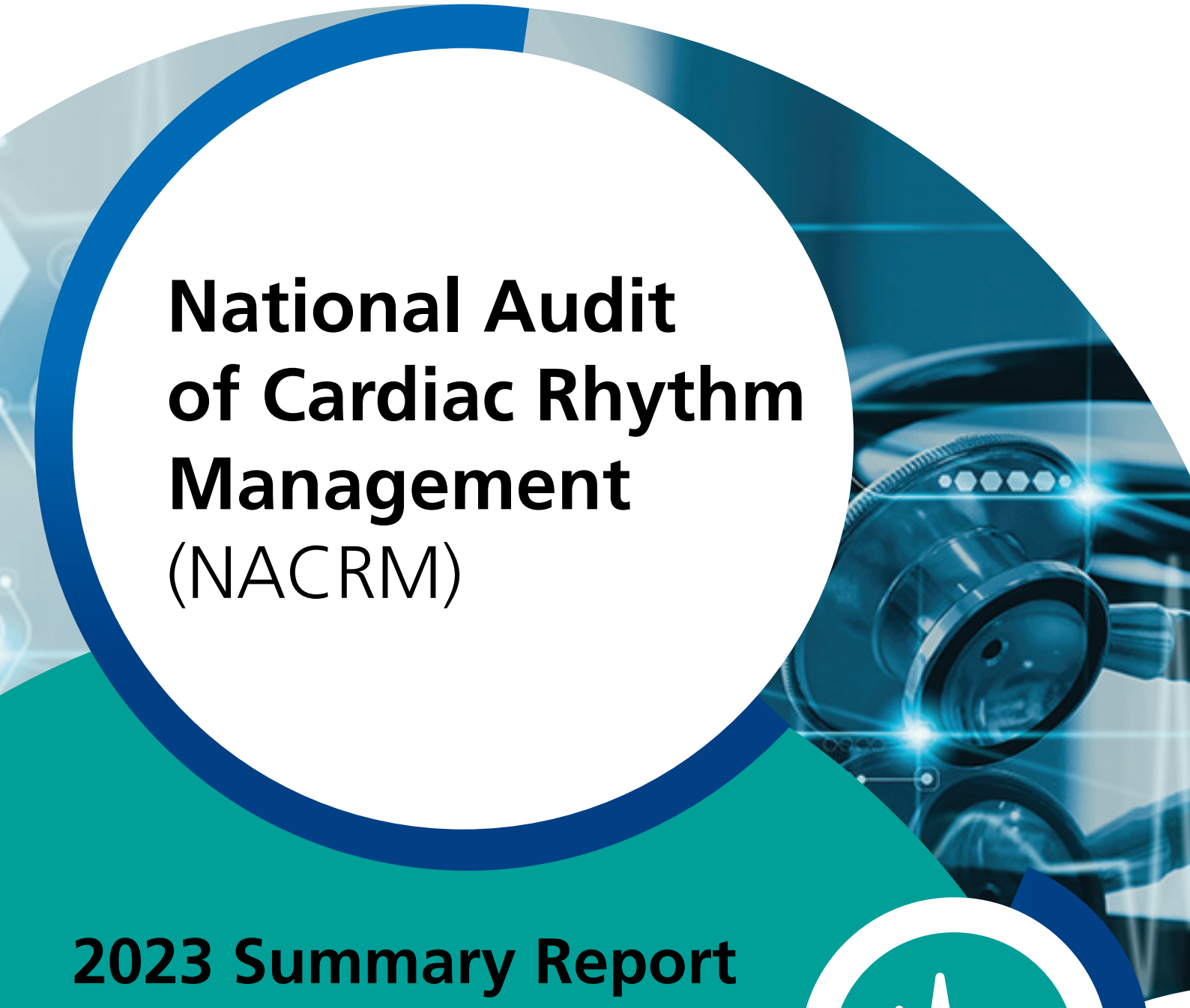
National Cardiac
Audit Programme

NICOR

National Audit of Cardiac Rhythm Management (NACRM)



2023 Summary Report

(2021/22 data)

BHRS
British Heart Rhythm Society

Contents

Report at a glance

Data from the period April 2021 to March 2022

Following a 17% drop in therapeutic implants in 2020/21 compared with 2019/20, there was an 11% increase in activity in 2021/22, but overall activity was still 7.7% lower than pre-pandemic levels. Ablation rates have improved but remain 11% down from 2019/20. Use of leadless pacemakers increased.

Devices

Pacemaker procedures were up to **93%**, implantable cardioverter defibrillator (ICD) procedures **89%** and cardiac resynchronisation therapy (CRT) procedures **93%** of pre-pandemic levels. Recovery across regions is variable.

New device technology is gaining ground. Over the last six years, there has been an increase in the use of subcutaneous ICDs (557 new implants compared to 4,048 transvenous devices) and leadless cardiac pacemakers (295 new implants).

21% of adult NHS centres were below national targets for simple device implants (up from **16.5%** in 2018/19). For complex devices, **41%** were below target (up from just over **38%** in 2017/18).

Ablation

Ablation activity almost ceased in the first COVID-19 lockdown. Activity has improved with all ablation activity up to **89%** of that in 2020/21 with complex atrial ablations up to **92%**. There was significant variability between centres.

Just over **18,000 catheter ablation procedures** were completed in 2021/22, up from 13,340 in 2020/21, but still **11%** lower compared to 2019/20.

72% of adult centres met the **pacing modality for atrioventricular block** (up from **58%** in 2014/15).

Eight NHS adult centres remained below target for all ablations, but only two were below the target for atrial fibrillation ablations.

For atrial fibrillation ablations, re-interventions rates are climbing (**7.3%** at one year and **13.3%** at two years). These are not at the levels that would be expected, suggesting some patients have been denied timely treatment, and waiting lists remain substantial.

Procedure volumes and training

Fewer subspecialty trainees obtained the high volume experience required to prepare them for independent practice as consultants.

- **21%** of adult NHS centres were below national targets for simple device implants (up from **16.5%** in 2018/19). For complex devices, **41%** were below target (up from just over **38%** in 2017/18).
- **40** adult NHS hospitals (out of 97) performed less than 60 **complex device implants** and **30** of 143 adult NHS hospitals reported less than 80 implants in 2021/22.
- A total of **520** operators performed at least 35 new/upgrade pacing procedures. **180** operators performed at least **60** new/upgrade procedures in 2021/22, of which at least **30** were complex.
- The number of trainees performing at least 35 **new/upgrade pacemaker implantation procedures** per year has risen from 16 in 2019/20 to **43** in 2021/22.
- The number of trainees achieving the target of performing at least **60 devices per year, (30 complex)** has increased substantially from three in 2020/2021 to **15** in 2021/22.
- **11** hospitals did not achieve the national standard of 50 cases per year for **atrial fibrillation ablation** which is the lowest number since the measurement was first reported in 2014/15.
- **19** out of 59 hospitals reported **fewer than 100 ablations** in 2021/22
- A total of **222** operators (including 16 trainees) performed at least 50 procedures, while **178** (including 11 trainees) carried out at least 25 simple ablations. Just over **200** operators performed at least 50 ablations, with at least **25** of those classified as complex, and **129** performed at least 50 complex ablations.
- Only **13** trainees undertook at least 25 complex procedures and at least 50 ablations in total and three reached the target of 50 complex procedures.More opportunities are needed for the next generation of consultants to gain significant experience

Device re-intervention and battery changes

Levels of device interventions and necessary battery changes remain stable

Hospitals planned their services to avoid patients missing device changes for battery depletion.

The reintervention rate in the first year after pacemaker implantation was stable at **4.6%**. The rate after complex devices was also stable at **5.7%**

Executive Summary

This report summarises the key findings from the National Audit of Cardiac Rhythm Management (NACRM), part of the National Cardiac Audit Program (NCAP). The NACRM report details activity in cardiac rhythm management (CRM) device and ablation procedures for England and Wales (Scotland has withdrawn from the audit, and the results from Northern Ireland are not included because of confidentiality and data protection issues).

The report covers the financial year 2021/22. It documents the recovery from the impact of the first year of the COVID-19 pandemic, which caused substantial disruption to cardiac care, as documented in last year's report. That recovery is not yet complete.

Focus of attention	Audit finding
Activity has not yet returned to pre-pandemic levels	Both total device (92%) and ablation procedures (89%) remained below activity in 2019/20. Recovery across regions has been variable.
Gradual decline in ICD implants and proportionately more CRT devices	Although implantable cardioverter defibrillator (ICD) implants reached 89% of 2019/20 levels, there has been a steady decline in these and a move towards cardiac resynchronisation therapy (CRT-P) devices for patients with heart failure. Total CRT device implants were 93% of 2019/20 levels.
New device technology is gaining ground	Over the last six years, there has been a notable increase in the use of subcutaneous ICDs (now 557 new implants compared to 4,048 transvenous devices) and leadless cardiac pacemakers (295 new implants).
Complex atrial ablations have recovered more than other forms of ablation	Complex atrial ablations were at 92% of 2019/20 levels, compared to 86% recovery for other types of ablation.
Many adult NHS centres remain below national targets for minimum activity	21% of adult NHS centres were below national targets for simple device implants (up from 16.5% in 2018/19). For complex devices, 41% were below target (up from just over 38% in 2017/18). Eight NHS adult centres remained below target for all ablations, but only two were below the target for AF ablations.
More trainees are receiving opportunities for a higher number of procedures	There has been a reassuring increase in high-volume trainees (for both devices and ablations).

Focus of attention	Audit finding
Re-interventions for devices are stable	Re-intervention rates for devices remain static at 4.6% for pacemaker implants and 5.7% for complex devices. However, there is considerable variability between centres.
Re-intervention rates for AF ablation are lower than expected (possibly representing missed opportunities for treatment)	For simple ablations, re-intervention rates are stable (3% at one year and 5.1% at two years). For AF ablation, as services normalise, re-intervention rates are climbing (7.3% at one year and 13.3% at two years). This is not yet at levels that would be predicted, suggesting some patients are still missing out on potentially beneficial treatment.

Summary of recommendations

1. Hospitals with poor data compliance should ensure that all members of the local CRM team comply with the requirements of the national audit dataset. Local training on the importance of each data field may be required.

   Centres failing to achieve the 90% goals (identified as red in their hospital reports) should require the clinical leads to analyse their poor performance. Although most submissions are made by allied health professionals, they are the responsibility of the consultants.

2. Data submission: centres with apparently very low volumes should engage with the validation process to ensure they are correctly represented. Device clinics should not submit records of follow-up patients they have 'inherited' from other implanting centres.

   The appropriateness and sustainability of centres with low volumes should be discussed locally and at a network level.

3. Consultants are reminded that submission of correct and complete data for procedures is their responsibility. Clinical directors should investigate whether low operator volumes result from poor data submission or genuinely low activity.

   Genuinely low-volume operators should be subject to close local audit for complications and decision-making, and the sustainability of their practice should be examined.

4. High device re-intervention rates are a cause for concern and should prompt a more thorough review of practice in a centre. Both high and low re-intervention rates for ablation may be a cause for concern.

   For complex atrial ablation, centres with very low re-intervention rates are more likely a cause for concern.

Commentary from partner organisations

The British Heart Rhythm Society (BHRS)

"The BHRS welcomes the latest NICOR report on CRM procedures for the year 2021/22 and appreciates all the hard work that has gone into getting this report out within 12 months. The report documents important trends in CRM – increasing use of the subcutaneous ICD and leadless pacing – but most importantly, demonstrates that services have not recovered from the effects of the COVID-19 pandemic. This reflects members' experiences in trying to restore services. There are increasing challenges in securing adequate elective facilities as in-patient pressures on acute medical admissions mount. There is also an increased in-patient workload, particularly in device work, including extraction and increasing referrals for in-patient ventricular tachycardia ablation. The report, as ever, will drive actions to address these pressure points. The next report for 2022/23 will be eagerly anticipated in 12 months' time."

Dr Alistair Slade, BHRS President

1 Introduction

This report summarises selected key findings from the National Audit of Cardiac Rhythm Management (NACRM), a part of the National Cardiac Audit Programme (NCAP). The NACRM report details activity in cardiac rhythm management (CRM) device and ablation procedures for England & Wales. Figures for Scotland and Northern Ireland are not included in this report. Scotland has withdrawn from the audit, and Northern Ireland is excluded from the report because of confidentiality and data protection issues.

The audit reports on data relating to (CRM) procedures from April 2021 to March 2022. These data were submitted by 172 hospitals in England and Wales for device procedures and 59 hospitals that reported ablations.

Our last report documented the impact of the first year of the COVID-19 pandemic. It caused substantial disruption to cardiovascular care in England and Wales. Between April 2020 and March 2021, there was a 20-30% fall in device implants and a 35% fall in ablations. For ablations, this fall was unevenly spread across hospitals, with a 60% fall in activity at some.

Several quality improvement (QI) measures have been included in this year's report. These are derived from QI measures set by the British Heart Rhythm Society (see https://www.nicor.org.uk/cardiac-rhythm-management-arrhythmia-audit/).

Further details on the background of the report, analytical methods and data can be found in the appendices. Hospital and operator details can also be found there, alongside charts documenting the geographical variation in activity.

The rest of this report is structured as follows:

- **Section 2** highlights the principal impacts of the second year of the COVID-19 pandemic
- **Section 3** focuses on several QI metrics that should continue to be a priority, either for individual operators, teams within hospitals or those leading service commissioning and development
- **Section 4** provides some pointers towards the future direction of the audit.

