Hospital for Children	GOS	1461	1453	8	99.5%	
Newcastle Freeman Hospital	FRE	479	470	9	98.1%	
Southampton Wessex Cardiothoracic Centre	SGH	751	745	6	99.2%	
Total		9071	8941	130	98.6%	

Survival rates for children undergoing congenital heart disease procedures are as, or better than, predicted

The results from the PRAiS2 risk-adjustment model can also identify 'outliers' by showing whether the survival outcomes achieved were as predicted, much higher or much lower.

For the 3-year period 2021/22 to 2023/24:

- **7 centres performed as predicted**
- **2 centres achieved results that were higher than expected (Leicester Glenfield Hospital for Children and Southampton Wessex Cardiothoracic Centre)**
- **London Great Ormond Street Hospital for Children had survival rates that were much higher than expected.**

Key:

FRE	Freeman Road Hospital, Newcastle
GRL	Glenfield Hospital, Leicester
BRC	Bristol Royal Hospital for Children
SGH	Southampton General Hospital
OLS	Our Lady's Children's Hospital, Dublin
ACH	Alder Hey Children's Hospital, Liverpool
LGI	Leeds General Infirmary
GSTT	Guy's and St Thomas' NHS Foundation Trust
BCH	Birmingham Children's Hospital
GOS	Great Ormond Street Hospital for Children

Average survival rates relative to prediction for paediatric CHD cases using PRAiS2 model (2021/22 to 2023/24)

(Survival much higher than predicted)
(Survival higher than predicted)
(Survival as predicted)
(Survival lower than predicted)
(Survival much lower than predicted)

The overall 30-day surgical mortality in adults with congenital heart lesions remains low

The overall unadjusted mortality rate (30 days after the date of the operation) for patients aged 16 years and over remains low at 0.6%.

This is based on a total of **876** surgical procedures in adult over 16 years old.

Note: The Society of Thoracic Surgeons–European Association for Cardio-thoracic Surgery (STAT) mortality score was implemented for use as an aggregated assessment of 30-day survival for adults with congenital heart disease operated upon in the UK since 2017/18.

Unadjusted 30-day surgical mortality (%) in patients aged 16 years and over

Surgical survival rates for patients with congenital heart disease aged 16 years or more are in line with predicted levels, even with very different case mixes

A total of 2,455 patients aged 16 years or over underwent congenital heart disease (CHD) surgical procedures between 2021/22 and 2023/24. To compare mortality outcomes across the 10 centres, the STAT score risk model adjusts for the relative complexity of the cases that are being undertaking.

The overall actual survival rate in 2021/22 to 2023/24 was 98.7%, slightly higher than the prediction of 98.2%. The average risk-adjusted predicted mortality across all patients between 1.5% and 2.8%.

This demonstrates the very different case-mix undertaken by individual hospitals (e.g. Newcastle is known to undertake cardiac transplantation in some patients with a background of complex congenital heart disease).

Even with these different case mixes, the results demonstrate that survival after surgery at each centre was within the predicted limits (all the centres undertook more than 30 adult surgical procedures).

Note:
A description of the STAT score risk model can be found here along with the relevant alert and alarm control limits to warn where performance may be of concern. To comply with small number suppression, numbers <3 are not shown and the totals for these centres will therefore be slightly lower than their actual activity. 'x' in totals means a number between 0 and 9 has been deleted.

