Specialist Rehabilitation following major Injury (NCASRI)

Final Audit Report

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Specialist Rehabilitation following Major Injury (NCASRI)

NCASRI – National Clinical Audit of Specialist Rehabilitation for Patients with Complex Needs following Major Injury

FINAL REPORT APRIL 2019

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https://www.kcl.ac.uk/cicelysaunders/about/rehabilitation/National-Clinical-Audit-

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FOREWORD

It is a pleasure to see this final report of the National Clinical Audit of Specialist Rehabilitation following Major Injury (NCASRI).

Specialist rehabilitation services form a critical component of the recovery pathway following major injury, relieving pressure on beds in acute services. However, in the absence of formal provision when Major Trauma Networks (MTNs) were established in 2012, it was acknowledged that specialist rehabilitation services for trauma patients lacked coordination, with large variations in provision across different parts of the country.

Numerous national guidelines and standards documents, including those from the Department of Health (DH), NHS England (NHSE), the British Society of Rehabilitation Medicine (BSRM), the Royal College of Physicians (RCP) and the National Institute for Health and Care Excellence (NICE), have made recommendations for improving the consistency and quality of care offered to patients with complex disability, many of whom will have life-long needs for rehabilitation and support.

This is the first national clinical audit focused on access to and provision of specialist rehabilitation for patients with traumatic injuries. It marks a major step towards improving the quality of care delivered to this patient group.

This report presents the final outputs of the programme. It explores the pathways of care and examines clinical practice – how patients that may require specialist rehabilitation are identified, where they receive that care, how long they wait and several other important criteria. It also tracks patients in their journey from the Major Trauma Centres (MTCs) to the specialist rehabilitation services, to find out how many patients actually receive the appropriate services and the outcomes that are achieved.

The audit identified good practice as well as gaps in current provision to improve the quality of services. Although NCASRI is not continuing, it has improved our understanding of what needs to be done and has sown the seeds for future development to optimise the journey towards recovery for patients and their families who are living with the aftermath of major injury.

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CONTEXT SETTING AND 'ROAD MAP' TO THIS REPORT

The National Clinical Audit of Specialist Rehabilitation following Major Injury (NCASRI) arose in the context of development of the Major Trauma Networks from 2010 onwards. It was recognised that rehabilitation had been overlooked in the initial planning and development of the trauma networks, and there was a lack of information on the extent of current service provision and how specialist rehabilitation units integrated with the acute trauma services. There was general acknowledgement that existing service capacity was insufficient to meet demand, but very little information was available about the rehabilitation needs of patients leaving the Major Trauma Centres (MTCs) or how well these needs were being met.

Following a call for new topic proposals for the National Clinical Audit and Patient Outcomes Programme (NCAPOP) in 2011, a topic proposal was submitted for specialist rehabilitation following major injury. After re-scoping in 2013, and tender through the Healthcare Quality Improvement Partnership (HQIP), the contract was awarded to Northwick Park Hospital in collaboration with the Trauma Audit and Research Network (TARN) and King's College London in 2015.

The NCASRI audit ran for three years, linking data from the key national datasets (held by TARN and the UK Rehabilitation Outcomes Collaborative (UKROC)) in order to track patients with complex needs for rehabilitation across the pathway from the MTCs to the specialist inpatient rehabilitation services.

This final report summarises the programme and details our findings in accordance with our analysis plan. The following 'road map' may help readers to locate some of the key elements as follows:

- An executive summary (Section 1) provides an overview of the programme, setting out the three elements of NCASRI with links to our previous reports (see section 1.2).

- The key findings are summarised in section 1.4 and 1.5 in the executive summary. They are detailed in sections 8-12.

- Recommendations for the future are summarised in section 1.6 and detailed in sections 13 and 14, with a final table (in section 14) summarising performance against the key standards and our recommendations.

The legacy of NCASRI

In the course of NCASRI we have collected and collated a uniquely rich dataset. Work is ongoing with TARN and HQIP to ensure that the historic NCASRI dataset can be retained and stored for potential future linkage and use (subject of course to the appropriate permissions).

However, a key purpose of the NCAPOP is to embed data collection into routine clinical practice after the end of the funded audit. The audit has recommended a minimum dataset that should be included as part of the mandated data requirements for the Rehabilitation Prescription in patients who still have complex needs for rehabilitation on discharge from MTCs. Negotiations for this are still ongoing, but this routine data collection would offer the potential to support future linkage between TARN and UKROC (again subject to permissions), and address some of the important questions that remain to be answered following the end of this audit.

1 EXECUTIVE SUMMARY

The National Clinical Audit for Specialist Rehabilitation following Major Injury (NCASRI) was commissioned in 2015 by the Healthcare Quality Improvement Partnership (HQIP), as part of its National Clinical Audit and Patient Outcomes Programme (NCAPOP).

NCASRI set out to determine the scope, provision, quality and efficiency of specialist rehabilitation services across England and improve the quality of care for adults with complex rehabilitation needs following major trauma.

A key component of NCASRI was to link data from the Trauma Audit Research Network (TARN) and the UK Rehabilitation Outcomes Collaborative (UKROC) datasets through NHS numbers, in order to track patients along their journey from the MTCs to the specialist (Level 1 and 2) rehabilitation services and to examine the outcomes and cost efficiency of rehabilitation for patients with major trauma.

1.1 Aims and objectives

The **overarching aim** of NCASRI was to provide a national comparative audit of the organisation and access to, quality, outcomes and cost-efficiency of specialist rehabilitation services provided for adults with complex needs following major injury in the English NHS.

The audit was designed to drive improved and equitable access to specialist rehabilitation services for patients with complex needs following major trauma, in order to improve their physical and psychological recovery, and reduce long-term disability and dependency.

A key aspect of NCASRI was to link the two major national clinical datasets for major trauma and for specialist rehabilitation in order to track patients down the care pathway and to consider how the findings may be used to stimulate change both locally and nationally.

1.2 The three NCASRI elements

NCASRI had 3 main elements:

1. An **organisational audit** to identify the current provision of specialist rehabilitation for trauma patients and to map the pathways of care into and out of these services (1).

2. A **prospective clinical audit** of new patients presenting within NHS Major Trauma Centres who have complex needs and receive specialist inpatient rehabilitation.

3. A **feasibility study** for identifying the pathway and outcomes for patients who require specialist inpatient rehabilitation on discharge from MTCs, but do not subsequently attend.

Reports

- The **First** NCASRI **Report** in October 2016 presented the findings from the organisational survey and a retrospective analysis of UKROC data on outcomes from rehabilitation following major trauma (1).

- The **Second** NCASRI **Report** in November 2017 described the challenges of NCASRI and the steps taken to overcome them. It also presented preliminary data from the MTCs (2).

- This **Final NCASRI Report** presents the findings from Elements 2 and 3 (the prospective clinical audit and feasibility study) and makes recommendations for future work.

1.3   Key standards for the audit

Key reference standards and indicators were drawn from several major national standards and guidelines documents published by the Department of Health, NHS England, the British Society of Rehabilitation Medicine (BSRM) and National Institute for Health and Care Excellence (NICE) (see Section 4.4 for details).

Key performance indicators included:

- Process of care, including the identification of patients' rehabilitation needs while in the MTCs.

- Timely assessment and transfer to Level 1 and 2 specialist rehabilitation units.

- Quality of care, including outcomes and cost-efficiency within the specialist rehabilitation services.

As with other clinical audits within the NCAPOP programme, the NCASRI audit included elements of service evaluation. One of the key questions was whether current bed capacity within the specialist rehabilitation services was sufficient to meet demand and, if not, then what additional bed capacity was required to meet the needs of patients with complex rehabilitation needs following major trauma and what types of rehabilitation intervention were required.

1.4   Key findings from the NCASRI audit

1.4.1   Prospective audit

The prospective NCASRI audit was conducted in the 18-month period between July 2016 and December 2017, with recruitment of patients in the MTCs from 1st July 2016 to 31st August 2017.

Within the rehabilitation pathway, the majority of patients have relatively simple (Category C/D) needs that can be met by their local general (Level 3) rehabilitation services. Patients with more complex (Category B needs) may require specialist rehabilitation in a local district (Level 2) service, and a small number of patients with highly complex (Category A needs) may require the specialist skills and facilities of a tertiary (Level 1) rehabilitation service.

Eligible patients were severely injured adults (16+ years with ISS ≥9) who required specialist in-patient rehabilitation (Category A or B needs) at the "transfer-ready" point or on discharge from an MTC.

Key objectives were:

- To recruit as many of the eligible patients as possible within the MTCs and to describe and document their rehabilitation needs using the tools within the Specialist Rehabilitation Prescription (SpRP).

- To determine the proportion of eligible patients who were subsequently admitted to a Level 1 or 2 specialist rehabilitation service.

- To examine how well their needs were met and the outcomes from rehabilitation in terms of functional gain and cost-efficiency.

Unfortunately it was beyond the scope of the audit, as commissioned, to determine in detail what happened to those patients who required specialist rehabilitation but did <u>not</u> subsequently receive it. However, we explored the feasibility of obtaining information about alternative pathways of care (i.e. the other forms of inpatient rehabilitation that patients access) from existing NHS datasets such as the Hospital Episode Statistics (HES) and Office for National Statistics (ONS) mortality data.

1.4.1.1   Major Trauma Centres

The key standards within the MTCs focussed substantially on the process for completion of a Rehabilitation Prescription (RP) and Specialist RP (SpRP) tools to evaluate and describe the rehabilitation needs of patients requiring further inpatient specialist rehabilitation.

NHSE   NHSE NATIONAL STANDARDS

The standards required that all patients with Injury Severity Scores ≥9 should have a standard RP. Those thought likely to have complex needs should be screened using the complex needs checklist (CNC). If this suggested Category A or B needs, they should be seen by a consultant in rehabilitation medicine (RM) who would complete the remainder of the SpRP, which consists of five tools.

Completion rates for the five individual SpRP tools ranged from 39-74%.