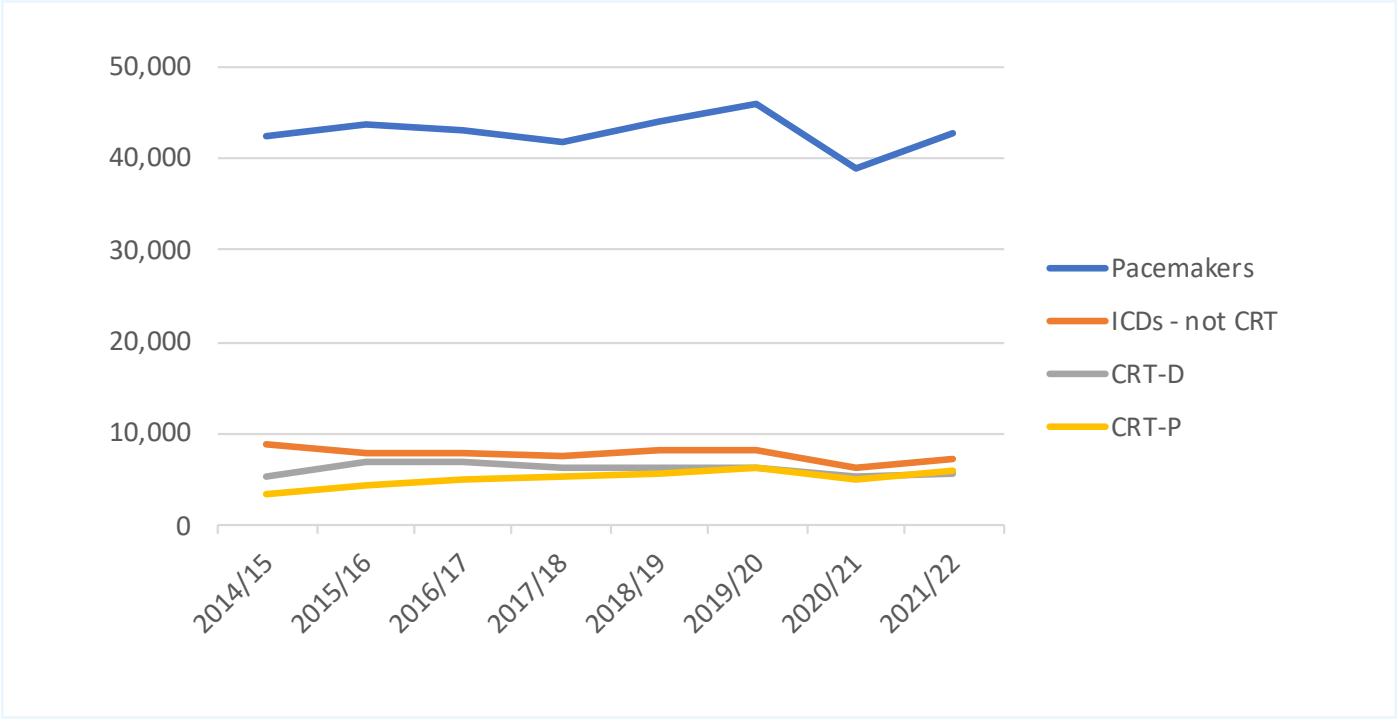
2 Recovery from the COVID-19 pandemic

2.1 There was a partial recovery in the number of devices implanted

Of the 172 centres reporting device implants in 2021/22, 150 were NHS adult hospitals, 19 were private hospitals, and the remaining three were children's hospitals.

Following a 17% drop in therapeutic implants in 2020/21 compared with 2019/20, there was an 11% increase in recovery, but overall activity was still 7.7% less than in 2019/20 [Figure 2.1].

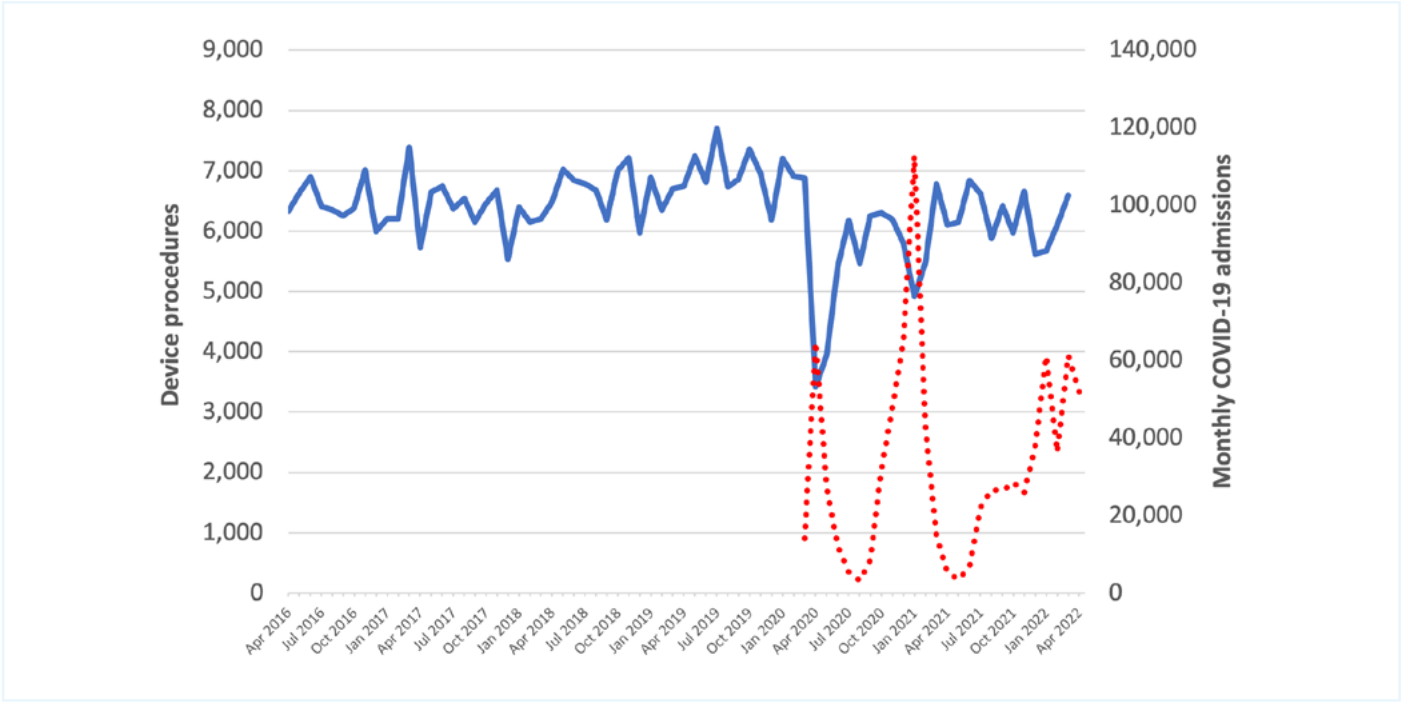
Figure 2.1: Number of procedures, 2014/15 - 2021/22 [NACRM data]



The monthly impact of the pandemic on device procedures is shown in Figure 2.2. The peaks in COVID-19 admissions at the end of 2021 and early 2022 had less effect on activity than the previous ones in 2020/21.

Reducing the waiting lists will be challenging until device activity either returns to pre-pandemic levels or, if possible, increases to higher throughput capacity than before.

Figure 2.2: Monthly device procedures against COVID-19 admissions, 2016/17 - 2021/22 [NACRM and UKHSA data[1]]



There is a gradual trend away from defibrillators, both implantable cardioverter defibrillators (ICDs) and cardiac rhythm management devices (CRT-Ds). This may reflect a change in practice, or the need for fewer box changes following improvements in battery technology. There is a general increase in cardiac resynchronisation therapy (CRT-P) device procedures [Figure 2.3].

Figure 2.3: Trends in all complex device implant procedures, 2014/15 - 2021/22 [NACRM data]

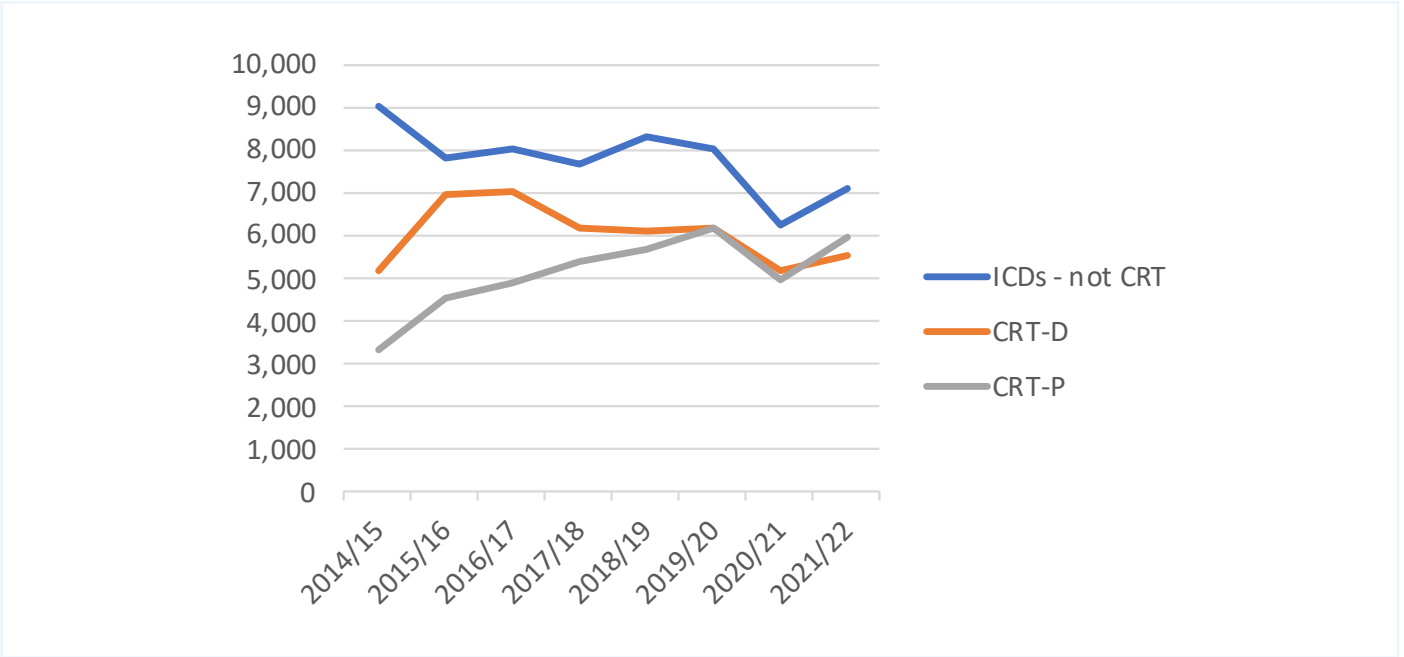


Table 2.1: Device activity, 2021/22 [NACRM data]

England						
	First Implant	Generator Change	Upgrade	Other	Undefined	Total
PPM (total)	26,999	9,072	103	2,510	2,120	40,804
LCP	294	26	6	80	20	426
ICD-TV	3,883	1,098	112	556	351	6,000
ICD - Subcutaneous	556	220	<3	78	48	90*
CRT-P	2,950	987	874	425	458	5,694
CRT-D	2,281	1,533	574	556	365	5,309
Other/blank	28	23	<3	374	628	1,50*
ILR	-	-	-	-	-	10,827

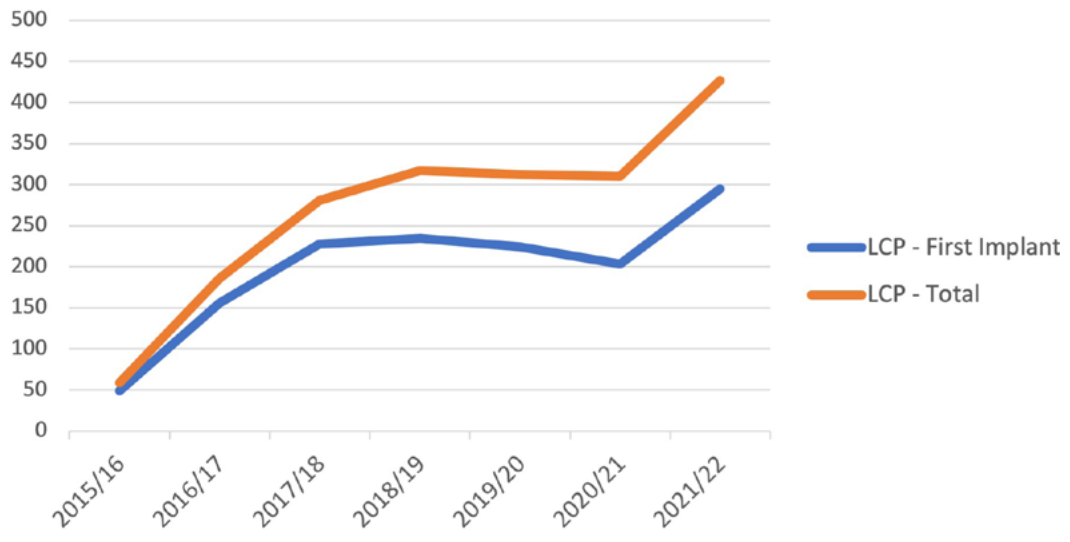
Wales						
	First Implant	Generator Change	Upgrade	Other	Undefined	Total
PPM (total)	1,453	291	<3	87	32	1,86*
LCP	<3	0	0	0	0	<3
ICD-TV	165	22	4	19	0	210
ICD - Subcutaneous	<3	<3	0	0	0	<3
CRT-P	186	32	30	15	4	267
CRT-D	115	39	26	20	6	206
Other/blank	<3	<3	0	<3	76	8*
ILR	-	-	-	-	-	259

England and Wales						
	First Implant	Generator Change	Upgrade	Other	Undefined	Total
PPM (total)	28,452	9,363	104	2,597	2,152	42,668
LCP	295	26	6	80	20	427
ICD-TV	4,048	1,120	116	575	351	6,210
ICD - Subcutaneous	557	221	<3	78	48	90*
CRT-P	3,136	1,019	904	440	462	5,961
CRT-D	2,396	1,572	600	576	371	5,515
Other/blank	30	24	<3	377	704	1,13*
ILR	-	-	-	-	-	11,086

PPM = permanent pacemaker; LCP = leadless cardiac pacemaker; ICD-TV = transvenous implantable cardioverter-defibrillator; CRT-P = cardiac resynchronisation therapy (pacing); CRT-D = cardiac resynchronisation therapy with ICD function; ILR = implantable loop recorder - *end number of total (from 0-9) removed as part of secondary supression.