Actual and predicted average survival rates for adult CHD cases using STAT score risk model (2021/22 to 2023/24)

Hospital	Surgical Episodes	Survivors	Deaths	Actual Survi
Leeds General Infirmary	255	251	4	98.4%
Belfast Royal Victoria Hospital	157	15x	<3	98.7%
Bristol Royal Hospital for Children and Bristol Heart Institute	276	27x	<3	99.3%
Liverpool Heart and Chest Hospital	256	25x	<3	99.6%
London Evelina London Children's Hospital	504	497	7	98.6%
Birmingham Queen Elizabeth Hospital	287	28x	<3	99.7%
Leicester Glenfield Hospital	127	12x	<3	98.4%
Southampton Wessex Cardiothoracic Centre	241	235	6	97.5%
London Barts Heart Centre	111	10x	<3	98.2%
Newcastle Freeman Hospital	241	235	6	97.5%
Total	2455	2422	33	98.7%

All hospitals achieved survival outcomes as or better than predicted for adults undergoing congenital heart disease surgical procedures

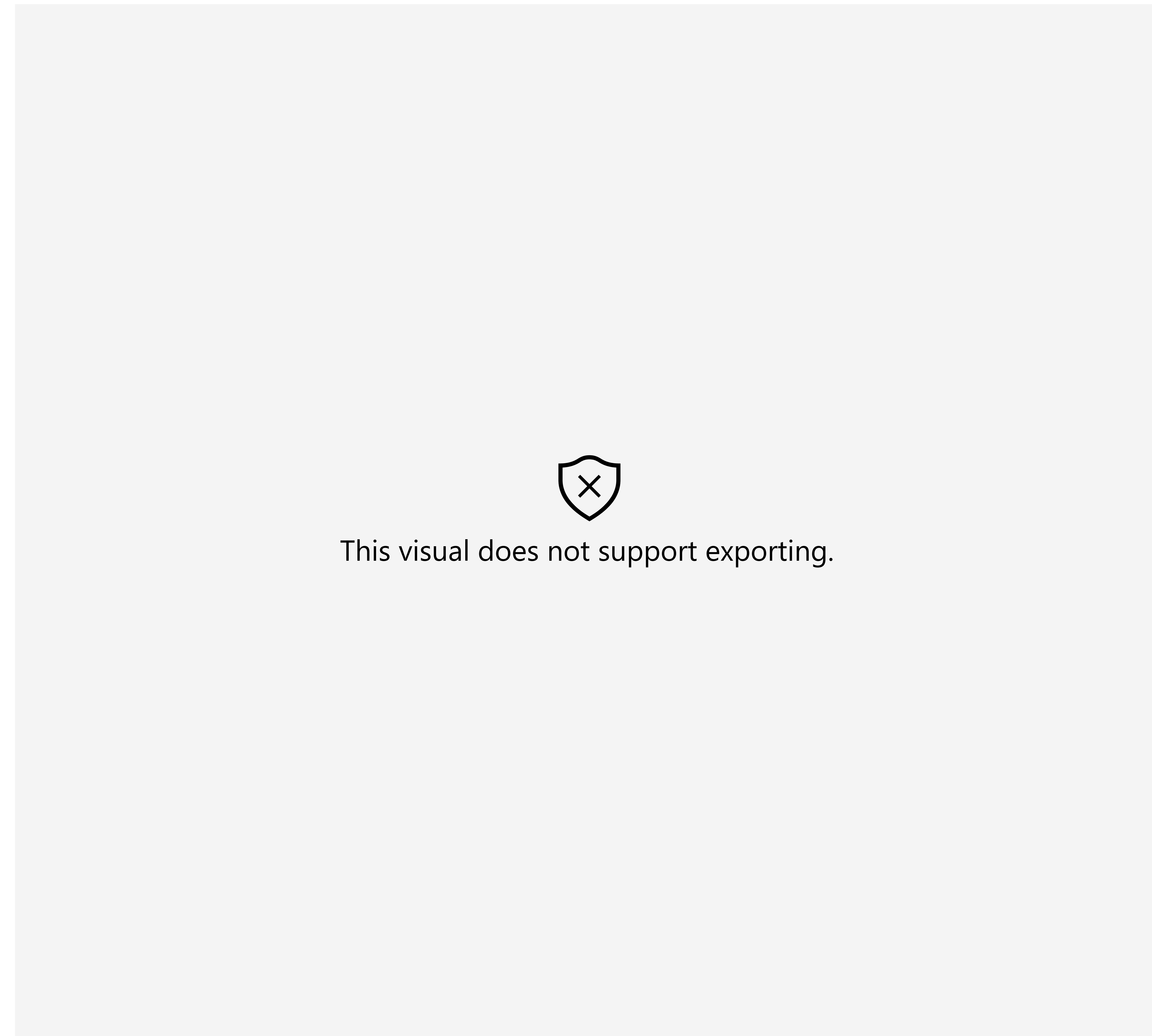
The results from the STAT score risk model can also identify 'outliers' by showing whether the overall survival outcomes for each hospital were as predicted or were much higher or much lower.