Standard RP: We found that recording rates for the standard RP were roughly the same overall in 2014/15 and 2016/17 (89% and 90% respectively) with all centres now achieving over 80%. They were slightly higher for the patients enrolled in NCASRI (96%).

Specialist RP: In the course of the first round it became clear that these standards (and indeed the full dataset) were unworkable due to the lack of RM consultants and time pressures for the clinical team. Completion rates for the five individual SpRP tools ranged from 39-74%. Nevertheless, this has created a rich dataset to characterise the rehabilitation needs of severely injured patients following major trauma.

A core minimum SpRP dataset was agreed for use in any future audit rounds. Data are presented in this report to illustrate the added value of even this minimum dataset to describe the rehabilitation needs of this group, compared with the information available prior to NCASRI.

- The most robust categorisation of rehabilitation need is made using the Patient Categorisation Tool (PCAT). However, the data show that the simpler Complex Needs Checklist (CNC) identified complex needs with reasonable accuracy.

- Conversely, the clinical categorisation of rehabilitation needs within the TARN dataset correctly identified just **38%** of patients who were subsequently confirmed as having Category A/B needs, and incorrectly identified **31%** of them as having Category C/D (25%) or no (6%) rehabilitation needs. In other words, the clinical categorisation alone was incorrect as often as it was correct, and thus not sufficiently accurate for standalone use.

These findings emphasise the importance of using either the CNC or the PCAT to confirm the categorisation of rehabilitation needs for any future rounds of audit – although the CNC is simpler and quicker to complete, and so more likely to be practical for implementation in a busy clinical setting.

1.4.1.2   Recruitment in the MTCs and case ascertainment

Only 16/22 adults MTCs participated in this audit. 4 of the remaining 6 had no RM consultant input.

Only 16 of the 22 MTCs that admit adult trauma patients participated in this first round of NCASRI. Of the six non-participating MTCs, four had no RM consultant input. Because the identification of patients with Category A/B needs relied significantly on RM consultant input, it is likely that eligible patients were significantly under-identified, even within the participating MTCs. To maximise recruitment in this first audit round, we accepted a variety of different criteria for identification of Category A/B needs, including clinical impression.

Of a total of 1468 patients identified as 'eligible' across all 22 MTCs, **1381 had Category A or B Needs** by at least one of the criteria and were thus **recruited for the NCASRI audit** within the participating MTCs. However this was almost certainly an under-estimation of the total number of patients with complex needs.

In light of the challenges to recruitment within the MTCs, data linkage between TARN and UKROC databases was conducted in two directions:

a. 'Forward selection' identified the number of recruited patients identified in the MTCs as requiring specialist rehabilitation who did and did not receive this.

b. 'Backward selection' identified the number of patients who received specialist rehabilitation, having been treated within the MTCs during the recruitment period, but who were not recruited in the MTCs (for example because their needs were not recognised or they were treated in a non-participating MTC).

Of the 1381 patients recruited in the participating MTCs, 550 (40%) were admitted for specialist rehabilitation, leaving 831 (60%) in the 'non-rehabilitation' group, for whom only HES data were available regarding their further hospital treatment and outcomes.

However, backward selection identified a total of **1154 patients admitted to specialist rehabilitation** following admission to an MTC, of whom just over half **(56%)** had Category A/B needs identified in the MTCs. The remainder were thought to have Category C/D needs, or had no rehabilitation needs identified in the MTCs. Just over three-quarters (77%) had come from participating MTCs, which is roughly in proportion to their representation (16/22 = 73%) in this audit round.

Recruitment rates varied widely between MTCs – a detailed breakdown by trauma network is given in Section 8 of the report.

1.4.1.3   Timely transfer to rehabilitation

NHSE NATIONAL STANDARDS

The standards require that patients who are thought to have complex needs for rehabilitation should be assessed within 10 days of referral and transferred to specialist rehabilitation within 6 weeks of being fit for transfer.

Within the prospective audit, overall compliance with the standard for waiting time for assessment (< 10 days) was **57%.**

- **86%** of patients were transferred to specialist rehabilitation within 6 weeks of referral.
- **91%** were admitted within 6 weeks of being ready for transfer.

However, these findings require some interpretation. For patients admitted to specialist rehabilitation, the mean time from onset to admission was 70 days (95% CI 58-90) but with outliers stretching more than 6 months for a minority (4%) of patients.

A proportion of this time, however, was taken with stabilising the patients before they were ready for rehabilitation. The mean time from referral to assessment was 6 days, and from assessment to admission 20 days – although the mean waiting time after being **ready for admission** was just 7 days.

There had been a modest improvement in response times since the first year retrospective analysis. The mean waiting time for assessment had reduced from 9 to 6 days and the overall waiting time from referral to admission reduced by 6 days.

1.4.1.4 Functional gain and cost-efficiency

NHSE NATIONAL STANDARDS

The standards required that, by discharge, all patients should have achieved some measurable gain or goal achievement, as measured by UK Functional Assessment Measure (UK FIM+FAM), Northwick Park Dependency Scale (NPDS) or Goal Attainment Scale (GAS) T-score (or other approved measure), or the reason for no gain recorded. Discharge destination should also be recorded.

Key goals for rehabilitation are often (but not always) improved independence in self-care and other activities of daily living. The UK FIM+FAM and NPDS are standardised measures of independent function within the UKROC dataset and GAS is a measure of the attainment of individual goals for rehabilitation. Of 1154 admissions for specialist rehabilitation, a total of 1044 episodes were completed at the time of linkage. Of these, **984 (94%)** showed some 'functional gain' captured by one or more of these measures, and the discharge destination was recorded in 99% across all providers.

There has been substantial improvement in reporting rates for most outcome measures across the individual rehabilitation service providers since Year 1 (see electronic Appendices 5a and 5b).

The mean net life-time savings from rehabilitation amounted to £504,106 per patient, generating a total of £582 million savings from this one-year cohort alone.

- Overall compliance with the standards for reporting cost-efficiency was 74%.

- The mean length of stay was 65 (Standard Deviation (SD) 56) days.

- The mean episode cost was **£39,398** and the mean cost saving was **£536 per week**, so that the mean time taken to offset the cost of rehabilitation by savings in the cost of ongoing care was **17 months.**

- The average age of this sample was 50 years, which means that the population (and society in general) have many years over which to benefit from these cost savings, even though life expectancy is reduced in severely disabled patients.

- Applying the life expectancy algorithm that is now integrated into the UKROC dataset, the mean net life-time savings after deducting for the cost of the rehabilitation programme amounted to £504,106 per patient, which would generate a total saving of £582 million from this small one-year cohort alone.

1.4.2 Implications for bed capacity

CAPACITY TO MEET DEMAND

A key question underpinning the work of NCASRI was whether the existing bed capacity for specialist in-patient rehabilitation was sufficient to meet demand within the patient population with complex rehabilitation needs following major trauma, and if not to estimate the additional bed capacity that would be required.

The total bed occupancy of the 1154 patients who received specialist rehabilitation was **75839 bed days** (equivalent to **218 beds** at 95% bed occupancy).

Approximately 40% of the 1381 recruited patients completed a specialist in-patient rehabilitation programme, suggesting that the existing bed capacity catered for about 40% of patients with Category A/B needs.

The total capacity required to meet demand may therefore be estimated at approximately 2.5 times the existing capacity to cater for approximately **2885 patients per year.** This would require a total allocation of approximately **547** Specialist Level 1 and 2 beds in England (i.e. an increased provision of **328 beds)** bringing the total average bed numbers **to 8.2 per million population**.

The total cost of this increased capacity would be circa £53m. For this investment to be made, it is necessary to demonstrate significant cost savings arising from rehabilitation. The figures suggest, however, that this one-year cohort alone generated estimated life-time savings of over £582m, so that the annual net cost benefit of investment in these additional rehabilitation beds would still be in excess of £500m. Few other interventions in healthcare have the potential to generate this level of ongoing savings.

1.4.3 The Non-rehabilitation group

The non-rehabilitation group consisted of **831** patients with confirmed complex needs who were not admitted to a Level 1 or Level 2 specialist rehabilitation service.

1.4.3.1 Patients in services that are registered with UKROC but not designated as Level 1 or 2

Out of these 831 patients, **89** were identified as having received rehabilitation in other services registered with UKROC, which include both slow-stream and Level 3 rehabilitation services, as well as newly developed services awaiting signposting and designation as Level 1 or Level 2 services. Data on caseload complexity and functional outcomes are presented for this group in Section 12 of this report.

As with the existing Level 1 and 2 services, these 89 patients made significant functional gains. Some had similar levels of complexity and dependency to those in the designated Level 1 and 2 services, suggesting that there are additional rehabilitation units out there that would be eligible for designation and commissioning as a Level 1 or Level 2 service to help meet the requirement for additional bed capacity. The findings also demonstrate the feasibility of capturing information on caseload complexity and functional outcome in non-designated services, provided that this is collected and reported systematically.

1.4.3.2 Patients identified in HES data

This left **742** patients for whom data were requested from NHS Digital's Data Access and Request Service (DARS). Data were received for **677** surviving patients.

Of these, **420 (62%)** had further inpatient treatment after leaving the MTC. The mean length of stay was about 6 weeks. Unfortunately, it was not possible to extract any meaningful data from HES on either the rehabilitation activity or outcomes for these patients. Approximately **16%** appeared to have had at least one episode within their ongoing spell of treatment where rehabilitation was the 'sole' or 'predominant' reason for admission (it was not possible to say which) but, as no dates were attached to these episodes, neither was it possible to tell how long they remained in the rehabilitation service.

NHS Digital does not currently collate any meaningful outcome data for rehabilitation patients, other than simple discharge destination. A total of 466 (61%) had been discharged home or to temporary accommodation by 6 months after discharge from the MTC. This number had risen to 577 (79%) by the time of data linkage in December 2017, but 10% were still in hospital.