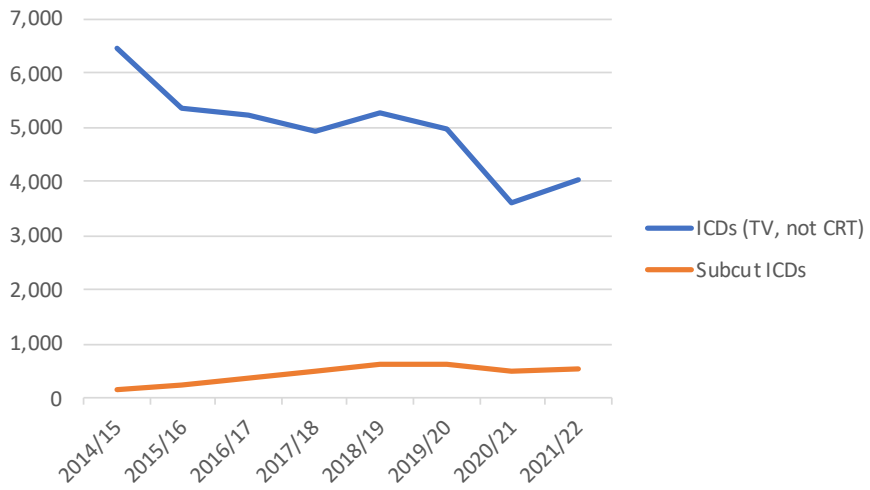
There have been some notable trends in leadless cardiac pacemaker (LCP) and ICD implantation. Reported LCP procedures did not change in the two years prior to the pandemic but increased sharply subsequently [Figure 2.4].

Figure 2.4: Leadless cardiac pacemaker procedures, 2015/16 - 2021/22 [NACRM]



Subcutaneous ICD implants increased greatly leading up to the pandemic but fell in 2020/21 and have not yet fully recovered [Figure 2.5]. This may reflect, in part, the availability of general anaesthesia.

Figure 2.5: First transvenous (TV) and subcutaneous (Subcut) ICD implants, 2015/16 - 2021/22

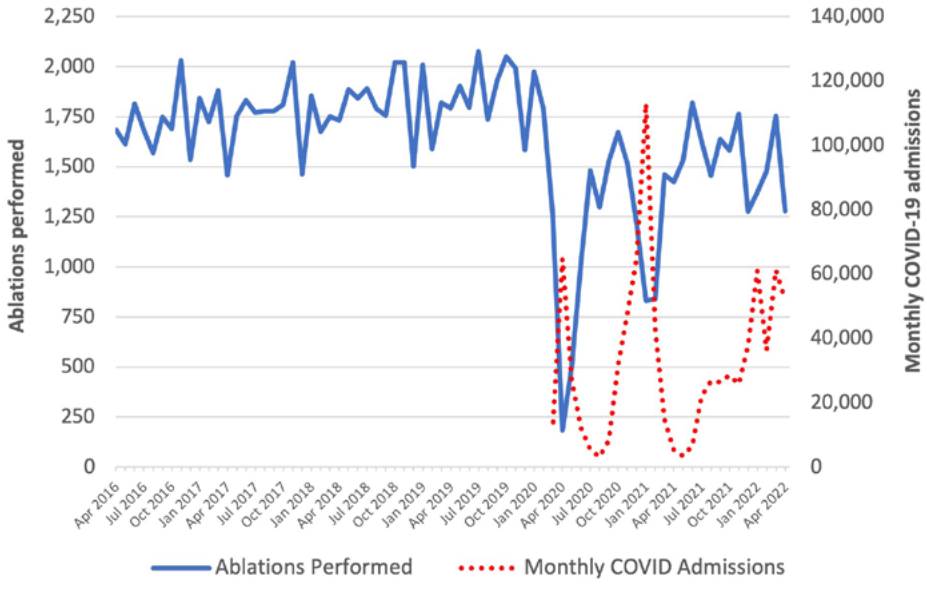


2.2 There was a partial recovery in the number of ablation procedures performed

Fifty-nine centres reported ablations in 2021/22, of which 43 were NHS adult hospitals and the rest private or children's hospitals.

Figure 2.6 shows the fall in ablation numbers because of the COVID-19 pandemic, which was particularly sharp during the first (March 2020) and second (December 2020) lockdowns. There was a smaller impact on ablation numbers from the peaks seen in COVID-19 admissions at the end of 2021 and early 2022.

Figure 2.6: Month-by-month data for ablations performed and COVID-19 admissions, April 2016 - April 2022 [NACRM and UKHSA data]



Catheter ablations are made up of:

- 'Simple' ablations where the only target is the AV node, the cavotricuspid isthmus for typical atrial flutter, and/or or an accessory pathway or slow AV nodal pathway for supraventricular tachycardia
- 'Complex A' including ablations for atrial fibrillation (AF) and all atrial tachycardias other than typical atrial flutter.
- 'Complex V' including all ventricular ablations, whether focal or substrate-based.

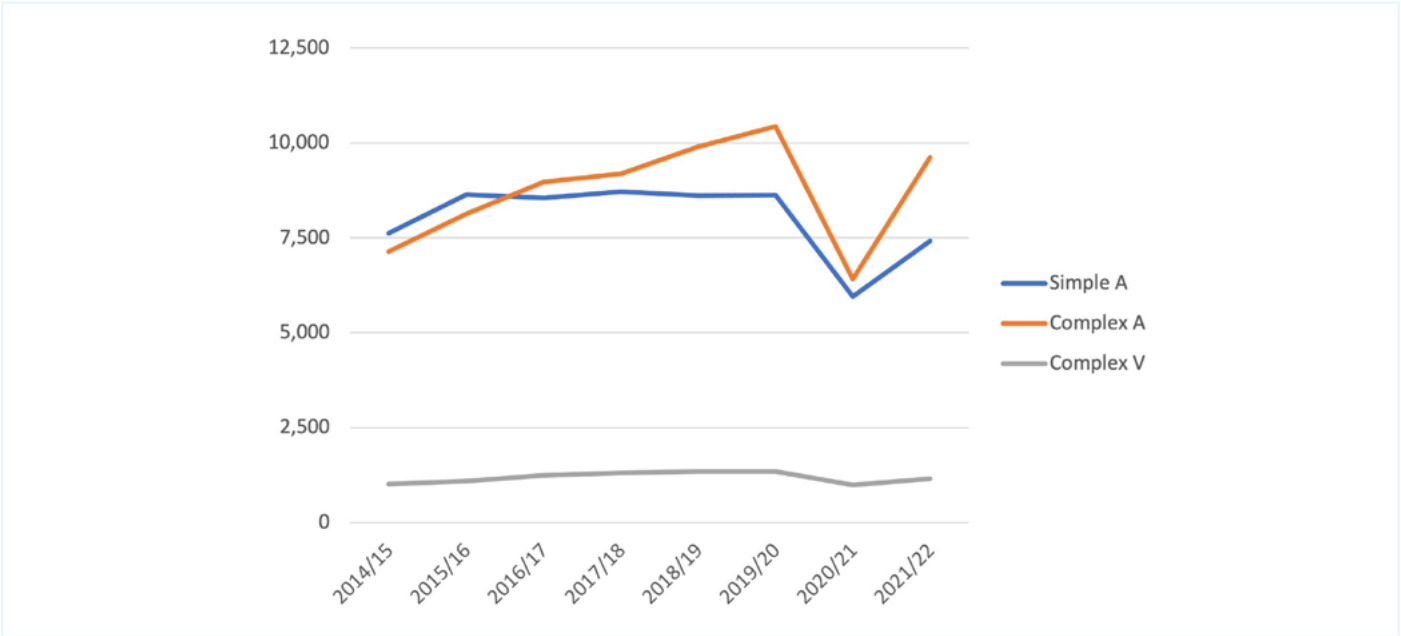
Complex A and V procedures include those with additional 'simple' targets.

In 2021/22, there was a total of just over 18,000 catheter ablation procedures, up from 13,332 in the first year of the pandemic but still 11% lower than in 2019/20 [Figure 2.7 and Table 2.2] and even further behind if accounting for the steady growth in the previous five years.

While numbers dropped across all types of ablation, complex atrial ablations (mostly for AF, the most common ablation) fell most during the first pandemic year, with a 40% reduction resulting from a combination of low perceived priority and lack of availability of anaesthetic support. Even though activity has recovered during 2021/22 to 92% of the pre-pandemic level, a substantial nationwide waiting list has accrued and addressing this remains challenging.

Unfortunately, the effectiveness of AF ablation diminishes with the time spent in AF, such that a significant proportion of patients have been permanently disadvantaged by delays in their treatment.

Figure 2.7: Number of ablation procedures, 2014/15 - 2021/22 [NACRM data]



Patient Vignette

"Mrs X was a 68-year-old lady with a history of atrial fibrillation.

She had paroxysmal atrial fibrillation diagnosed early in 2022 when she presented to hospital with breathlessness and presyncope. Her symptoms continued, and when reviewed in outpatients, she was referred to her local centre for consideration of an ablation. Almost 12 months on, she had had three further admissions and had less significant weekly symptoms which were not controlled with medication. She was still waiting for an outpatient review at the centre.

Once again, she found herself in her local admissions unit. On this occasion, she was referred to her local centre for consideration of an inpatient ablation. She was accepted for this and spent a further 10 days in hospital before being transferred. She was frustrated that she had to wait in hospital, but realised that if she was discharged again, nothing would progress quickly.

For an entire year, she felt her life had been on hold. Furthermore, she had used considerable healthcare resources. Had delays in the system not built up as a consequence of the COVID-19 pandemic, she could have had the procedure sooner and reduced the risks of further admissions."

Table 2.2: Yearly ablation procedures, 2014/15 - 2021/22 [NACRM data]

	2014/15	2014/15	2014/15	2014/15	2014/15	2014/15	2014/15	2014/15
Simple	7,614	8,639	8,550	8,718	8,617	8,630	5,948	7,420
Complex A	7,142	8,127	8,971	9,189	9,906	10,440	6,411	9,616
Complex V	1,013	1,081	1,237	1,302	1,344	1,338	981	1,151
Total	**15,757**	**17,841**	**18,744**	**19,194**	**19,854**	**20,396**	**13,332**	**18,178**

These total figures mask significant variations between different regions [Figure 2.8 and Table 2.3]. The greatest drops in activity during 2020/21 were in East Midlands, London, the North West and South West, and the North East. Of these regions, catheter ablation activity in 2021/22 remained below pre-pandemic levels in all but the North East. Ablation activity in other regions has recovered to or exceeds that prior to the pandemic. The variation in the provision of access to ablation remains unequal across the country.