In addition, individual analysis of the 44 specific CHD surgical procedures showed that none of the hospitals were outliers for 30-day mortality (i.e. their outcomes were not outside the statistically acceptable limits of the STAT score risk model).

Key:

FRE	Freeman Road Hospital, Newcastle
GRL	Glenfield Hospital, Leicester
BRC	Bristol Royal Hospital for Children
SGH	Southampton General Hospital
OLS	Our Lady's Children's Hospital, Dublin
ACH	Alder Hey Children's Hospital, Liverpool
LGI	Leeds General Infirmary
GSTT	Guy's and St Thomas' NHS Foundation Trust
BCH	Birmingham Children's Hospital
GOS	Great Ormond Street Hospital for Children

Average survival rates relative to prediction for adult CHD cases using the STAT score risk model (2021/22 to 2023/24)



(Survival much higher than predicted)
(Survival higher than predicted)
(Survival as predicted)
(Survival lower than predicted)
(Survival much lower than predicted)

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Variability in post-procedural complication rates between hospitals may be accounted for in part by different case mixes

Although surgical mortality is a key indicator of performance, the rates of different complications after an operation are also important.

To reflect this, the audit captures data on six complications[7] following CHD procedures from 2021/22 to 2023/24:
-Four are surgical-related (across 3,354 procedures)
-Two involve interventional catheters (across 2,696 transcatheter interventions and 618 electrophysiology procedures).

Some significant variations can be seen between centres, though making direct comparisons is challenging given their differences in case mix.

The table on the right shows the percent of six post-procedural complications for 2021/22 to 2023/24. The audit has reviewed and refined the definitions of all complications and the first results from this will be published in 2025.

Percentage of procedures followed by one or more of six post-procedural complications (2021/22 to 2023/24)

Hospital	ECMO	Renal support	Unplanned pacemaker	Prolonged pleural drainage	com an
Birmingham Children's Hospital	3.01	1.55	1.28	2.28	
Bristol Royal Hospital For Children	1.74	6.96	1.87	1.34	
Dublin Our Lady's Children's Hospital	1.23	0.56	1.46	2.35	
Leeds General Infirmary	1.79	5.76	1.79	1.66	
Leicester Glenfield Hospital	3.13	0.00	0.16	0.16	
Liverpool Alder Hey Hospital	3.20	1.40	1.40	0.70	
London Evelina London Children's Hospital	0.54	3.26	0.70	1.09	
London Great Ormond Street Hospital for Children	2.22	1.65	0.89	1.14	
Newcastle Freeman Hospital	6.10	6.50	1.97	0.59	
Southampton Wessex Cardiothoracic Centre	1.49	0.99	1.12	0.99	
Total	2.21	2.57	1.18	1.25	

Over half of all procedures in infancy have a successful prenatal diagnosis

The audit collects data for babies diagnosed antenatally with a cardiac defect who then undergo an intervention in the first year of life.

In 2023/24, the detection rate was 52% for all infants requiring a procedure in the first year of life.

Over the last 7 years, the rate of antenatal diagnosis has plateaued at just over 50%.

Note: The data exclude spontaneous intrauterine deaths, termination of pregnancy, non-intervention after birth and unrecognised death in community or non-tertiary centre. For additional information, see [here](#).