1.5   Challenges addressed during NCASRI

NCASRI is unusual in that it is the first NCAPOP audit to address an area of practice mainly within the specialised services. These high cost/low volume services encompass a very small number of patients with highly diverse needs, managed across an equally diverse range of services. A number of challenges were therefore recognised from the outset that have required the NCASRI team and HQIP to work closely together to overcome. These and the steps taken to address them are described in detail in our **Second NCASRI report**, but included the following:

Challenge	Solutions
The very low starting base of knowledge, data recording and service provision – including a total lack of reliable data collection within existing NHS datasets.	**Building on the assets of existing data collection within TARN and UKROC, we added data fields to address the information gaps and then linked these datasets using the NHS number to track patients along their journey from the MTCs to the specialist rehabilitation services.**
The absence of an agreed audit dataset, or established data collection tools for rehabilitation following major trauma.	**Working closely with the MTC teams, we piloted the SpRP tools to develop a uniquely rich dataset for analysis in the first round, but then agreed a more manageable core minimum dataset for use in future rounds of audit.**
The lack of consultants in rehabilitation medicine to support the MTC teams in identification of patients with complex needs.	**The data collection procedures were adjusted to accept data completed by any member(s) of the team including doctors, nurses and allied health professionals (AHPs)**
The need to engage MTC teams and accept data from a range of different platforms for data entry to minimise data burden.	**To support engagement in this first round, we accepted data from several different computer platforms as well as paper versions of the tools. While not sustainable going forward, this inclusive approach enabled us to recruit over twice the anticipated number of patients.**
The limited timescale of the programme to support robust data linkage to maximise case ascertainment.	**The challenges of the limited timescale were highlighted at an early stage and a bid was prepared to extend the audit to include two rounds of audit, both with the requisite 2-year timescale to capture all patients receiving rehabilitation.**
Unable to secure funding for the second-round audit, which has limited the opportunity to take forward and apply the lessons learned from this first round audit.	**Through a no-cost extension, we have worked with HQIP to salvage the detailed Round 1 dataset to support further linkage outside of NCASRI programme, to maximise the benefit to patients with complex rehabilitation needs following major trauma.**

1.6 Summary and Conclusions

The table below summarises the key findings, conclusions and recommendations. Further details are listed in Section 14.

Findings	
Structure and organisation	
There was poor integration of rehabilitation medicine within many of the MTNs: 45% of MTCs had less than the 2-3 visits per week from a consultant in RM, and 18% had none at all. This has impacted negatively on implementation of the RP and SpRP.	**All MTNs, commissioners and MTC service providers should review their processes and referral pathway for rehabilitation following major trauma and ensure that standards for rehabilitation provision and RM consultant involvement in the MTCs are fully met.** **This should form part of regular review of the service specifications for Major Trauma and Specialist Rehabilitation.**
There is a shortage of consultants and specialists in RM trained in the acute rehabilitation needs of major trauma patients.	**Workforce planning policies should be reviewed** **a. To develop a sufficient supply of RM consultants.** **b. To consider development of advanced clinical practice and consultant roles for AHP and nursing staff to work alongside them.**
There was wide variation in the provision of specialist inpatient rehabilitation – bed numbers ranging from 1-8 per million population. The overall shortfall in bed capacity was estimated at approximately 330 beds. Specialist provision for hyper-acute rehabilitation and for complex musculoskeletal rehabilitation was particularly short.	**It is unclear from this single audit what the relationship is between bed provision and outcomes. Further work is required in this area to establish patient-centric and cost effective means of delivering specialist rehabilitation.**
Process within the MTCs	
Implementation of the standard RP has continued to develop. The overall completion rate was 90%, ranging from 81-100% across the MTCs. At the outset of NCASRI, however, the RP included only very scant information on rehabilitation needs.	**A parallel stream of work to develop the standard RP has led to expansion of its content with some additional fields relating to rehabilitation now a mandated requirement for the enhanced tariff.** **Further development is required, however, to ensure systematic identification of patients with complex needs.**
From the initial data collection of five tools, a minimum SpRP dataset has been developed comprising: • The Complex Needs Checklist (CNC). • The Rehabilitation Complexity Scale (RCS-ET). • The clinical category of rehabilitation need. However, the other tools proved useful for clinical decision-making and, once familiar with them, many clinicians wished to continue to use them.	**All patients who have complex needs requiring further specialist in-patient rehabilitation at discharge from the MTC should have this SpRP minimum dataset recorded on TARN.** **The other SpRP tools (PCAT, NPDS and NIS) should remain available on TARN for optional use by the MTC teams.**

Provision for specialist hyper-acute and complex musculoskeletal rehabilitation was particularly short.

Findings	
Within the specialist rehabilitation services	
Response times for assessment and transfer improved slightly in the course of the NCASRI audit. 57% of patients were assessed within 10 days of referral. 91% were transferred within 6 weeks of being ready for transfer. Identification of complex Category A/B needs shortened the overall waiting time by 6 days.	**Despite this improvement, these standards still represent a long delay, creating pressure on the acute services.** **Once the capacity issues outlined above have been addressed (including the development of additional hyper-acute rehabilitation capacity to support early transfer), the standards for response times will require review.** **Continued comparative data reporting of response times through TARN and UKROC should be provided to support further service improvement.**
Reporting of functional gain and cost-efficiency improved during the course of the audit: 94% of complete episodes showed some improvement in independence. 75% recorded cost-efficiency. The mean weekly saving in cost of care was £536, offsetting the cost of rehabilitation in just 17 months. This gave a mean life-time saving of >£500K per patient, generating a total saving of £582 million from this one-year cohort alone	**Specialist rehabilitation for patients with complex needs following major trauma is both effective and highly cost efficient for those who receive it.** **Despite improvements, the reporting of cost-efficiency is still variable across providers and further work is required to ensure consistency in reporting of this important information**
Going forward	
This first and only round of NCASRI has generated a rich dataset that describes the rehabilitation needs of patients following major trauma. This level of detail will not be collected again and there are important opportunities to learn from its further analysis and linkage.	**HQIP, TARN and UKROC are now working together to transfer the data controllership to TARN and support future applications for permission for future linkage and analysis.**

1.7　Future work

This first and only round of NCASRI audit has provided useful information about patients with complex rehabilitation needs and how they are currently managed within the trauma networks.

Some modest improvements in practice have been made during the short time-frame of this audit as outlined above, but there is still a great deal to be done.

Patients who get to specialist rehabilitation do well, but a large number with similar needs miss out on this service.

The results presented in this report demonstrate that we do not serve the needs of this complex and vulnerable group of patients particularly well. Those who actually get to specialist rehabilitation make good functional gains within their potential capability, but there is a large cohort of patients with similar needs who miss out on this service. Some of these patients may improve spontaneously and make the transition home without this specialist treatment, but others do not. Apart from having a somewhat better idea of the numbers that fall into each category, and their needs at discharge from the MTC, we still know very little about what happens to those patients who do not receive rehabilitation.

As the programme is not continuing it is not possible to define any clear future work programme as part of NCASRI. However, there are still some important opportunities to embed the lessons into routine clinical practice for future evaluation to improve the quality of services offered to patients with complex needs for rehabilitation, which is outlined in Section 13 of this report.

List of Abbreviations and glossary of terms

1.7.1   List of abbreviations

Abbreviation	Full Term
BSRM	British Society of Rehabilitation Medicine
CAG - Trauma	Clinical Advisory Group (for Major Trauma)
CAG - HRA	Confidentiality Advisory Group (to the Health Research Authority)
CI	Confidence Interval
CNC	Complex Needs Checklist
CRG	Clinical Reference Group
CRM	Consultant in Rehabilitation Medicine
DARS	Data Access Request Service
DH	Department of Health
DMS	Defence Medical Service
GAS	Goal Attainment Scale
HES	Hospital Episode Statistics
HQIP	Health Quality Improvement Partnership
HRG-4	Healthcare Resource Group
ICD 10	International Classification of Diseases 10th Edition
IQR	Inter-quartile Range
ISS	Injury Severity Score
KCL	King's College London
MDT	Multi-disciplinary Team
MINAP	Myocardial Ischaemia National Audit Project
MTC	Major Trauma Centre
MTN	Major Trauma Network
NCASRI	National Clinical Audit for Specialist Rehabilitation following major Injury
NHSE	NHS England
NICE	National Institute for Health and Care Excellence
NIS-Trauma	Neurological Impairment Set for Trauma

Abbreviation	Full Term
NPCNA	Northwick Park Care Needs Assessment
NPDS	Northwick Park nursing Dependency Score
ONS	Office of National Statistics
OPCS4	Operating Procedure Codes
PCAT	Patient Categorisation Tool
PPI	Patient and Public Involvement
RCP	Royal College of Physicians
RCS-ET	Rehabilitation Complexity Score – Trauma
RCS-M	Rehabilitation Complexity Score – Medical subscale
RM	Rehabilitation Medicine
ROC	Receiver Operating Characteristics
RP	Rehabilitation Prescription
RR&R	Recovery, Rehabilitation and Re-enablement
SpRP	Specialist Rehabilitation Prescription
SSNAP	Sentinel Stroke National Audit Programme (SSNAP)
SUS	Secondary Uses Service
TARN	Trauma Audit and Research Network
TRETSPEF	Treatment Specialty code (within HES data)
TU	Trauma Unit
UK FIM + FAM	UK Functional Assessment Measure
UKROC	UK Rehabilitation Outcomes Collaborative