Figure 2.8: Percentage variation in ablation numbers by region, 2020/21 and 2021/22 compared with 2019/20 [NACRM data]

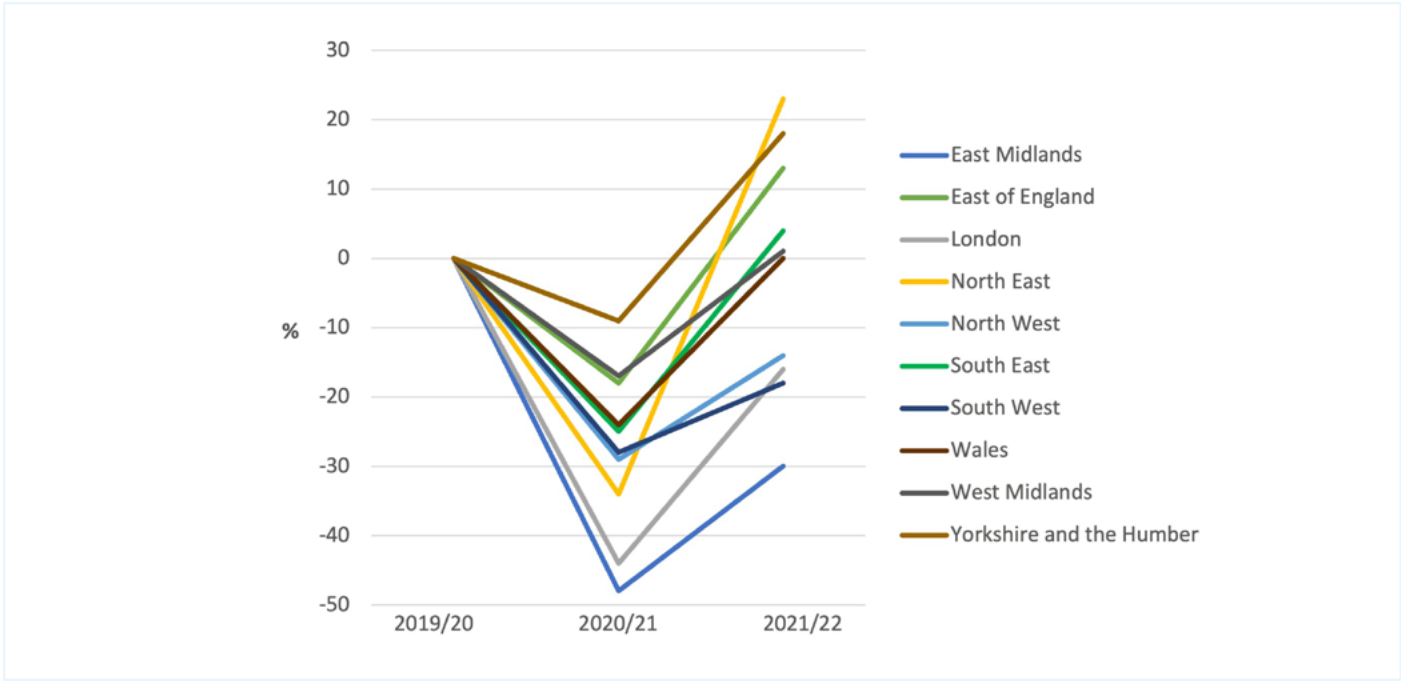


Table 2.3: Percentage change in ablation numbers by region, 2019/20 - 2021/22 [NACRM data]

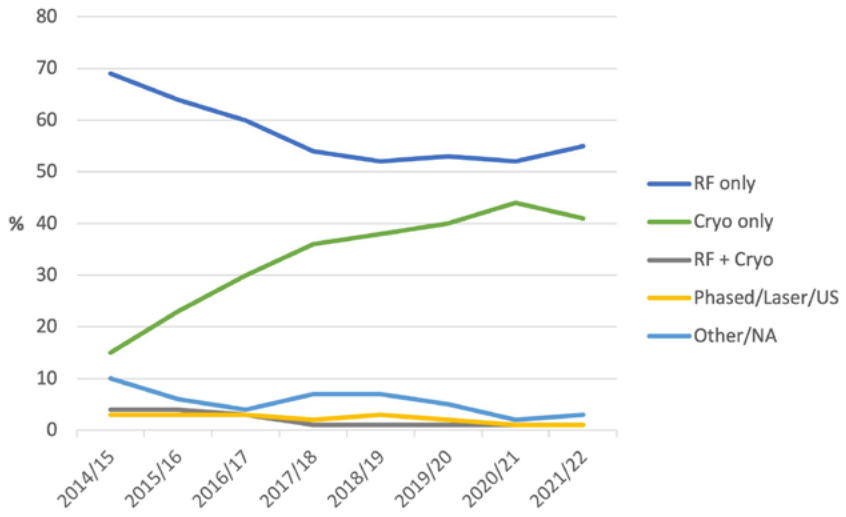
	Number of ablation procedures			Change from pre-pandemic activity		
	2019/20	2020/21	2021/22	2019/20	2020/21	2021/22
East Midlands	1,161	600	814	0%	-48%	-30%
East of England	1,783	1,469	2,020	0%	-18%	13%
London	4,123	2,298	3,481	0%	-44%	-16%
North East	491	324	605	0%	-34%	23%
North West	2,734	1,932	2,358	0%	-29%	-14%
South East	3,536	2,662	3,695	0%	-25%	4%
South West	975	702	801	0%	-28%	-18%
Wales	417	315	416	0%	-24%	0%
West Midlands	1,535	1,278	1,553	0%	-17%	1%
Yorkshire and the Humber	856	780	1,011	0%	-9%	18%

2.3 The growth in the use of cryoablation has plateaued

Between 2014/15 and 2021/22, more than 55,000 ablations were performed with atrial fibrillation as the only target. Initially, the overwhelming majority of cases used 'point-by-point' delivery of radiofrequency (RF) lesions to isolate the pulmonary veins. A variety of alternative technologies for 'single-shot' ablation were then introduced, including the use of cryo-, laser and ultrasound balloons ablation, and phased RF arrays.

The proportion of cases using cryoballoons increased steadily from 15% to 41% by the end of this period. In 2020/21 the proportion was slightly higher, probably reflecting the pandemic having a lower impact on certain high-volume centres that favour cryoablation. Use of the other 'single-shot' technologies and of combined RF and cryoablation has fallen from a maximum of 4% to 1% each [Figure 2.9].

Figure 2.9: Proportion of ablation technologies used for ablation of atrial fibrillation, 2014/15 - 2021/22 [NACRM data] [NACRM data]



2.4 There has been a recovery in the numbers of trainees undertaking device procedures

At present, the NACRM audit counts procedures whether the doctor was first operator, second operator, or the supervising consultant. As all cardiology trainees are exposed to device procedures early on in their training, this results in large number of trainees appearing in the data with very low numbers. This does not mean that they were 'first operators' or that patients were being operated on by inexperienced doctors without considerable supervision.

More trainees are being given opportunities for moderate case numbers. However, the number of trainees implanting very high numbers of devices (≥ 90) continues to fall [Figure 2.10]. This is a general downward trend which is mirrored in the data for complex procedures, despite a slight uptick in the latter figure this year [Figure 2.11].

Figure 2.10: Number of trainees undertaking procedures by volume of all device implants, 2017/18 - 2021/22 [NACRM data]

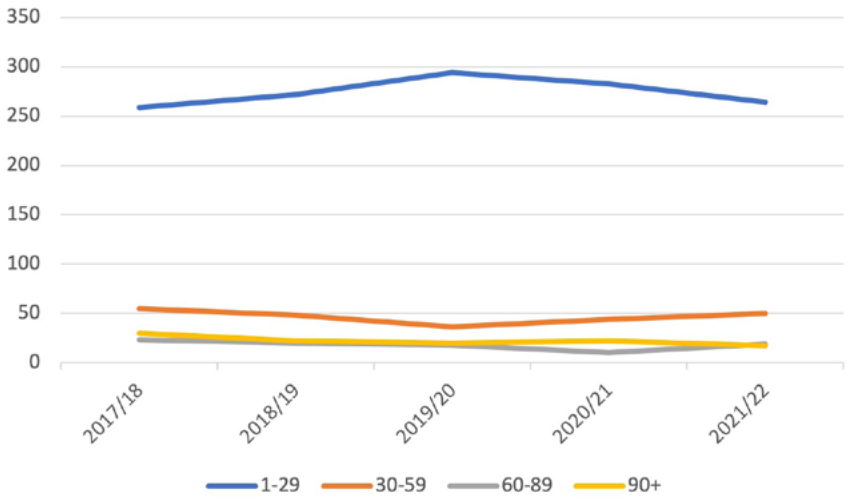
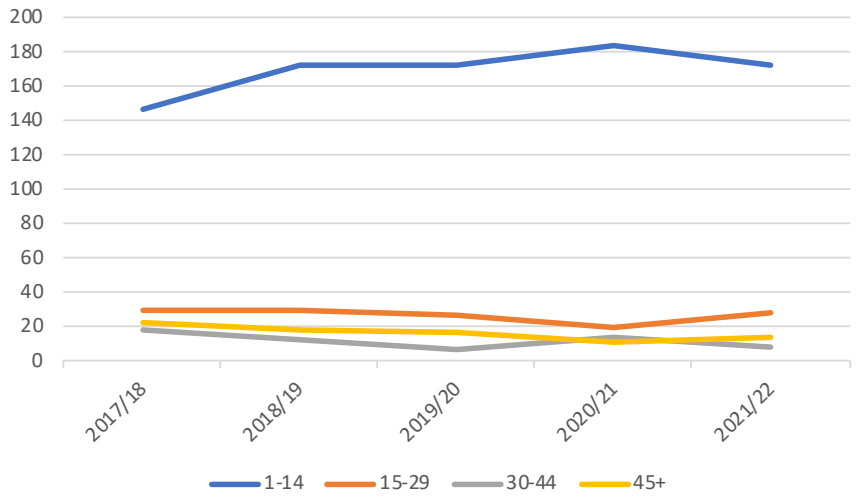


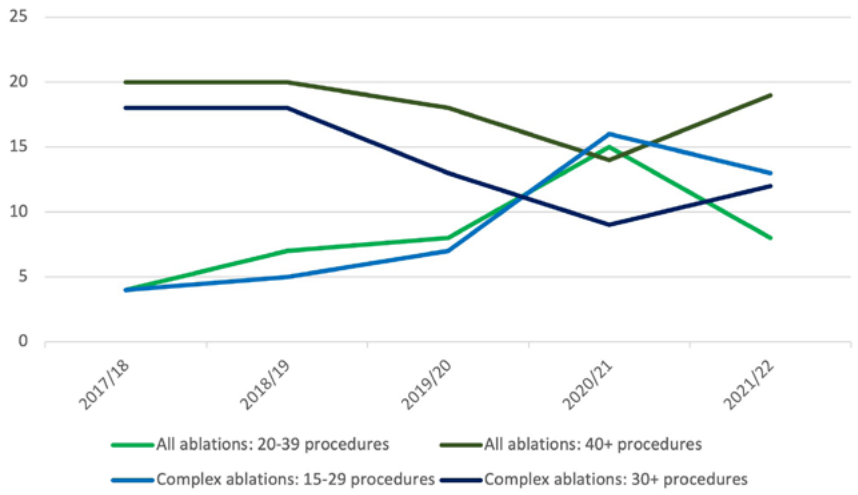
Figure 2.11: Number of trainees undertaking procedures by volume of complex device implants, 2017/18 - 2021/22 [NACRM data]



2.5 There has also been a recovery in the number of ablations that trainees are performing

Last year we reported that the pandemic had dramatically impacted training, with fewer trainees undertaking high volumes of ablations or device implants. In 2021/22, the number of trainees undertaking small volumes of ablation fell, and the number undertaking higher volumes rose, reaching pre-pandemic levels [Figure 2.12].

Figure 2.12: Trainee numbers – ablation procedures, 2017/18 - 2021/22 [NACRM data]



3 Selected quality improvement metrics

3.1 Background and data sources

Details about the Quality Standards in this section can be found in the Appendices including the data they are derived from and the logic behind them. They are broadly divided into five categories:

1. Data completeness and validity (standards 1-2)
2. Hospital volumes (standards 3-6)
3. Operator volumes (standards 7-11)
4. Adherence to NICE guidelines (standards 12-15)
5. Procedural success and complication rates (standards 16-18).

3.2 Many hospitals are still failing to submit adequate data

3.2.1 Overview of QI metric

QI Metric Description/Name	Data Completeness and Validity (1-2)
Why is this important?	A key indicator of an effective service with good governance is compliance with audit. This means complete, accurate and valid data entry. It also ensures accurate recording of the clinical activity for the centre and the doctors working there.
QI theme	Effectiveness.

QI Metric Description/Name	Data Completeness and Validity (1-2)
What is the standard to be met?	**Quality Standard 1** Hospitals should achieve ≥90% completeness in each of 6 data domains for device and ablation procedures (completeness). **Quality Standard 2** Hospitals should achieve ≥90% validity in key data domains for device and ablation procedures.
Key references to support the metric	N/A.
Numerator	**Data Completeness** For each domain, the average of fields completed. **Data Validity** Devices: records in which the stated system type matches capability of the generator model. Ablation: records in which 'ablation attempted' matches other related entries.
Denominator	Number of records.
Trend	Despite the pandemic, there has been a trend towards improvement in data completeness and validity. The PowerPoint presentation (Appendix 13) and appendices contain further details.
Variance	Wide variation exists between hospitals, with some consistently achieving 100% completeness in all domains.

Additional information can be found in the appendices. The accuracy and data completeness should continue to be a priority for hospitals, and those leading service commissioning and development.

3.2.2 Recommendations for those not achieving the standard

Hospitals with poor data compliance should ensure that all members of the local CRM team comply with the requirements of the national audit dataset.

Local training on the importance of each data field may be required.

Centres failing to achieve the 90% goals (identified as red in their hospital reports) should require the clinical leads to analyse their poor performance. Although most submissions are made by allied health professionals, they are the responsibility of the consultants.

3.3 Hospital volumes are increasing again after the first year of the pandemic

3.3.1 Overview of QI metric

QI Metric Description/Name	Hospital Activity Volumes (3-6)
Why is this important?	International studies have demonstrated that outcomes tend to be poorer in hospitals undertaking low volumes of device and ablation procedures. The British Heart Rhythm Society publishes standards documents for hospitals and clinicians undertaking these procedures in adults. These include minimum recommended procedure volumes, which are stringent by international standards. The standards documents are regularly reviewed.
QI theme	Safety.
What is the standard to be met?	**Quality Standard 3 (Device Implantation)** BHRS Standards (2018) recommend that pacing centres undertake a minimum of 80 device implants per year. Training centres should perform more than 100 device implants per year. **Quality Standard 4 (Complex Device Implantation)** BHRS Standards (2018) recommend that complex device centres undertake a minimum of 60 such procedures (ICD and CRT implant/upgrades) per year (80 is desirable).