This link will be added at the publication stage

Percentage of CHD procedures in the first year of life for infants who had a prenatal diagnosis

● Percentage of cases with prenatal diagnosis ● Total procedures

60 50 40 30 20 10 0

3,000 2,500 2,000 1,500 1,000 500 0

Total procedures

2014/15 2015/16 2016/17 2017/18 2018/19 2019/20 2020/21 2021/22 2022/23 2023/24

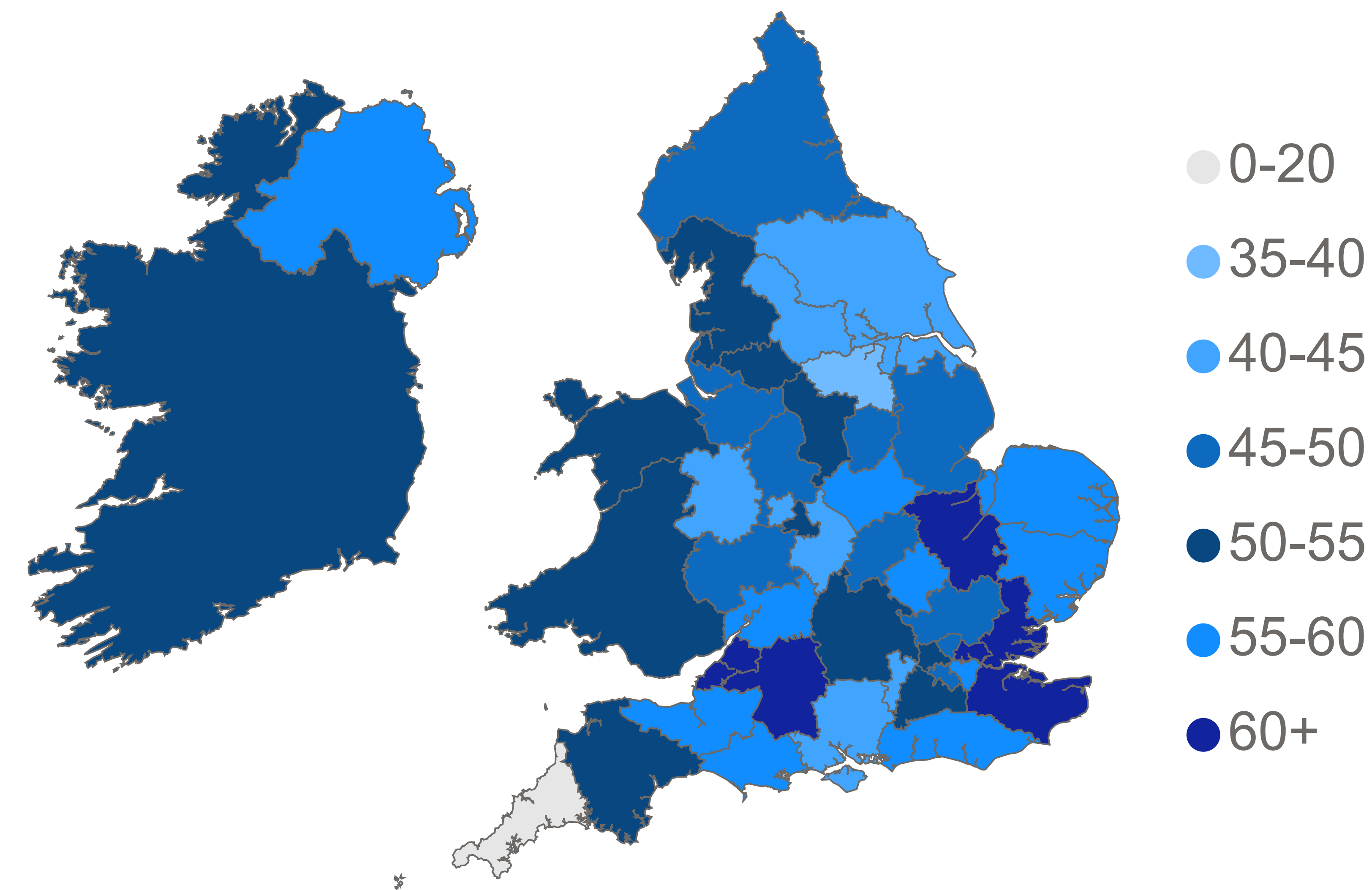
Considerable variation is seen in the rate of prenatal diagnosis across Integrated Care Boards and University Health Boards