1.7.2 Glossary of terms

Term	Description
Clinical Advisory Group (Trauma CAG)	The NHS Clinical Advisory Group that reported to the Department of Health in 2010 making recommendations for Regional Networks for Major Trauma
Confidentiality Advisory Group (HRA)	The Confidentiality Advisory Group to the Health Research Authority that reviews applications for access to confidential patient information without consent under Section 251 of the Care Act 2014
Complex Needs Checklist (CNC)	A screening tool to assist MTC staff to identify patients with complex needs requiring further inpatient specialist rehabilitation
Clinical Reference Group (CRG)	Groups appointed by NHS England to provide clinical advice for the strategic planning and commissioning of Specialised Services
Consultant in Rehabilitation Medicine (RM)	A consultant physician with higher specialist training and accreditation in the field of rehabilitation medicine
Data Access Request Service	A service offered by NHS Digital to provide NHS data for analysis and linkage with other datasets
Major Trauma Centre (MTC)	A specialist hospital responsible for the care of the most severely injured patients involved in major trauma. It provides 24/7 emergency access to consultant-delivered care for a wide range of specialist clinical services and expertise
Major Trauma Network (MTN)	The collaboration between the providers commissioned to deliver co-ordinated trauma care services in a geographical area
Neurological Impairment Set for Trauma (NIS-Trauma)	A clinical tool for recording the severity and type of impairments. The NIS-Trauma is adapted specifically for use with trauma patients
NHS England (NHSE)	An executive non-departmental public body of the Department of Health that oversees the budget, planning, delivery and day-to-day operation of the commissioning side of the NHS in England
Northwick Park nursing Dependency Score /Northwick Park Care Needs Assessment	A clinical tool for measuring a patient's level of dependency on care and nursing, which is translated by a computerised algorithm to estimate the need for, and cost of providing, care in the community
Patient Categorisation Tool (PCAT)	A clinical tool for identifying and describing a patient's complex needs for rehabilitation, and categorising these into four levels (A-D) in line with the NHSE criteria for requiring specialist rehabilitation services
Receiver Operating Characteristic (ROC)	ROC curves are frequently used to show in a graphical way the connection/trade-off between clinical sensitivity and specificity for every possible cut-off for a test or a combination of tests
Rehabilitation	A process of assessment, treatment and management with on-going evaluation by which the individual (and their family/carers) are supported to achieve their maximum potential for physical, cognitive, social and psychological function, participation in society and quality of living
Rehabilitation Complexity Score – Trauma (RCS-E)	A clinical tool for measuring a patient's resource requirements for rehabilitation in terms of nursing, therapy and medical care. The Trauma version (RCS-ET) is adapted specifically for use in acute trauma care settings

Term	Description
Rehabilitation Prescription (RP) (standard)	*A* document detailing a patient's rehabilitation needs and making recommendations for how these should be met after they are discharged from the acute trauma services
Sensitivity and Specificity	Test *sensitivity* is the ability of a test to correctly identify those with the disease (true positive rate), whereas test *specificity* is the ability of the test to correctly identify those without the disease (true negative rate)
Specialist rehabilitation	The total active care of patients with complex disabilities by a multi-professional team who have undergone recognised specialist training in rehabilitation, led/supported by a consultant trained and accredited in rehabilitation medicine
Specialist rehabilitation prescription (SpRP)	The rehabilitation prescription for a patient who is identified as having highly complex needs requiring further specialist in-patient rehabilitation. It includes the RP together with four standardised tools to record rehabilitation needs
Trauma Audit and Research Network (TARN)	An organisation that provides the national clinical database for acute trauma care in England
Trauma Unit (TU)	A hospital that is part of the major trauma network providing care for all except the most severe major trauma patients
UK Rehabilitation Outcomes Collaborative (UKROC)	An organisation commissioned by NHSE that provides the national clinical database for specialist rehabilitation services in England

2 INTRODUCTION AND OVERVIEW

Major trauma describes serious injuries that are life-changing and could result in death or serious disability, including head injuries, severe wounds and multiple fractures.

Following major injury, the majority of patients will make a good recovery with the support of their local services. However a small number will have complex rehabilitation needs requiring the skills and facilities of a specialist in-patient rehabilitation unit to make the transition from hospital to the community, and to maximise their recovery of physical, psychological and social function. By relieving pressure on beds in acute services, specialist rehabilitation services form a critical component of the trauma pathway to optimise patient flow within the Major Trauma Networks (MTN). To date, however, the main focus of attention has been on the acute and frontline services.

The NHS Clinical Advisory Group Report on Regional Networks for Major Trauma 2010 highlighted the limited capacity and fragmentation of specialist rehabilitation services across England, and noted that this was the area of the pathway most in need of development. The report recommended the use of a Rehabilitation Prescription (RP) to identify ongoing needs and make recommendations for rehabilitation after discharge from the acute trauma services. The British Society of Rehabilitation Medicine (BSRM) Core Standards for Trauma (2013) (3) recommended a further 'Specialist Rehabilitation Prescription' (SpRP) to identify patients with complex needs requiring referral to a specialist in-patient rehabilitation unit.

Despite this, when the MTNs were established in 2012, the allocated funding included no formal provision for specialist rehabilitation. Some regions recognised this need and included provision within their local planning, but others did not. This has led to considerable variation in the scope and standard of provision for post-trauma rehabilitation in different parts of the country.

In accordance with the MTN policy, after definitive care has been provided at a Major Trauma Centre (MTC), patients with complex rehabilitation needs who cannot be transferred directly to a specialist rehabilitation unit are repatriated to their local Trauma Unit or acute hospital to relieve pressure on MTC beds. Some patients may spend an extended period of time there, waiting for a bed to become available. Others may never receive the services they need.

At the outset of this audit, NHS coding and national information systems, including the **Trauma Audit and Research Network (TARN)** (4) provided important information on acute care and crude outcomes (e.g. mortality), but little or no information about process or patient outcomes in the rehabilitation aspects of the patient pathway. The **UK Rehabilitation Outcomes Collaborative (UKROC)** (5) systematically recorded in-patient data on needs, inputs and outcomes from all specialist rehabilitation services in England and reported national benchmarking information on quality and outcomes, including cost-efficiency. However, it collated de-identified data only, so that tracking of individual patients between acute care and rehabilitation services was not possible.

The **National Clinical Audit of Specialist Rehabilitation following Major Injury (NCASRI)** was commissioned in 2015 by the Healthcare Quality Improvement Partnership (HQIP), as part of its National Clinical Audit and Patient Outcomes Programme (NCAPOP). It was funded by NHS England and the Welsh Government in Year 1, and by NHS England in Years 2 and 3. Its purpose was to determine the scope, provision, quality and efficiency of specialist rehabilitation services across England and improve the quality of care for adults with complex rehabilitation needs following major trauma.

- A key component of NCASRI has been to link data from the TARN and UKROC datasets, using the NHS number, in order to track patients from the MTCs to the specialist rehabilitation services and to examine the outcomes and cost efficiency of rehabilitation following major trauma.

- Outcomes and quality of care were evaluated in accordance with standards and recommendations laid out in national documents from the Department of Health (DH), NHS England (NHSE), the British Society of Rehabilitation Medicine (BSRM) and the National Institute for Health and Care Excellence (NICE). Recommendations are also made on data collected within tools that highlight any specific shortcoming in the clinical care and rehabilitation of major trauma patients.

NCASRI had 3 main elements:

1. An **organisational audit** to identify the current provision of specialist rehabilitation for trauma patients and to map the pathways of care into and out of these services (1st year).

2. A **prospective clinical audit** of new patients presenting within NHS Major Trauma Centres (MTCs) who have complex needs and receive specialist rehabilitation (2nd and 3rd year).

3. A **feasibility study** for using existing datasets such as the UKROC, ONS and HES data to identify how far it is possible to determine from existing NHS data the pathway and outcomes for patients who require specialist rehabilitation on discharge from MTCs, but do not subsequently attend (3rd year).

Reports:

- The **First NCASRI Report** in October 2016 presented the findings from the organisational survey and a retrospective analysis of UKROC data on outcomes from rehabilitation following major trauma (1).

- The **Second NCASRI Report** in November 2017 described the challenges of NCASRI and the steps taken to overcome them. It also presented preliminary data from the Major Trauma Centres (2).

- This **Final NCASRI Report** presents the findings from Elements 2 and 3 (the prospective clinical audit and feasibility study) and makes recommendations for future work.

3 BACKGROUND

3.1 Major Trauma

The 2007 National Confidential Enquiry in Patient Outcome and Death report entitled 'Trauma: Who cares?" (6) highlighted a lack of consistent data collection and variation in outcomes across the country. This drove the need for the establishment of a more coordinated approach to trauma care.

In 2010, the **NHS Clinical Advisory Group for Major Trauma (Trauma CAG)** reported to the Department of Health (England) (7), recommending the establishment of networks within each region to provide coordinated pathways of care for patients following major trauma.

3.1.1 What is Major Trauma?

According to NHS Choices, '**major trauma'** means **'multiple, serious injuries that could result in disability or death'**.

Within the scientific literature, major trauma is defined using the **Injury Severity Score (ISS)** (8) which assigns a value to injuries in different parts of the body and totals them to give a figure representing the severity of injury. An ISS >15 is defined as '**major trauma'**.

This definition, however, does not include all those who would benefit from the regionalisation of trauma care. The Trauma CAG took a more inclusive view, encompassing patients with lower ISS scores and recommending, for example, that all patients with an ISS ≥9 should have their rehabilitation needs formally considered and documented.

3.1.2 Major Trauma Networks (MTNs)

A **Major Trauma Network (MTN)** is the collaboration between the providers commissioned to deliver coordinated trauma care services in a geographical area.

- At its heart is the **Major Trauma Centre (MTC)** (or 'Collaborative', when there is more than one centre in a given network). The Trauma Network includes all providers of trauma care, particularly: pre-hospital services, other hospitals receiving acute trauma admissions (e.g. **Trauma Units),** and rehabilitation services.

- Within this system, patients who suffer major injury are treated and stabilised at an MTC. They then progress along a care pathway, the details of which vary according to their rehabilitation needs and the specification of local and regional rehabilitation services.

The first four MTNs were established in London in 2010. The rest of England followed in 2012, giving a total of 20 MTNs. There are currently 27 MTCs (22 of them treating adults) established across England, each linked with a number of supporting Trauma Units (TUs) – (See Section 8 for more details).