QI Metric Description/Name	Hospital Activity Volumes (3-6)
What is the standard to be met?	**Quality Standard 5 (Catheter Ablation)** BHRS Standards (2020) recommend that ablation centres undertake a minimum of 100 ablation procedures per year in total. **Quality Standard 6 (AF Ablation)** BHRS Standards (2020) recommend that centres undertaking AF ablation should perform a minimum of 50 such cases per year.
Key references to support the metric	References can be found in the reference list in Appendix 1.
Numerator	Pacemaker implants and complex device (ICD, CRTP, CRTD) implants/upgrades, simple and complex ablations.
Denominator	N/A.
Trend	Thirty of 143 adult NHS hospitals reported fewer than 80 implants in 2021/22. This is a slight fall from 2020/21 (32/146). Forty of 97 adult NHS hospitals reported fewer than 60 complex device implants. Nineteen of 59 hospitals undertook fewer than 100 ablations. This figure continues the overall slight improvement in the number of centres meeting the standard. Fewer hospitals undertake AF ablation (49). Eleven hospitals did not achieve the standard, which is the lowest number since this measure was first reported in 2014/15.
Variance	Centres that are apparently low volume may partly reflect under-reporting. Some genuinely low-volume centres may be new, or in remote geographies.

3.3.2 Numbers of hospitals meeting targets for devices

Not all NHS or private hospitals submit data to NICOR. Of those that do, the percentage of NHS adult hospitals not reaching the target has increased since the pandemic, having steadily fallen before that [Table 3.1]. This will be in part because activity has not yet returned to normal levels.

It is unclear whether this measure is useful to gauge private hospitals. Many of the staff working there will also hold NHS contracts and so develop their experience by undertaking procedures in NHS hospitals.

The target is also not good for children's hospitals because of the small number of procedures that are required for children and the complexity of care that some require. It would be preferable for paediatric hospitals to benchmark against themselves and to seek international data upon which to assess acceptable performance.

Table 3.1: Numbers of hospitals meeting targets by type of device, 2014/15 - 2021/22 [NACRM data]

Simple devices								
	2014/15	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**
NHS adult hospitals	164	170	165	163	158	156	146	143
Number below standard	57	31	29	29	26	26	32	30
% below standard	35%	18%	18%	18%	17%	17%	22%	21%
Private hospitals	17	18	18	17	17	17	16	16
Number below standard	17	17	16	14	14	14	13	16
% below standard	100%	94%	89%	83%	82%	82%	81%	100%
Children's hospitals	4	4	4	<3	4	5	<3	<3
Number below standard	4	4	4	<3	4	5	<3	<3
% below standard	100%	100%	100%	100%	100%	100%	100%	100%

Simple devices

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
All Hospitals	185	192	187	183	179	178	164	161
Number below standard	78	52	49	46	44	45	47	48
% below standard	42%	27%	26%	25%	25%	25%	29%	30%

Complex devices

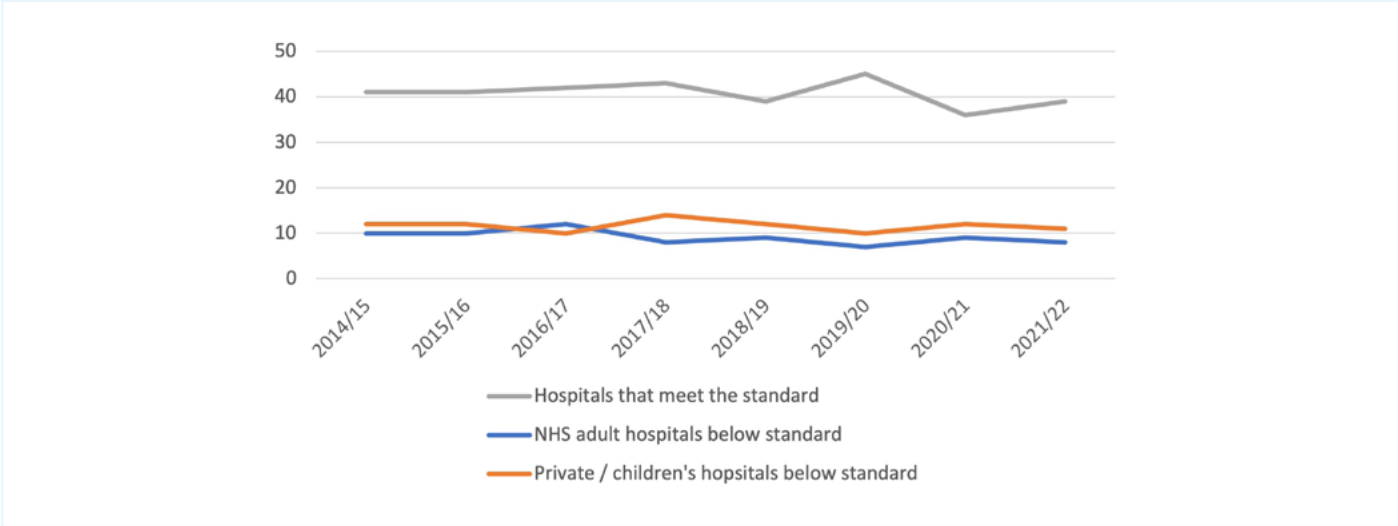
	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
NHS adult hospitals	99	112	112	112	112	111	103	97
Number below standard	61	53	41	43	40	39	42	40
% below standard	62%	47%	37%	38%	36%	35%	41%	41%
Private hospitals	16	15	17	15	15	16	13	16
Number below standard	16	15	17	15	14	16	13	16
% below standard	100%	100%	100%	100%	100%	100%	100%	100%
NHS children's hospitals	4	4	<3	<3	5	4	<3	<3
Number below standard	4	4	<3	<3	5	4	<3	<3
% below standard	100%	100%	100%	100%	100%	100%	100%	100%
All Hospitals	119	131	132	130	132	131	118	115
Number below standard	81	72	61	61	59	59	57	58
% below standard	68%	55%	46%	47%	48%	45%	48%	50%

3.3.3 **Numbers of centres meeting targets for ablations**

Nineteen out of fifty-nine hospitals reported fewer than 100 ablations in 2021/22, two fewer than the previous year. Of those, 11 were either private or children's hospitals and eight were NHS adult hospitals. Numbers have been broadly similar since 2014 [Figure 3.1].

Imperial College/Hammersmith Hospital continues to fail to report its ablation activity.

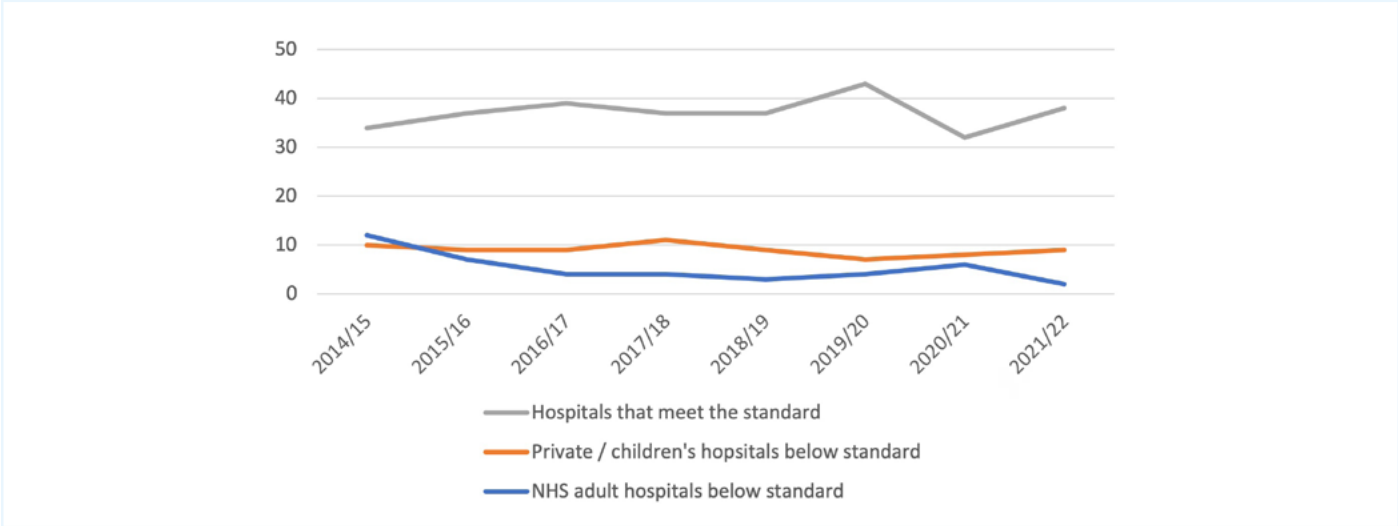
Figure 3.1: Number of centres meeting targets for volume of ablations, 2014/15 - 2021/22 [NACRM data]



3.3.4 **Numbers of centres meeting targets for AF ablation**

Fewer hospitals (49) reported undertaking AF ablation in 2021/21, of which 38 met the standard. Nine private or children's hospitals did not meet the target, and two NHS hospitals reported doing under 50 cases in the year. There has been a gradual fall in the number of centres not meeting this standard [Figure 3.2], and 11 is the fewest number of centres ever to do so.

Figure 3.2: Number of centres meeting targets for volume of AF ablations, 2014/15 - 2021/22 [NACRM]



3.3.5 Recommendations for those not achieving the standard

Data submission: centres with apparently very low volumes should engage with the validation process to ensure they are correctly represented.

Device clinics should not submit records of follow-up patients they have 'inherited' from other implanting centres. The appropriateness and sustainability of centres with low volumes should be discussed locally and at a network level.

3.4 There is still a large number of operators who report low volumes

3.4.1 Overview of QI metric

QI Metric Description/Name	Operator volumes for device and ablation procedures (7-11)
Why is this important?	Studies have demonstrated that device and ablation procedure outcomes tend to be poorer when undertaken by low-volume operators. The British Heart Rhythm Society has made recommendations for individual specialists undertaking device (2018) and ablation (2020) procedures in adults. The standards documents are regularly reviewed.
QI theme	Safety.
What is the standard to be met?	**Quality Standard 7 (Pacemaker Implantation)** The minimum volume for an implanting specialist is 35 total new/upgrade devices per year. **Quality Standard 8 (Defibrillator/Cardiac Resynchronisation Therapy)** For those who are non-CRT implanters, it is recommended that operators implant 60 devices per year, of which 30 must be new ICD implants or upgrades.

QI Metric Description/Name	Operator volumes for device and ablation procedures (7-11)
What is the standard to be met?	If the operator implants CRT devices, again, 60 device implants per annum is recommended, of which 20 should be new CRT-P/D implants or upgrades. If the consultant is training an SpR they should perform a minimum of 30 ICD or CRT implants or upgrades per year, and 40 is desirable. **Quality Standard 9 (All Ablation)** An operator undertaking catheter ablation should perform at least 50 ablation procedures per year. **Quality Standard 10 (Simple Ablation)** An operator performing simple ablations should perform at least 25 simple ablations per year. **Quality Standard 11 (Complex Ablation)** For those undertaking complex procedures (generally AF ablation), the recommendation is at least 25 such procedures from a total of at least 50 procedures per year. Fifty or more complex procedures is desirable. Operators performing single-shot atrial fibrillation ablation should be performing a minimum of 25 ablations using that technique each year.
Key references to support the metric	References can be found in the reference list in Appendix 1.
Numerator	Pacemaker implants and complex device (ICD, CRTP, CRTD) implants/upgrades, simple and complex ablations.
Denominator	N/A.
Trend	There is a rise in the number of operators reaching minimum volumes for devices (520 in 2021/22), but still fewer than in 2019/20 (550). Many operators do not reach minimum standards. Similarly, there is a rise in those reaching minimum standards for ablation (212) but there are many low-volume operators.
Variance	There is wide variation in operator volumes. There are a significant number of low-volume operators where it is likely that their names have been entered in error.

3.4.2 **Operator volumes for devices**

Table 3.2 details operator volumes. Operator status (cardiologist, trainee, etc) is taken from the GMC list of registered medical practitioners. This recognises those with a CCST or who are registered trainees. A few reported operators were not cardiologists (eg anaesthetists) and their details have probably been entered in error.

A total of 520 operators performed at least 35 new/upgrade procedures, of which 43 were trainees. Some 180 performed at least 60 new/upgrade procedures in 2021/22, of which at least 30 were complex. Fifteen trainees also met this standard.

Over the past three years, there has been a steady increase in the numbers of trainees meeting the standards required of consultants in terms of numbers performed. For Quality Standard 7 (at least 35 new/upgrade procedures per annum), the number of trainees achieving this has risen from 16 in 2019/20 to 43 in 2021/22.

The number of trainees achieving the target for Quality Standard 8 (at least 60 devices per annum, of which 30 are complex) has increased substantially from two and three in 2019/20 and 2020/2021 to 15 in this year's data.