The maps show the variation between ICBs/HBs in prenatal diagnosis rates for infants who underwent a procedure in the first year of life.

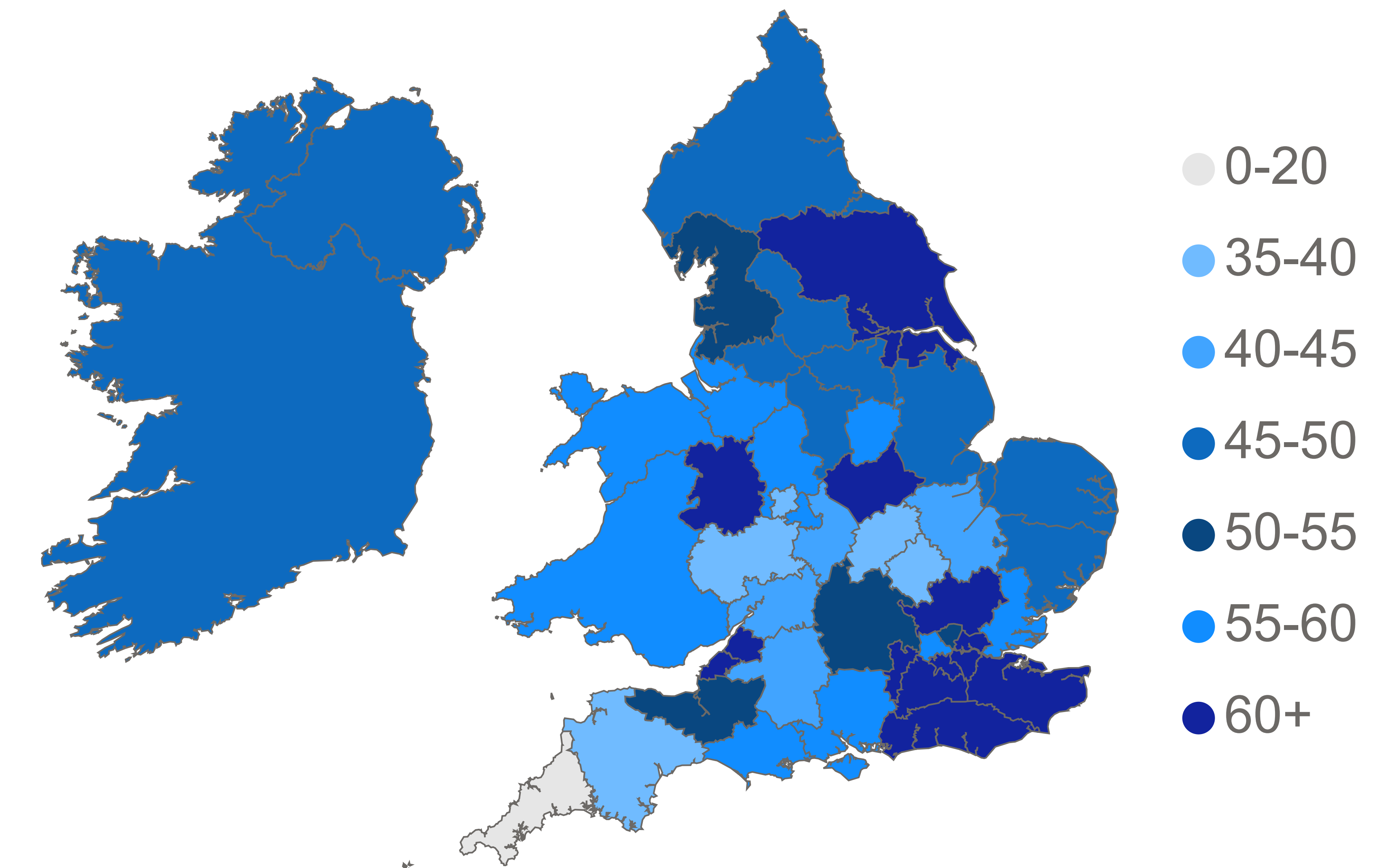
In 2023/24, the highest rate of antenatal diagnosis was 67% in East London Health and Care Partnership.