Recognising the importance of early and specialist rehabilitation in managing flow and removing bottle-necks in the acute patient pathway, the Trauma CAG recommended the appointment of a consultant in RM as Director of Rehabilitation in every MTN, to support strategic development and provide clinical leadership of acute trauma rehabilitation services. This recommendation is now included in the NHS England (NHSE) Service Specification for Major Trauma (9).

The Trauma CAG also recommended use of the **Rehabilitation Prescription (RP)** for severely injured patients (ISS ≥9), setting out their needs for further rehabilitation after they leave the MTC. The term attracted some controversy at the time, but was coined not to suggest that a doctor should 'prescribe' the type and amount of rehabilitation, but to indicate that recommendations for rehabilitation should be regarded with the same importance and priority as any other treatment or intervention prescribed on discharge from the MTC.

As with the establishment of the stroke networks, most of the emphasis in planning and implementation was on the development of the acute and frontline services. Rehabilitation was added as something of an afterthought – and in some cases not at all. This may have adverse consequences both for individual patients and for the efficient operation of the MTNs.

3.2 Specialist rehabilitation

3.2.1 What is specialist rehabilitation?

According to the NHSE 2014 Service Specification for Specialist Rehabilitation (10)

Rehabilitation is a process of assessment, treatment and management with on-going evaluation, through which the individual (and their family/carers) is supported to achieve their maximum potential for physical, cognitive, social and psychological function, participation in society and quality of living. Patient goals for rehabilitation vary according to the recovery trajectory and stage of their condition (11).

Specialist rehabilitation is the total active care of patients with complex disabilities by a multi-professional team who have undergone recognised specialist training in rehabilitation, led by a consultant trained and accredited in Rehabilitation Medicine.

Evidence: There is now a strong body of trial-based evidence and other research to support both the clinical and cost-effectiveness of multi-disciplinary rehabilitation (12) especially when offered in a continuous chain through dedicated specialist settings. Early transfer to specialist centres and more intense in-patient rehabilitation programmes are cost-effective (13, 14) particularly in the small group of people who have high care costs due to very severe brain injury (15-17).

Despite their longer length of stay, the cost of providing early specialist rehabilitation for patients with complex needs is rapidly offset by longer term savings in the cost of community care, making this a highly cost-efficient intervention (18).

3.2.2 The role of consultants in rehabilitation medicine

Not all patients with complex disability have the potential to gain from rehabilitation. Consultants in RM play a critical role in assessing complex needs, planning how these will be met, and expediting transfer to the most appropriate next stage of rehabilitation or long-term care for that particular individual.

In the context of trauma, the **core activities of an RM consultant** include (3):

- Diagnosis and medical management of conditions causing complex disability. These include musculoskeletal injuries, limb loss, brain and spinal cord injury arising from trauma itself, and also any pre-existing physical, psychological or mental health conditions.

- Anticipation and prevention of physical, psychological and social complications, based on knowledge of a condition's natural history and prognosis.

- Evaluation of a patient's potential to gain from rehabilitation and prognosis for recovery.

- Defining rehabilitation needs, planning how they will be met, and directing patients to appropriate services.

- Coordinating care and collaborating with other medical and therapy teams, as well as health and social care commissioning agencies, to negotiate individual funding for bespoke rehabilitation programmes when necessary.

- Communicating with families to provide information and support, and to manage expectations.

- Making best-interests decisions on treatment and care – with the team and family – for patients who lack the mental capacity to decide for themselves.

RM consultants therefore play a vital role in the MTCs, and should be closely involved both at a clinical level and in the planning and delivery of services across all parts of the MTNs. They are particularly involved with the specialist services for patients with complex needs, but also provide a networking role to support local non-specialist services. They provide an important resource for advice and training of staff with respect to rehabilitation needs and interventions.

They are by no means, however, the sole source of expertise. There is now a body of highly experienced nurses and allied health professionals working within the MTNs to coordinate and direct the care of patients with complex rehabilitation needs.

3.2.3   Which patients need specialist rehabilitation?

Injuries requiring rehabilitation will range from the very modest to the very severe, and not every patient will require specialist rehabilitation. The NHSE Service Specification for Specialist Rehabilitation (10) defines three levels of service (1 to 3) and four categories of patient need (A to D).

- The majority of trauma patients will have an uncomplicated recovery and progress rapidly down the 'Recovery, Re-enablement and Rehabilitation' (RR&R) pathway. Their rehabilitation needs (Category C or D) can be met within their local general (Level 3) rehabilitation services (see Figure 3.1).

- Those with more complex (Category B) needs may require referral to their local specialist (Level 2) rehabilitation services for coordinated intensive rehabilitation programmes.

- A small number of patients with highly complex (Category A) needs require the specific staff expertise and facilities of tertiary specialised (Level 1) rehabilitation services.

- Level 1 rehabilitation units are expected to have a case-mix with over 85% Category A patients. Level 2 units may have a more varied case-mix of patients with Category A or B needs.

- Spinal injury units are currently not part of the NHSE service specification for specialist rehabilitation, but Level 1 and 2 units nevertheless take a proportion of patients with spinal cord injury (SCI) – especially where the SCI is an incomplete injury or with medical aetiology.

Further detail on the criteria for rehabilitation needs within each category can be found in the NHSE Service specification D02: Specialist rehabilitation services for patients with highly complex needs (10) http://www.england.nhs.uk/wp-content/uploads/2014/04/d02-rehab-pat-high-needs-0414.pdf

Figure 3.1: Pathway for patients with trauma
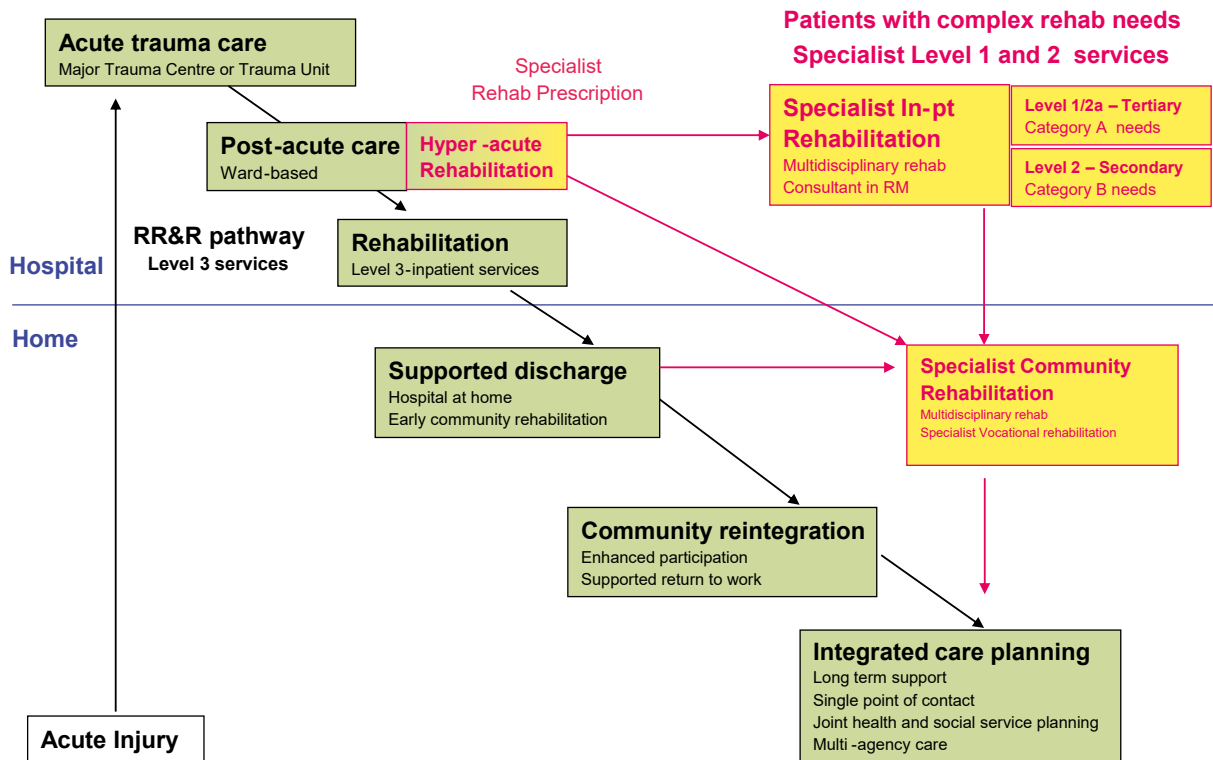
Copyright Prof L Turner-Stokes (2012). Reproduced with permission.

3.2.4 Rehabilitation Service provision in the UK

Since the re-organisation of the NHS following the Health and Social Care Act 2012, tertiary specialist rehabilitation for patients with highly complex (Category A) needs are commissioned directly by NHS England. Local specialist and general services are commissioned by the Clinical Commissioning Groups (CCGs).

Specialist rehabilitation is also provided across regionally-based networks, although these are not necessarily coterminous with the MTNs.

Hyper-acute specialist rehabilitation services: Development of the MTNs has instigated a new category of 'Hyper-acute rehabilitation' unit (3). These units are sited within acute care settings. They take patients at a very early stage in the rehabilitation pathway, when they still have unstable medical and surgical needs requiring continued active support from the trauma, neuroscience or acute medical services. These units are still undergoing development and a variety of service models for hyper-acute rehabilitation exist in different parts of the country (20).

Tertiary 'specialised' rehabilitation services[*] (Level 1) are high-cost/low-volume services, which provide for patients with highly complex rehabilitation needs that are beyond the scope of their local and district specialist services. These are normally provided in coordinated service networks planned over a regional population of between 1 and 5 million, through NHSE specialised commissioning arrangements. These services are sub-divided into:

- **Level 1a:** for patients with high physical dependency.
- **Level 1b:** mixed dependency.
- **Level 1c:** mainly mobile patients with cognitive/behavioural disabilities.