Table 3.2: Operator volumes for devices compared with quality standards (QS), 2019/20 - 2021/22 [NACRM data]

Devices			
	2019/20	**2020/21**	**2021/22**
Total operators performing at least one device procedure	1,504	1,438	1,418
Cardiologists	955	873	808
Paediatric Cardiologists	20	15	16
Trainees	291	320	350
Not Cardiologists	36	31	27
Cardiothoracic Surgeons	62	44	42
Unknown	140	155	173
QS 7 - Operators performing at least 35 new/ upgrades per annum	**550**	**498**	**520**
QS 7 - Trainees performing at least 35 new/ upgrade procedures per annum	**16**	**26**	**43**

Pacemaker implants/upgrades

	2019/20	2020/21	2021/22
Total operators performing at least one pacemaker implant/upgrades	1,373	1,324	1,288
Cardiologists	911	830	753
Paediatric Cardiologists	12	11	12
Trainees	266	297	331
Not Cardiologists	25	22	19
Cardiothoracic Surgeons	38	30	22
Unknown	121	134	151
QS 8 - Complex operators performing at least 60 devices per annum, of which 30 are complex	**213**	**155**	**180**
QS 8 - Trainee complex operators performing at least 60 devices per annum, of which 30 are complex	**<3**	**<3**	**15**

CRT/ICD implants/upgrades

	2019/20	2020/21	2021/22
Total operators performing at least one pacemaker implant/upgrades	844	805	803
Cardiologists	598	540	489
Paediatric Cardiologists	11	9	11
Trainees	150	173	206
Not Cardiologists	12	7	5
Cardiothoracic Surgeons	17	8	12
Unknown	56	68	80

3.4.3 Operator volumes for ablation procedures

Table 3.3 details operator volumes for ablation. Operator status (cardiologist, trainee, etc) is again taken from the GMC list of registered medical practitioners. This identifies accredited specialists and official trainees (with National Training Nos). There were 272 cardiologists, 9 paediatric cardiologists and 100 trainees. Many of the 'others' may be clinical or overseas fellows not in national training schemes.

A few reported operators were not cardiologists (e.g. anaesthetists) and their details have probably been entered in error. Forty-five operators were 'unknown'.

A total of 222 operators (including 16 were trainees) performed at least 50 procedures, while 178 (including 11 trainees) carried out at least 25 simple ablations. Just over 200 operators performed at least 50 ablations, with at least 25 of those classified as complex, and 129 performed at least 50 complex ablations.

Only 13 trainees undertook at least 25 complex procedures and at least 50 ablations in total and three reached the target of 50 complex procedures.

Table 3.3: Operator volumes for ablations compared with quality standards (QS), 2019/20 - 2021/22

All ablations			
	2019/20	**2020/21**	**2021/22**
Total operators performing at least one ablation	398	408	422
Cardiologists	297	282	268
Paediatric Cardiologists	14	10	9
Trainees	53	79	96
Not Cardiologists	5	<3	5
Unknown	29	35	44
QS 9 - Operators performing at least 50 ablations per year	**201**	**177**	**212**
QS 9 - Trainees performing at least 50 ablations per year	**<3**	**<3**	**14**

Simple ablations			
	2019/20	**2020/21**	**2021/22**
Total operators performing at least one ablation	371	381	397
Cardiologists	281	270	260

Simple ablations

	2019/20	2020/21	2021/22
Paediatric Cardiologists	13	9	9
Trainees	46	74	90
Not Cardiologists	<3	0	<3
Unknown	28	28	36
QS 10 - Operators performing at least 25 simple ablations per year	**178**	**157**	**178**
QS 10 - Trainees performing at least 25 simple ablations per year	**<3**	**<3**	**11**

Complex ablations

	2019/20	2020/21	2021/22
Total operators performing at least one ablation	346	341	354
Cardiologists	269	248	243
Paediatric Cardiologists	10	9	7
Trainees	40	52	61
Not Cardiologists	5	<3	<3
Unknown	22	30	40
QS11 - Operators performing at least 50 ablations, with at least 25 being complex	**191**	**161**	**202**
QS11 - Operators performing at least 50 complex ablations per annum	**139**	**75**	**129**
QS11 - Trainees performing at least 50 ablations, with at least 25 being complex	**<3**	**<3**	**13**
QS11 - Trainees performing at least 50 complex ablations per annum	**0**	**0**	**<3**

3.4.4 Recommendations for those not achieving the standard

Consultants are reminded that submission of correct and complete data for procedures is their responsibility.

Clinical directors should investigate whether low operator volumes result from poor data submission or genuinely low activity.

Genuinely low-volume operators should be subject to close local audit for complications and decision-making, and the sustainability of their practice should be examined.

3.5 Adherence to NICE and other guidelines is either improving gradually or stable

QI Metric Description/Name	Adherence to NICE and Other Guidelines (12-15)
Why is this important?	To reduce morbidity and mortality, NICE and other relevant guidelines should be followed.
QI theme	Effectiveness.
What is the standard to be met?	**Quality Standard 12 (Pacing for Sinus Node Disease in the Absence of Atrial Fibrillation)** Fewer than 10% of devices should be VVI(R) devices. **Quality Standard 13 (Pacing for Atrioventricular Block in the Absence of Atrial Fibrillation)** Fewer than 10% of devices should be VVI(R) devices. **Quality Standard 14 (ICDs for Primary Prevention)** 80% of ICD implants for primary prevention should be documented to meet at least one of the NICE criteria: • Left ventricular dysfunction ≤35% despite optimum medical therapy and who are not in NYHA functional class IV. • A familial cardiac condition with a high risk of sudden death. • Prior surgical repair of congenital heart disease.

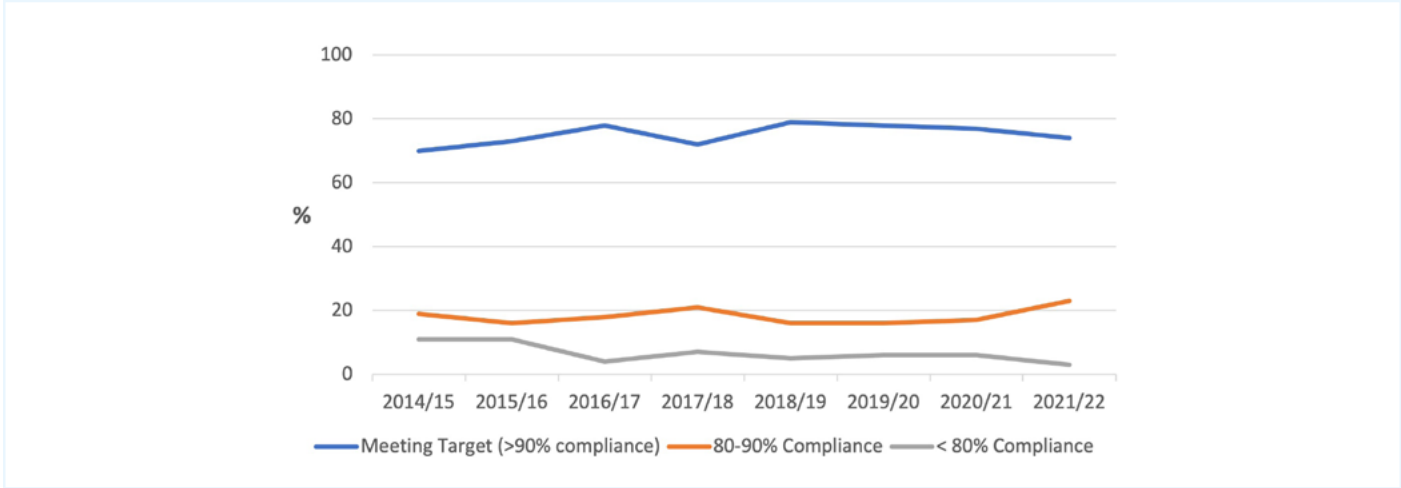
QI Metric Description/Name	Adherence to NICE and Other Guidelines (12-15)
What is the standard to be met?	**Quality standard 15 (ICDs for Secondary Prevention)** 80% of ICD implants for secondary prevention should be documented to meet at least one of the NICE criteria: • Prior cardiac arrest caused by ventricular tachycardia (VT) or fibrillation. • Sustained VT causing syncope or significant haemodynamic compromise. • Sustained VT and left ventricular ejection fraction ≤35%.
Key references to support the metric	References can be found in the reference list in Appendix 1.
Numerator	Patients documented to meet the above criteria.
Denominator	Patients undergoing first pacemaker and ICD implants.
Trend	Compliance for pacing patients with sinus node disease remains static, with 74% of centres meeting target compliance. There has been a gradual improvement in centres meeting target compliance for dual chamber pacing in patients with A-V block (to 72%). Compliance with NICE guidelines for ICD implantation for primary prevention continues to improve (now 53%). The relatively low rates of compliance with guidelines for secondary prevention (36%), probably represents issues with data entry.
Variance	There is considerable variation between centres and initially centres should review the accuracy of data entry.

3.5.1 Pacing for sinus node disease in the absence of atrial fibrillation

NICE TA324[2] guidance states that "Dual-chamber pacemakers are recommended as an option for treating symptomatic bradycardia due to sick sinus syndrome without atrioventricular block".

It is accepted that 100% compliance would be inappropriate, and that a dual chamber system is not appropriate in all cases. The target, therefore, is 90% compliance. Though compliance rates remain below target, 97% of implanting centres reported 80% compliance rates or higher, the greatest proportion since 2014/15 [Figure 3.3].

Figure 3.3: Compliance rates of dual chamber pacemakers for sinus node disease, 2014/15 - 2021/22 [NACRM data]

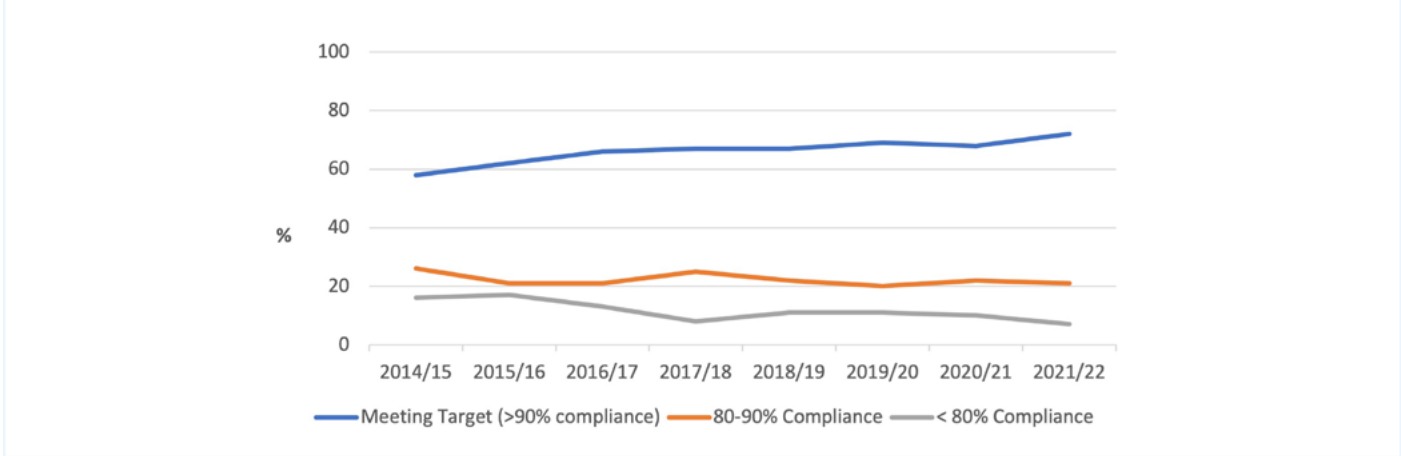


3.5.2 Pacing for Atrioventricular Block in the Absence of Atrial Fibrillation

NICE TA88[3] guidance states that "for most people who have sick sinus syndrome with atrioventricular block, and for those with atrioventricular block without continuous atrial fibrillation, dual-chamber pacing is preferred to single-chamber pacing."

Again, in certain specific circumstances, single-chamber pacemakers are more clinically appropriate. Consequently, the standard is that, on average, 90% of implants should meet guidelines. In 2021/22, 72% of implanting centres met that target. A further 21% were close, with at least 80% of implants meeting the target [Figure 3.4].

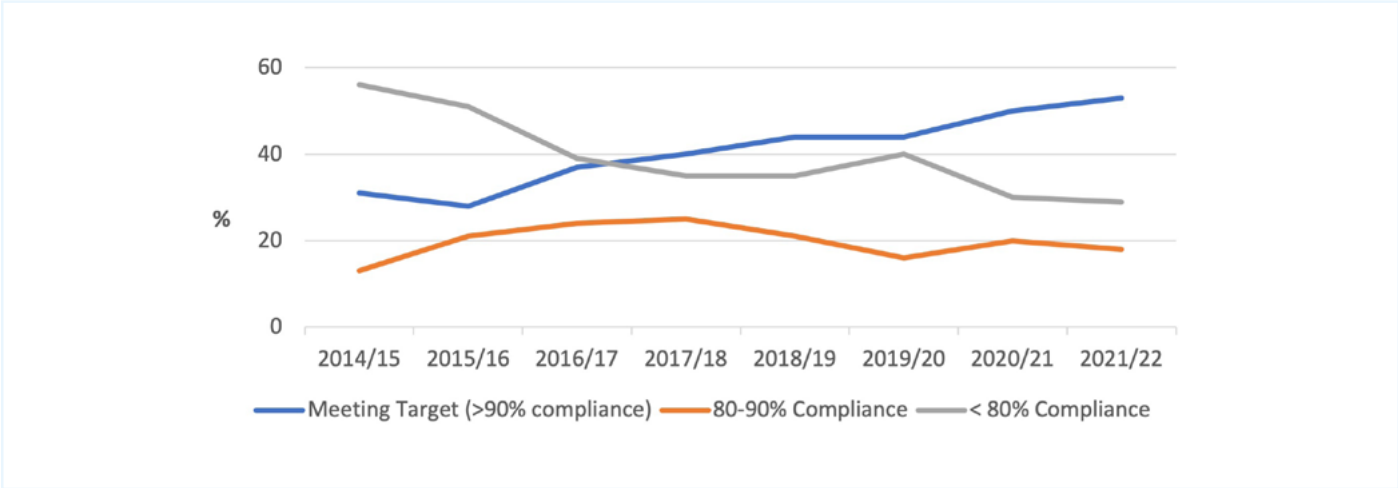
Figure 3.4: Dual chamber pacemakers for A-V block – compliance rates, 2014/15 - 2021/22 [NACRM data]



3.5.3 **ICDs for primary prevention**

NICE TA314[3] guidance details the indications for ICD therapy for both primary and secondary prevention (further details can be found in Appendix 1). There is a steady trend towards higher rates of compliance for primary prevention, some of which may be the result of improved data entry [Figure 3.5].