There is also a noticeable change in intra-regional rates of prenatal diagnosis between the two financial years 2022/23 and 2023/24 (e.g. in Devon where the figure rose to 53% in 2023/24 from 37% the year before).

Percentage of CHD procedures in the first year of life for infants who had a prenatal diagnosis in 2023/24



Percentage of CHD procedures in the first year of life for infants who had a prenatal diagnosis in 2022/23



Antenatal diagnosis of four reported lesions remains good with anticipated cyclical variations in rates of prenatal detection

The figure shows the prenatal detection rate of four individual cardiac lesions where a procedure is performed in the first year of life:

- Hypoplastic Left Heart Syndrome (HLHS)
- Tetralogy of Fallot
- Transposition of the Great Arteries with intact ventricular septum (TGA-IVS)
- Atrio-ventricular septal defect (AVSD)

For those requiring a procedure in the first year of life, the prenatal detection of TGA-IVS was highest in 2023/24 at 91%, improved from the previous year.

Detection rates for all the remaining lesions were lower than the previous year. While this could be due to cyclical variation, the data could reflect:

- a genuine fall in detection
- an increase in the termination of pregnancy for these diagnoses
- differences in screening timing and methods used by sonographers.

Percentage of procedures in first year of life for infants with prenatal diagnosis by specific lesion

Fallot HLHS TGA-IVS Complete AVSD

100
90
80
70
60
50
40
30

2014/15 2015/16 2016/17 2017/18 2018/19 2019/20 2020/21 2021/22 2022/23 2023/24

Note: A full table of results is available here (Link will be functional when publication goes live).

This link will be added at the publication stage.

Future Direction

Over the next year, the NCHDA audit has the following aims:

1. From April 2025, we are introducing PRAiS4 which is the recalibrated and refined risk adjustment model for analysis of mortality in paediatric CHD surgery.

2. New definitions for post-procedural complications have been agreed and all centres will be urged to comply with these to improve data quality and completeness.

3. With the establishment of the Patent Foramen Ovale Closure (PFOC) Registry, we have agreed specific inclusion and exclusion criteria for each domain and will establish a method to merge the data between the registries.

4. Ongoing work with the Fetal Working Group and National Congenital Anomaly and Rare Disease Registration Service (NCARDS) with aim to create a bidirectional link to optimise data quality and full case ascertainment.

5. Collaboration with the Clinical Reference Group (CRG) and CHD networks to acquire data for non-procedural based metrics like outpatient waiting times, surgical waiting lists and times, etc.

6. Encourage the use of the new online tools to improve data quality and allow hospitals rapid access to their own and benchmark performance data in as near to ‘real-time’ as possible.

7. Review the statistical methodology around the outlier process, focusing on specific procedures performed in low numbers.

8. Work with colleagues in Scotland to incorporate data from the audit there.

9. Consider the methodologies needed to report on long-term outcomes by diagnosis, collaborative initiatives to reduce early morbidity, and patient reported outcome measures (PROMs).

10. Explore and report on ethnicity data.

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