Local (district) specialist rehabilitation services (Level 2) are typically planned over a district-level population of 350,000 to 500,000, and are led or supported by a consultant trained and accredited in Rehabilitation Medicine (RM), working both in hospital and community settings. The specialist multi-disciplinary rehabilitation team provides advice and support for local general rehabilitation teams. These are **Level 2b** services. As some parts of England have no access to tertiary specialised rehabilitation services, local specialist rehabilitation services have extended their reach in some areas to support a **supra-district** catchment of 750,000 to 1 million people, and take a higher proportion (at least 50%) of patients with very complex needs. These are **Level 2a** services.

Within each locality, **local non-specialist (Level 3), rehabilitation** teams provide general multi-professional rehabilitation and therapy support for a range of conditions within the context of acute services, intermediate care or community services. These are **Level 3b** services. In addition, local services which 'specialise' in certain conditions and include a significant component of rehabilitation (for example stroke, or care of the elderly) may act as a local source of expertise, even though they do not meet the criteria for designation as a 'specialist rehabilitation service'. These are **Level 3a** services.

These developments have led to a 5-tier system, as shown in Figure 3.2. **The focus of this audit is on patients requiring hyper-acute and Level 1 and 2 specialist rehabilitation services only.**

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[*] Previously known as 'Complex specialised rehabilitation services' in the National Definition Set, version 2.

Figure 3.2: Different levels of specialisation in rehabilitation service provision in England

Category of patient need

A

B

C or D

Complexity of need

Patients requiring rehabilitation

Level 1: Tertiary Specialist rehabilitation services
Catchment population
>1 million

Level 2: Local Specialist rehabilitation services
2a – Supra-district services
2b – Local district services

Level 3: Non-specialist rehabilitation services
3a – Other specialist services
3b – Generic rehab services

3.2.5   Identifying patients with complex needs requiring specialist rehabilitation

By its very nature, major trauma results in a complex range of impairments and disabilities, which typically include a mixture of physical, cognitive, emotional, social and behavioural problems. ISS scores do not necessarily provide a good indication of rehabilitation needs.

The NHSE service specification for Major Trauma (9) mandates use of the **Rehabilitation Prescription (RP)** within the MTCs as a condition for payment of the Best Practice Tariff (BPT) and also requires assessment by an RM consultant within 3 calendar days for patients with more complex rehabilitation needs.

3.2.6   British Society for Rehabilitation Medicine (BSRM) Core Standards for Trauma

The British Society of Rehabilitation Medicine (BSRM) Core standards for Specialist Rehabilitation following Major Trauma 2012 (3) recommend that patients who are thought likely to have complex rehabilitation needs requiring further in-patient specialist rehabilitation when they leave the MTC should be reviewed by an RM consultant. A **Complex Needs Checklist (CNC)** has been developed to assist in the identification of these individuals.

Those confirmed as having complex (Category A or B) needs, should have a **Specialist Rehabilitation Prescription (SpRP)** drawn up by the RM consultant or their designated deputy, before being transferred to an appropriate rehabilitation setting.

The SpRP does not stand alone but adds a set of four further validated measurement tools to the standard RP, which define and describe their needs for rehabilitation (3):

- The **Patient Categorisation Tool (PCAT),** which identifies Category A and B needs.

- The **Rehabilitation Complexity Scale for Trauma (RCS-ET)**, which identifies the resource requirements to meet the individual's rehabilitation needs.

- The **Neurological Impairment Set for Trauma (NIS-Trauma)** provides a measure of the severity of trauma-related impairments, against which to evaluate functional outcome.

- The **Northwick Park Dependency Scale (NPDS)** – a measure of dependency that translates to an assessment of care needs and costs (the **Northwick Park Care Needs Assessment (NPCNA);** which is used to estimate the cost-efficiency of rehabilitation).

More details about these tools are given later in this report.

The RP and SpRP present a major opportunity to capture data on the need for, and provision of, specialist rehabilitation within the trauma networks. However, their exact nature and content are still under development, and data reporting varies widely between centres.

This audit captures patients referred for specialist rehabilitation at the point when they are ready for discharge from the MTCs. This will help to embed robust systems for identifying patients with complex needs and expediting appropriate referral and transfer to meet their continuing needs for rehabilitation.

3.3 National Clinical Databases for Trauma and Specialist Rehabilitation

3.3.1 The Trauma Audit and Research Network (TARN)

The Trauma Audit and Research Network (TARN) leads the National Clinical Audit for trauma care across England, Wales and the Republic of Ireland. It provides a statistical base to support clinical audit, to aid the development of trauma services and to inform the research agenda.

Established in 1989, TARN's key role is to deliver a high-quality service that supports clinicians in driving improvements in trauma care. It holds the largest trauma database in Europe with over 500,000 cases, and is self- funded through annual hospital subscription fees.

NHS Trusts, commissioners, regulatory bodies, NHS England and the Department of Health rely on TARN's national clinical trauma audit data. TARN offers the means to monitor care and outcomes by:

- Providing a robust data collection system that can adapt to and reflect changes in service delivery.

- Delivering case-mix adjusted analysis to report on comparative outcomes.

- Reporting of key standards and recommendations to support improvements in care and in the commissioning of trauma care services.

These are delivered through three themed clinical reports, the Major Trauma Dashboard, and national reports.

Data submitted to TARN relates primarily to the acute care pathway from incident to hospital discharge, and is entered into the secure web-based **electronic data collection and reporting system (eDCR)** by hospitals.

Since the introduction of the standard **Rehabilitation Prescription**, hospitals have been able to record the presence of an RP. In 2013, completion of the response to **four mandatory RP questions** on the TARN data collection system became part of the qualifying criteria for enhanced payment using the Best Practice Tariff in Major Trauma Centres (9). These four mandatory questions were:

- **Does the patient have a Rehabilitation Prescription?**

If yes to the above:

- Does the patient have physical rehabilitation needs?
- Does the patient have cognitive or psychological needs?
- Does the patient have psychosocial needs?

In addition to the mandatory RP, fields for an extended Rehabilitation Prescription (eRP) are also available on TARN for MTCs that wish to use the eDCR to collate more detailed information. The eRP is not mandatory, and it is different from the SpRP. The eRP includes descriptive information about impairments, functional limitations and psychosocial issues, as well as recommendations for rehabilitation, but does not include the formal measurement tools included in the SpRP.

3.3.2   The UK Rehabilitation Outcomes Collaborative (UKROC)

The UK Rehabilitation Outcomes Collaborative (UKROC) provides the national clinical database for specialist rehabilitation services in England. It was established in 2010 through a National Institute for Health Research (NIHR) programme grant for applied research (2008–2015) (19). It is based at Northwick Park Hospital in London and overseen by the BSRM.

UKROC systematically collates patient-level data for all case episodes admitted for in-patient specialist rehabilitation in England; the database now contains over 40,000 recorded episodes. The dataset comprises socio-demographic and process data (e.g. waiting times, discharge destination) as well as clinical information on:

- The complexity of rehabilitation **needs**.
- The **inputs** provided to meet those needs.
- The **outcomes,** including functional gain and cost-efficiency.

Key measurement tools within the UKROC dataset relevant to this audit are summarised in Table 3.1 and further detailed in Appendix 1.

NHSE

NHSE NATIONAL STANDARDS

Since July 2015, UKROC has been directly commissioned by NHSE to provide the commissioning dataset for specialist rehabilitation services. Registration and submission of the full UKROC dataset is a commissioning requirement for designation, and for eligibility for payment as a Level 1 or 2 specialist rehabilitation service.

From a commissioning perspective, UKROC performs the following key functions:

- It collates information on service characteristics (staffing levels, caseload complexity and catchment population) to 'signpost' services for designation at the appropriate service level.
- It provides monthly activity reports for contracting and commissioning purposes.
- It also provides quarterly benchmarking reports on quality and outcomes, including response times for assessment and admission, functional gain and cost-efficiency. The figures for each specialist rehabilitation unit are compared to average figures for providers within the same service level.

The NCASRI audit builds on the programme of work initiated through UKROC to provide insights into cost-effective models of care for patients with complex disabilities following major trauma.

Prior to NCASRI, UKROC collated only de-identified data, which precluded the tracking of individual patients. In parallel to this audit, permissions were sought to **collect identifiable data** (NHS number and date of birth) and create data linkage with TARN to enable tracking of individual patients longitudinally through the care pathway.

Table 3.1: Key measurement tools within the UKROC dataset

Tool	Structure	Purpose
Needs for rehabilitation		
Patient Categorisation Tool (PCAT) (21, 22)	Checklist and ordinal measure Total score range 17–50	Records the types of need a patient may have that lead to a requirement for treatment in a specialist rehabilitation unit (Category A or B needs).
Neurological Impairment Set for Trauma (NIS-Trauma) (23)	Checklist and ordinal measure Total score range 0–110	Records the severity of neurological and other trauma-related impairments, against which to evaluate outcome.
Inputs		
Rehabilitation Complexity Scale (RCS-E) (24, 25)	Ordinal measure Total score range depends on version	Records the resource requirements to meet the patient's needs for medical support, basic care and nursing, therapy and equipment.
Northwick Park Dependency Score (NPDS) (26)	Ordinal measure Total score range 0–100	Records basic care and nursing dependency. Translated by a computerised algorithm within the UKROC software to the Northwick Park Care Needs Assessment (NPCNA).
Northwick Park Care Needs Assessment (NPCNA) (27)	Interval scale of estimated care hours and costs	Provides a timetable of care needs and estimates the cost of care per week in the community.
Outcomes		
UK Functional Assessment Measure (UK FIM+FAM) (28)	Ordinal measure Total score range 30–210	A global measure of disability comprising 16 items addressing physical function (FIM+FAM motor) and 14 addressing cognitive, communicative and psychosocial function (FIM+FAM cognitive).
Cost-efficiency (18)	The time taken to offset the cost of rehabilitation by the resulting savings in the cost of on-going care in the community. This is calculated from 'mean episode cost of rehabilitation' divided by 'mean reduction in weekly cost of care' between admission and discharge, as estimated by the NPCNA.	