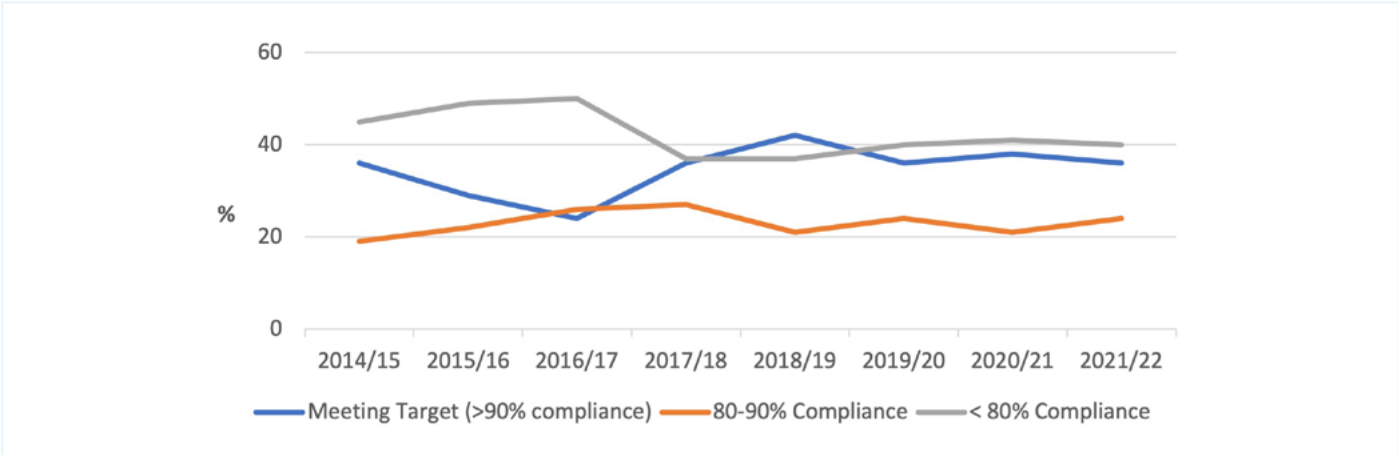
Figure 3.5: Compliance rates of ICDs for primary prevention, 2014/15 - 2021/22 [NACRM data]



3.5.4 **ICDs for secondary prevention**

In contrast to primary prevention, documented compliance with NICE TA314 guidance for secondary prevention remains low, with approximately 40% achieving less than 80% compliance [Figure 3.6].

Figure 3.6: Compliance rates of ICDs for secondary prevention, 2014/15 - 2021/22 [NACRM data]



3.6 Re-intervention rates for ablation are rising, which may be a good sign

3.6.1 Overview of QI metric

QI Metric Description/Name	Procedural Success and Complication Rates (16-18)
Why is this important?	Patients and clinicians want a successful procedure without complications. A re-intervention suggests that there has been a complication, or a procedure has failed to achieve what was intended. There are no absolute standards that have been set nationally or internationally. Therefore relative standards have been adopted.
QI theme	Safety.
What is the standard to be met?	**Quality Standard 16 (Pacemakers)** The rate of re-interventions within a year of a first pacemaker implant should be below the 95% upper control limit (national mean + 2 standard errors). **Quality Standard 17 (Complex Devices)** The rate of re-interventions within a year of a first complex device (ICD or CRT) implant should be within the 95% control limit (national mean + 2 standard errors). **Quality Standard 18 (Catheter Ablation)** The frequency with which patients undergo a repeat procedure (i.e. to the same or related target) within a year of catheter ablation should be within the 95% control limit (national mean + 2 standard errors).
Key references to support the metric	N/A.
Numerator	All device re-interventions in the year following an index procedure, at the implanting hospital or elsewhere. All repeat ablations in the year or two years following an index procedure, at the ablating hospital or elsewhere.

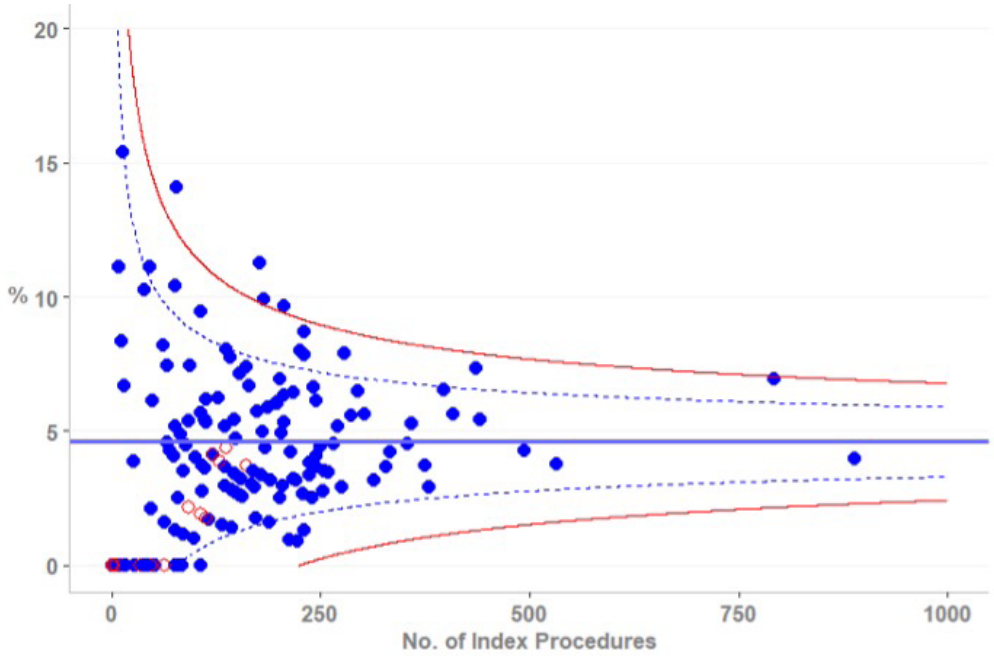
QI Metric Description/Name	Procedural Success and Complication Rates (16-18)
Denominator	All first pacemaker and complex (ICD±CRT) implants. All catheter ablations, divided into simple, complex atrial, and ventricular targets.
Trend	For both simple and complex devices, re-intervention rates were broadly in line with previous years. Rates of re-intervention for devices were the same in 2021/22 as in 2020/21. For 'simple' ablations, one-year re-intervention rates averaged 3%. Four centres were above the 95% confidence interval, of which two were beyond the 99% confidence interval. The two-year re-intervention rate was 5.1%. Again, four centres were beyond the 95% confidence interval with two beyond the 99% confidence interval. For complex atrial procedures, the re-intervention rate at one year was 7.3%. Four centres were beyond the 95% confidence interval and none beyond the 99% centile. At two years, the rate was 13.3%. Only two centres were beyond the 95% confidence interval, and one of those was beyond the 99% centile. This is far below the rates of 20% or more seen in trials, suggesting that, perhaps, patients are not being followed up and listed for repeat ablation as often as they might be. For complex ventricular ablations, rates were similar at 8.2% at one year and 12.8% at two years. At one year, two centres were beyond the 95% centile but not beyond the 99%. At two years, three centres were beyond the 95% centile.
Variance	Reasons for variance are unclear. For some centres, higher rates of redo complex atrial ablation may be a sign of high quality.

3.6.2 **Re-intervention rates for pacemakers**

For devices, the overwhelming majority of re-interventions in the first year are because of complications (revisions because of lead displacement, wound revisions, and explants due to infection). A second procedure may occasionally be required because of a technical issue with a device, for example because of premature battery depletion. Procedures can also result from a change to the clinical indication, requiring an 'upgrade', though this is relatively rare. The re-intervention rates are, therefore, a useful surrogate for the rates of important complications.

The audit reports on further procedures that have taken place within a year of a first implant. The re-intervention rate for new pacemakers remains was 4.6% in 2021/22 [Figure 3.7]. This is in line with previous years. Four centres were beyond the 99th centile. All of those undertook less than 250 new pacemakers per annum.

Figure 3.7: One-year re-intervention rates for new pacemakers against volume of procedures, 2021/22 [NACRM data]

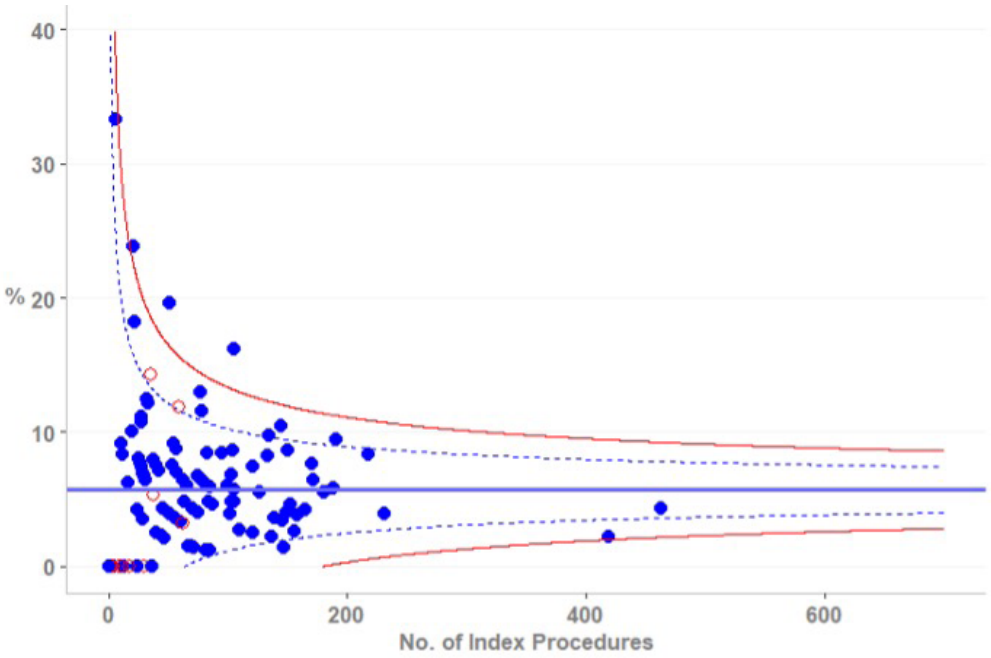


Red circles represent hospitals with less than 90% complete NHS numbers in 2020/21. The red line is the 99% confidence interval. The blue dashed line is the 95% confidence interval. The solid blue line is the mean.

3.6.3 **Re-intervention rates for complex devices**

A re-intervention rate of 5.7% was achieved for new complex devices [Figure 3.8]. Three hospitals were beyond the 99th centile.

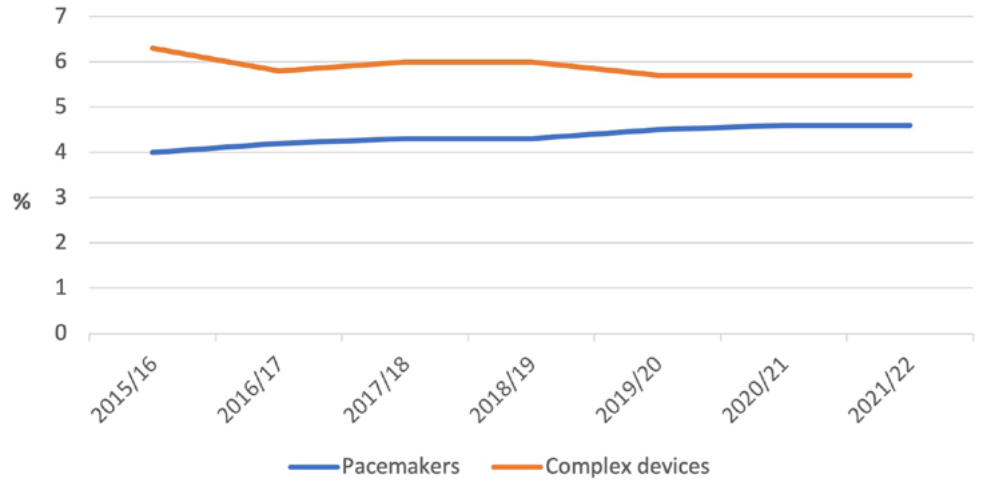
Figure 3.8: One-year re-intervention rates for complex devices against volume of procedures, 2021/22 [NACRM data]



3.6.4 Re-intervention rates over time

There is a contrasting pattern in re-intervention rates. Since 2015, the re-intervention rate for pacemakers have gradually increased, from 4.0% to 4.6% (although the rate in 2020/21 was the same) whilst for complex devices it has fallen to 5.7% (again a level which has been stable since 2019/20) [Figure 3.9].