Full details, including electronic versions of the tools, may be found on the UKROC website https://www.kcl.ac.uk/cicelysaunders/research/studies/uk-roc/tools

4 THE NCASRI PROGRAMME – SCOPE, OBJECTIVES AND STANDARDS

4.1 History, contracting and scope of NCASRI

The NCAPOP programme (29) is a set of centrally-funded national clinical audits, outcome review programmes and registries that collect data on compliance with evidence based standards, and provide benchmarked reports on compliance and performance. They also measure and report patient outcomes.

Contracts to deliver these audits are awarded by tender with funding usually for 3 years in the first instance, with potential to extend for a further 2 years, subject to agreement. There is an expectation that, following the initial investment, audits will become embedded in clinical practice going forward. Key examples of NCAPOP audits that have been embedded into clinical practice leading to demonstrable improvements in the quality of care and patient outcomes include the Stroke: Sentinel Stroke National Audit programme (30), the Myocardial Ischaemia National Audit Project (MINAP) (31) and the National Emergency Laparotomy Audit (NELA) (32). However, it should be noted that this embedding into clinical practice can take up to 10-15 years.

4.1.1 Procurement and contracting

The contract for the provision of the NCASRI was awarded to the London North West Healthcare NHS Trust (LNWHT) in 2015 (now London North West University Healthcare NHS Trust (LNWUHT). Led by Prof Lynne Turner-Stokes, it was undertaken in a tripartite collaboration between:

- The UK Rehabilitation Outcomes Collaborative (UKROC) at Northwick Park Hospital.
- The Trauma Audit and Research Network (TARN) at Manchester University.
- The Cicely Saunders Institute of Palliative Care, Policy and Rehabilitation at King's College London.

Key stakeholder groups were identified as follows:

- The **BSRM Trauma Rehabilitation Working Group** (chaired by Dr. Judith Allanson) providing oversight and direction, while supporting the engagement of the Consultants in Rehabilitation Medicine (RM) in the audit.
- The **Clinical Reference Groups (CRGs) for 'Major Trauma' and for 'Specialist Rehabilitation'** providing oversight and direction for the audit process and supporting engagement of NHSE commissioners for implementation of recommendations. Both CRGs include active Patient and Public Involvement (PPI) membership.

4.1.2   Scope of programme

The history and scoping of NCASRI are described in the second year report.

- The audit was one of 11 topics chosen for procurement in 2011.

- The original proposal was widely based, encompassing neurological rehabilitation following all major illness and injury, and including rehabilitation services in the local Level 3 pathway, as well as Level 1 and 2 specialist services.

- The scope was subsequently narrowed by NHSE to focus on rehabilitation for patients with complex needs in the MTCs and specialist Level 1 and 2 rehabilitation services only, in the first instance. However it was anticipated that the range and scope of the audit might expand in subsequent rounds to encompass the wider group of patients requiring rehabilitation in the non-specialist pathway (i.e. the Trauma Units and Level 3 services).

4.1.3   Adjustments to scope at contracting

The original tender for the NCASRI programme included elements to explore the feasibility of capturing patient-reported data on outcomes and experience (PROMs/PREMs). Building on the work already underway by TARN in conjunction with Quality Health, this was planned to expand the information on vocational outcomes and experience of rehabilitation and outcomes outwith the Level 1 and 2 services. However, this element was not contracted as the collection of PROMS and PREMS was not supported under NHSE policy at that time and the funding for this element was withdrawn. The feasibility element was therefore limited to exploration of what information can be gleaned through linkage with existing datasets such as HES and ONS mortality data.

4.1.4   Adjustments to scope within programme

The original programme was intended to include services in Wales and the Defence Medical Services (DMS). However, the organisational audit demonstrated that service organisation in Wales was so different from England that the Welsh Government withdrew after Year 1. The programmes, content and population served by the DMS were also so different that they elected not to participate in the prospective audit.

4.1.5   Term

The initial contract for the NCASRI audit was for three years with the potential to extend for an additional two years subject to approval by NHSE. The scope of NCASRI was restricted to Level 1 and 2 specialist rehabilitation, partly because further development work on the standard Rehabilitation Prescription (RP) was already underway and there was no desire to duplicate this. However, it was anticipated that these two strands of work would come together if the programme continued into Years 4-5.

A key purpose of the NCAPOP is to embed data collection into routine clinical practice after the end of the funded audit. Years 1-3 therefore included preparatory work (analysis of data and exploration of feasibility with teams on the ground) towards a reduced core dataset that is feasible for use and informs clinical decision-making so that teams on the ground would actually want to continue to implement it as part of their everyday practice going forward. It was always likely, however, that it would take more than one round of audit to achieve this goal.

An extension request was submitted in autumn 2017 to extend NCASRI to Years 4-5. Unfortunately this was not granted, which has limited the potential for NCASRI to make a meaningful impact on improvement in patient care. The consequences of this are discussed further in Section 5.2.

4.2   Patient and Public Involvement (PPI)

Patients and public have been involved in all aspects of design and planning of this audit:

- UKROC, TARN and KCL all have their own established PPI groups, and there is PPI representation on the NCASRI Programme Board.

- PPI members were actively involved within the CRGs for both Major Trauma and Specialist Rehabilitation and helped to oversee the development of NCASRI from preparation of the initial topic proposal to development of the NCASRI project plan as this matured.

- A group of PPI members acted as a sounding board providing direct feedback to the NCASRI project team, as well as being involved in the various stakeholder workshops.

Particular concerns raised by PPI members that are addressed by this audit are:

- Lack of continuity of care between acute care services and rehabilitation.

- Insufficient capacity within the existing rehabilitation services to meet the needs of patients requiring ongoing rehabilitation after major trauma – particularly for patients with non-neurological injuries.

4.3   Aims and objectives

4.3.1   Over-arching aim

NCASRI OVER-ARCHING AIM

NCASRI aims to provide a national comparative audit of the organisation, access to, quality, outcomes and efficiency of specialist rehabilitation services provided for adults with complex needs following major injury in the English NHS.

The audit was designed to drive:

- Improved and equitable access to specialist rehabilitation services for eligible patients.

- Improved physical and psychological recovery, and the reduction of long-term disability and dependency following specialist rehabilitation.

Return to employment is usually not a feasible option for the group of patients with severe complex disability that forms the target population for this audit. Therefore, other methods were used to record and compare the cost-efficiency of rehabilitation services, such as the reduction of care needs, and the time taken for the cost of the rehabilitation programme to be offset by estimated savings in the cost of ongoing care in the community.

4.3.2 Specific objectives

1. To enable these improvements through the provision of high-quality data that compares providers of healthcare.

2. To achieve and maintain close alignment with the relevant national standards and clinical guidelines as published by the DH, BSRM and NICE.

3. To link data at the individual patient level to TARN, UKROC and other relevant national datasets to maximise impact and reduce data entry burden.

4. To consider and plan from the outset other linkage activity which might in the future facilitate extension of the audit further along the patient care pathway.

5. To consider and plan how the audit's reports and other outputs will be used to stimulate change, both locally and nationally.

4.3.3 Main elements

As previously noted, NCASRI had 3 main elements:

1. An **organisational audit** to identify the current provision of specialist rehabilitation for trauma patients and to map the pathways of care into and out of these services.

2. A **prospective clinical audit** of new patients presenting within NHS Major Trauma Centres (MTCs) who have complex needs and receive specialist inpatient rehabilitation.

3. A **feasibility study** for identifying the pathway and outcomes for patients who require specialist inpatient rehabilitation on discharge from MTCs, but do not subsequently attend.

It also included an element of service evaluation to determine whether current bed capacity within the specialist rehabilitation services was sufficient to meet demand and, if not, then what additional bed capacity and types of rehabilitation intervention were required to meet the needs of patients with complex rehabilitation needs following major trauma.

4.4 Key standards for patients with complex needs following major trauma

Reference standards and indicators are drawn from the following national clinical guidelines and standards documents shown in Table 4.1.

Table 4.1: Sources for the Key standards and Guidelines

Year	Standards document	Source
2005	The National Service Framework (NSF) for Long term neurological conditions (LTNC) (33)	**DH**
2009	NICE guidelines for Rehabilitation after Critical Illness (34)	**NICE**
2009	Standards for Rehabilitation Services mapped on the NSF for LTNC (35)	**BSRM**
2015	Specialisation in Neurorehabilitation Services (36)	**BSRM**
2013	Core Standards for Rehabilitation following Major Trauma (3)	**BSRM**
2010	The NHS Clinical Advisory Group Report on Regional Networks for Major Trauma (7)	**DH**
2014	Service specification for Major Trauma (9)	**NHSE**
2014	Service specification for Specialist Rehabilitation for patients with Highly Complex Needs (10)	**NHSE**

DH = Department of Health; NICE = National Institute for Health and Care Excellence;
BSRM = British Society of Rehabilitation Medicine; NHSE = NHS England

Performance indicators are intended to provide a valid measure of a provider's quality of care. The NCASRI audit has examined the quality of specialist rehabilitation received by patients with complex needs following major injury, including:

- At service level: structure, organisation and pathways.

- At patient level: needs, inputs, processes and outcome.

The performance indicators have included:

- Process of care, including the identification of rehabilitation needs while in the MTCs.

- Timely assessment and transfer to Level 1 and 2 specialist rehabilitation units.

- Quality of care, including outcomes and cost-efficiency within the specialist rehabilitation services.

4.5   Reference standards and performance indicators for NCASRI.

The following table of standards is divided by topic, and shows the year of the programme in which the standard was reported, the element of the audit to which it relates, and the data source that was used to assess whether the standard was met.