Figure 3.9: Re-intervention rates (%) for devices, 2015/16 - 2021/22 [NACRM data]



3.6.5 **Re-intervention rates for ablation**

While re-intervention rates for device procedures largely reflect complications, this is not the case for ablations. An ablation complication is not treated by a further ablation, and ablation re-interventions reflect a number of factors. Case selection (especially for AF ablation) and the quality of the original procedure predominates, but re-intervention within a year also reflects the willingness of the patient and doctor to undertake a further ablation, the timing of follow-up appointments, and the waiting list for ablations.

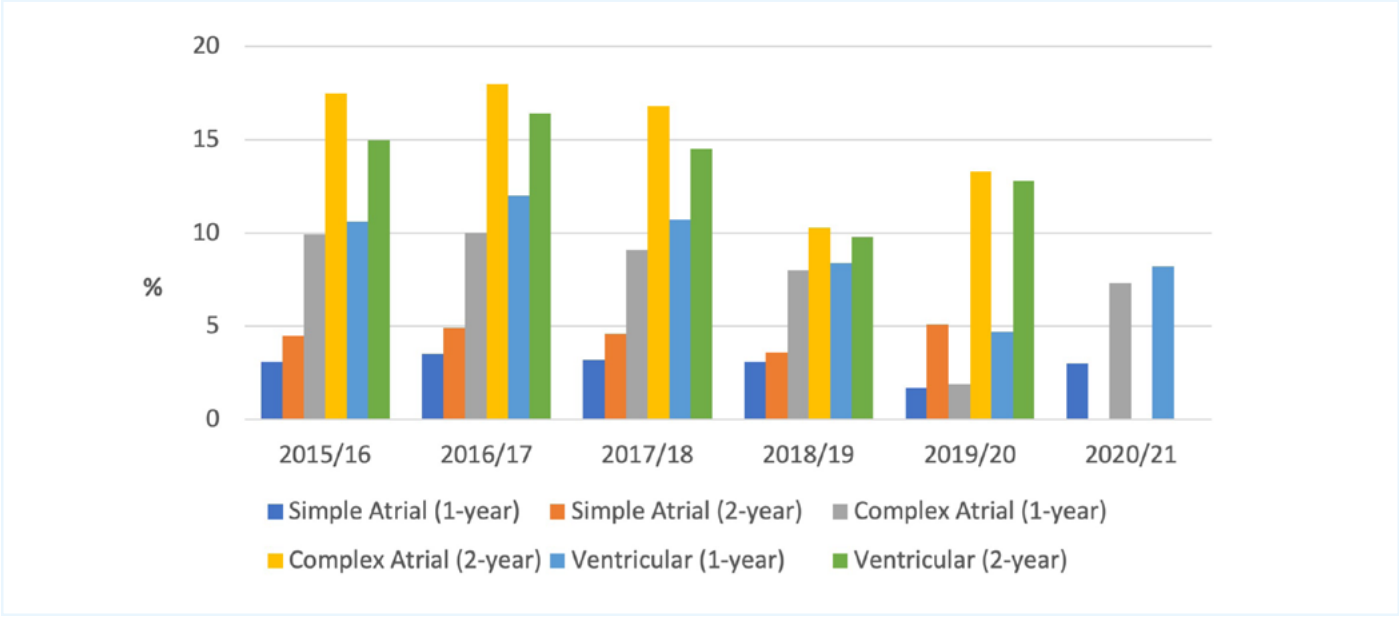
This is particularly the case for AF ablation. Most large-scale studies have shown that a second ablation is undertaken in 20-40% of patients and do benefit in the majority of cases. Re-intervention rates following AF ablation in the UK are significantly lower than other countries, which may mean that a proportion of patients are not receiving a procedure with a good chance of benefit.

In 2020/21, re-intervention rates for ablation procedures fell significantly, especially for AF. This reflected the fall in the capacity to undertake procedures and the increased waiting times for outpatient review. Therefore, the low re-intervention rate probably indicates suboptimal care.

Ablations are predominantly an elective procedure to improve quality of life, rather than to prevent death. They were consequently de-prioritised during the COVID-19 pandemic. It would be expected, for example, that around 20% of patients who have an ablation for atrial fibrillation would require and benefit from a second ablation. In 2020 that rate fell to 1.9%, suggesting a significant disruption to care.

The recovery to more normal levels suggests that patients are being seen sooner and relisted for procedures from which they are likely to derive significant symptomatic benefits. The increased volume of complex atrial re-interventions is particularly encouraging, indicating a normalisation of practice [Figure 3.10].

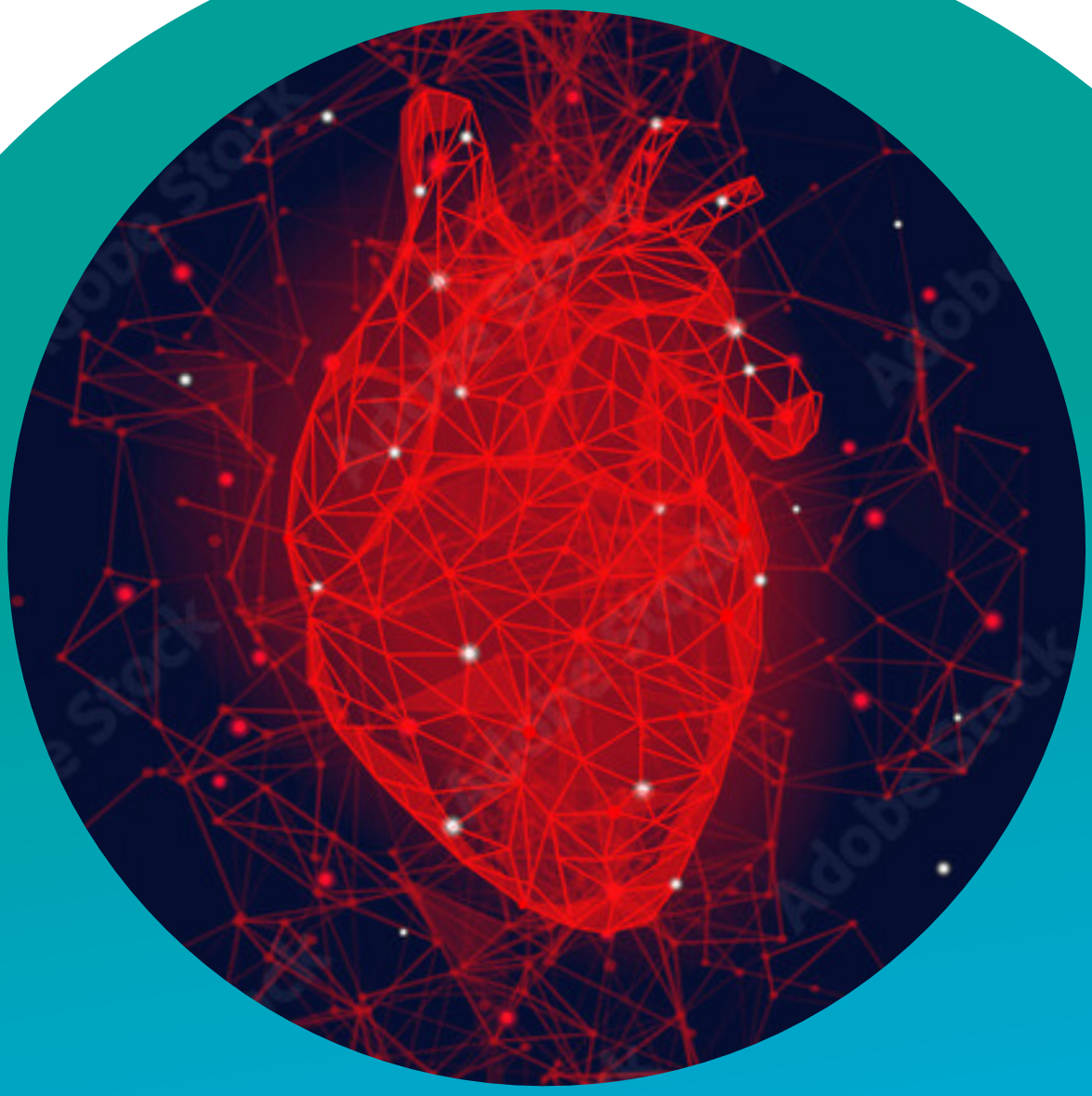
Figure 3.10: Re-intervention rates (%) for ablation procedures, 2015/16 - 2020/21 [NACRM data]



3.6.6 Recommendations for those with outlier re-intervention rates

High device re-intervention rates are a cause for concern and should prompt a more thorough review of practice in a centre. Both high and low re-intervention rates for ablation may be a cause for concern.

For complex atrial ablation, centres with very low re-intervention rates are more likely a cause for concern.



4 Future directions

Next year's report will continue to track how activity levels are recovering relative to the pre-pandemic baseline. Some believe that there has been a shift in practice towards a more conservative approach and further thought needs to be given to the low re-intervention rates post-AF ablation.

Hopefully, those rates will increase as capacity increases to review patients and re-list them promptly. Others suggest that 'backlog' of cases that built up because of changes to practice have now been worked through.

Patient Reported Outcome Measures (PROMS)

For many years, we have expressed a wish to collect Patient Reported Outcome Measures (PROMS) for AF ablation, as this procedure is performed almost exclusively for symptom relief. We therefore welcome the inclusion of mandatory PROMS submission under the recently published commissioning document from NHS England. This will drive more careful case selection and the findings will be reported through this audit in due course.

Continuous data submission

Direct submission of data to the audit via the NICOR web portal will, in future, be strongly encouraged, especially for ablations. To date, most centres have entered records for device and ablation procedures in large retrospective batches, generated from their hospital IT systems. This means that any changes to the audit dataset are slow and costly to implement because each hospital requires modifications to its systems.

Use of the NICOR portal will permit centres to upload their data continuously, avoiding time lags and enabling rapid reporting back to them of their results so they can benchmark their performance with others. This will also be a more responsive system that can readily accommodate changes to the data requirements (eg incorporating clinical details for congenital heart disease, new ablation technologies, etc).

Linkage with other datasets

Discussions are underway to link data with other cardiac audit domains. This will help in answering questions that have not previously been possible to investigate, such as whether timelier primary PCI reduces the risk of requiring an ICD. The Domain Expert Groups (DEGs) within NICOR and the broader cardiology community will help prioritise such questions.

Linking with Health Episode Statistics (HES) data will also be pursued, in order to obtain data on emergency admissions post-procedure (eg to improve reporting on complications).

5 Appendices

- **Appendix 1.** Methodology
- **Appendix 2.** Device and ablation procedures by geography
- **Appendix 3.** Individual hospital reports – devices
- **Appendix 4**. Individual hospital reports – ablation
- **Appendix 5.** Hospital procedure volumes – devices
- **Appendix 6.** Hospital procedure volumes – ablation
- **Appendix 7**. Operator volumes – devices
- **Appendix 8.** Operator volumes – ablation
- **Appendix 9.** Data completeness and validity – devices
- **Appendix 10.** Data completeness and validity – ablation
- **Appendix 11.** 1-year re-intervention rates – devices
- **Appendix 12.** 1- and 2-year re-intervention rates – ablation
- **Appendix 13.** PowerPoint file with additional charts

All appendices can be located on the NICOR CRM webpage

6 References

See Appendix 1.

1. https://coronavirus.data.gov.uk/details/download
2. https://www.nice.org.uk/guidance/ta324/chapter/4-Evidence-and-interpretation
3. Overview | Dual chamber pacemakers for symptomatic bradycardia due to sick sinus syndrome and/or atrioventricular block | Guidance | NICE Overview | Dual chamber pacemakers for symptomatic bradycardia due to sick sinus syndrome and/or atrioventricular block | Guidance | NICE
4. Overview | Implantable cardioverter defibrillators and cardiac resynchronisation therapy for arrhythmias and heart failure | Guidance | NICE Overview | Implantable cardioverter defibrillators and cardiac resynchronisation therapy for arrhythmias and heart failure | Guidance | NICE

7 Thanks and acknowledgements

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Please go to www.nicor.org.uk for more information.

Email: nicor.auditenquiries@nhs.net

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National Institute of Cardiovascular Outcomes Research (NICOR)

NICOR is a partnership of clinicians, IT experts, statisticians, academics and managers who, together, are responsible for the National Cardiac Audit Programme (NCAP) and a number of health technology registries, including the UK TAVI registry. Hosted by Arden & GEM CSU, NICOR collects, analyses and interprets vital cardiovascular data into relevant and meaningful information to promote sustainable improvements in patient well-being, safety and outcomes. NICOR is funded by NHS England and the GIG Cymru (NHS Wales).

Email: nicor.auditenquiries@nhs.net

British Heart Rhythm Society (BHRS)

The BHRS is an affiliated group of the British Cardiovascular Society. BHRS serves as a unifying focus for doctors and allied health professionals involved in arrhythmia care and electrical therapies in the UK. BHRS recommends standards for hospitals and individuals undertaking device and ablation procedures, and runs formal certification programmes for professionals.

www.bhrs.com

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NHS Wales is the public funded National Health Service of Wales providing healthcare to some 3 million people who live in the country. The Welsh Government sets the Health Care strategy and NHS in Wales delivers that strategy and services via the seven Local Health Boards, three NHS Trusts and two Special Health Authorities. The NHS has a key principle which is that good healthcare should be available to all.

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