Structure and organisation	Reported	Source
RM consultants should be closely involved both at a clinical level and in the planning and delivery of all Major Trauma Networks to support and direct rehabilitation for patients with complex needs. • *Within each Major Trauma Centre (MTC) an identified RM consultant (or consultants) should be an integral part of the MTC Team.* • *Involvement of an RM consultant, attending the MTC or TU at least 2–3 times per week. This should be written into their job plan.* • *At an operational level, key roles for the RM consultant should include rounds of multi-disciplinary wards and team-based planning meetings.*	1st year	**Element 1 Survey**

1. Process within the MTC		Reported	Source
1.1	*All patients with ISS scores ≥9 should have a Rehabilitation Prescription (RP).*	1st year + Final	**Elements 1 and 2 TARN**
1.2	*Rehabilitation planning (including the commencement of the RP) should start within 48 hours of admission.*	1st year	**Element 1 Survey**
1.3	*A consultant in RM should be involved from an early stage in the patient's trauma pathway (within 3 calendar days) to assess patients with complex rehabilitation needs, to participate in their rehabilitation planning, and to expedite onward referral. This will normally involve a consultant in RM attending the MTC or TU at least 2–3 times per week.*	1st year	
1.4	*Patients thought likely to have complex rehabilitation needs requiring specialist in-patient rehabilitation should have the following completed by the MTC team:* • Rehabilitation Complexity Score (RCS-ET). • Checklist of complex needs.	Final	**Element 2 TARN**
1.5	*If the checklist suggests the patient is likely to have Category A or B needs, they should be reviewed by a consultant in RM or their designated deputy.*	Final	**Element 2 TARN**

1. Process within the MTC	Reported	Source
1.6	*The consultant in RM (or designated deputy) should complete:* • *The PCAT tool – to confirm Category A or B needs.* *If Category A or B needs are confirmed, a Specialist Rehabilitation Prescription (SpRP) should be completed before discharge from the MTC including:* • *The Northwick Park nursing Dependency Scale (NPDS).* • *The Neurological Impairment Set – Trauma (NIS-Trauma).* • *Details of referral to one or more named Level 1/2 service.* • *Discharge destination.*	Final	**Element 2** **TARN/** **UKROC**

2. Assessment and transfer to Level 1/2 service	Reported	Source
2.1	*Following referral, the patients should be assessed by the Level 1/2 service within 10 days.*	1st year + Final	**UKROC***
2.2	*A consultant in RM (or their designated deputy) should complete a Patient Categorisation Tool (PCAT) to confirm that the patient has complex (Category A or B) needs for rehabilitation.*	1st year + Final	**UKROC**
2.3	*If accepted in principle, but the patient is not yet fit for transfer, they may be placed on an inactive waiting list pending further review. Serial recordings of the RCS-ET Medical score may help to determine the 'R-point', at which the patient is Ready for transfer and placed on the active waiting list.*	(Final)	**Serial recordings were not used**
2.4	*Patients identified as requiring Level 1/2 in-patient rehabilitation should be transferred to specialist in-patient rehabilitation within six weeks of being fit for transfer.*	Final	**UKROC**

* UKROC currently only collects these data for patients who are actually admitted to a Level 1 or 2 service.

3. Specialist Level 1 and 2 in-patient rehabilitation services	Reported	Source
3.1	*All Level 1 and 2 services should be led by a consultant in RM and/or neuropsychiatry, depending on caseload.*	1st year	**Element 1 Service profiles**
3.2	*All Level 1 and 2 services should meet at least the minimum standards for safe and effective staffing levels as laid down in the BSRM standards.*	1st year	
3.3	*All Level 1 and 2 services should be registered with UKROC and contribute the full UKROC dataset for every patient enrolled under the NHSE-commissioned rehabilitation programme.*	1st year	
3.4	*Assessment of function and rehabilitation needs should be documented within 10 days of admission and within the last 7 days before discharge, including RCS-E, NPDS and UK FIM+FAM.*	1st year	**Element 1 UKROC**
3.5	*By discharge, all patients should have achieved some measurable gain or goal achievement, as measured by UK FIM+FAM, NPDS or GAS T-score (or other approved measure), or the reason for no gain recorded. Discharge destination should also be recorded.*	1st year + Final	**Elements 1 and 2 UKROC**
3.6	*Cost-efficiency data* should be reported in all episodes. It was originally suggested that (excluding patients who remain in prolonged disorders of consciousness at discharge) cost-efficiency for trauma patients should be within two standard deviations of the mean within each service group for 85% of patients. As yet there is no robust data to inform whether this is an appropriate means to identify outliers*	1st year + Final	**Elements 1 and 2 UKROC**

* Measured in the time to offset the costs of rehabilitation by savings in on-going care, as estimated by the Northwick Park Dependency Score (NPDS/NPCNA)

5 ELEMENT 1: STRUCTURE, ORGANISATION AND PRE-AUDIT PRACTICE

Element 1 of NCASRI was completed in Year 1 and comprised:

1. Mapping of specialist rehabilitation service provision, including:
   a. The number and geographic distribution of the Level 1 and 2 services, and their relationship to the MTNs.
   b. Their existing capacity for trauma patients.
   c. Case-load and staffing levels – the extent to which they met the BSRM standards.
   d. Reporting practice for the UKROC dataset.

2. Evaluation of practice in the MTCs, including:
   a. Patient flows – access to Level 1 and 2 rehabilitation services.
   b. Involvement of rehabilitation medicine (RM) consultants in the MTCs.
   c. Implementation of the rehabilitation prescription (RP) – data and reporting methods for the RP and SpRP tools.
   d. Strengths and weaknesses of the existing provision.

3. Analysis of existing data from the 3 years preceding the audit, including:
   a. TARN data relating to rehabilitation.
   b. UKROC data for trauma patients, including waiting times for assessment and admission, discharge destination, outcomes (measurable functional gain) and cost-efficiency.

Practice within the MTNs was broken down by *network*.

Practice within the rehabilitation services was broken down by *service level*.

The findings are detailed in the **First Year NCASRI Report**, but the summary and recommendations from this first stage were as follows:

- There was wide variation across the country in both the current levels of provision of specialist rehabilitation services and the degree of integration within the Major Trauma Networks.

  – In 2014–15 a total of 65 adult services in England were signposted as Level 1 or 2 in-patient specialist rehabilitation units. Together these provided approximately 994 occupied beds for specialist rehabilitation, with 195 (19%) of those being used for trauma patients. Provision varied considerably across the country, ranging from 1-8 beds per 1 million population for adult trauma patients.
  – The existing capacity for trauma patients within in-patient specialist rehabilitation services therefore catered for up to about 1000 patients per year. This represents approximately 5% of the total number of adults admitted to MTCs following major trauma and registered on the TARN database.

Specialist rehabilitation capacity for trauma patients varied widely across the country.

Existing capacity catered for approximately 5% of adults admitted to MTCs.

- Provision for specialist hyper-acute rehabilitation beds and complex musculoskeletal rehabilitation was particularly short.
- Under-commissioning was a significant problem. In comparison with national standards, between half and two-thirds of the specialist rehabilitation units had insufficient staffing to manage a complex caseload and so diluted the case-mix with less complex patients in order to meet their activity targets.

- For those patients who actually reached the Level 1 and 2 services, the majority were assessed and admitted within a reasonable space of time and made measurable functional gains. On average the cost of rehabilitation was balanced by savings made in the cost of on-going care in the community within two years of discharge from rehabilitation.

- However, a small proportion waited for a disproportionate length of time after they were fit for transfer to rehabilitation, which may impact negatively on their outcomes. This retrospective audit did not capture the needs or complexity of patients that never reached rehabilitation services.

45% of MTCs had <2-3 visits/ week from an RM consultant, and 18% had none at all.

- Fewer than half the MTNs complied with the national recommendation for consultants in Rehabilitation Medicine (RM) to be appointed to provide clinical and strategic leadership of acute trauma rehabilitation services, and many MTCs had little or no input from RM consultants at any level. 10/22 MTCs (45%) had less than the 2-3 visits per week from a consultant in RM, with 4 (18%) having no input at all. It was acknowledged that this might impact on the success of the prospective audit, which relied on RM consultants to identify the denominator group of patients with complex (Category A or B) rehabilitation needs.

- Although a Rehabilitation Prescription (RP) was a requirement for the enhanced 'best practice' tariff in the MTCs for patients with ISS scores ≥9, and was completed in 89% of patients, the mandated data collection comprised just 4 data fields in the TARN database, providing little useful information about rehabilitation needs.

- In the absence of central guidance on what form the RP should take, individual MTCs had each developed their own systems with little commonality between them. While all 22 MTCs had implemented use of the standard RP to some extent, recording methods varied, with three different computer platforms in use and some using paper only.

- Systematic data collection was therefore scanty. It was not possible to examine rates of completion for the Specialist Rehabilitation Prescription (SpRP) tools as the facility to record these within the TARN database was only introduced in 2016.

This programme therefore started from a very low base in comparison with some other national clinical audits, due to a lack of published data evaluating rehabilitation services for patients with serious injury. Moreover, there was great variance in adoption of standards, commissioning of services, service structure and service delivery in both rehabilitation and MTC settings. It was acknowledged that this posed a risk for subsequent stages of the audit as the majority of other national audits start out with much clearer and established quality standards and service structures.

5.1 Challenges for the NCASRI audit and analysis plan

Our **Second Year report** outlined some of the key challenges for the NCASRI audit and the steps that we have taken to overcome these, which included some adjustment to our analysis plan. These are summarised briefly below.

5.1.1 Scope of the audit and background development of the RP and SpRP

This audit took place against a moving background of development of the Rehabilitation Prescription.

At baseline, there was no defined system for determining rehabilitation needs or directing patients to the appropriate service at the interface between MTCs and rehabilitation services.

- Although the concept of a rehabilitation prescription had been mooted, and a minimum RP data set was included in the TARN dataset as a mandated requirement for the Best Practice Tariff, little guidance had been issued regarding its form or content.

Service provision varied due to differing commissioning arrangements and the lack of national tariffs

- Implementation of the RP as a clinical tool was variable, each MTC having adjusted this according to their local needs. However, a project was ongoing to develop a more consistent approach. This work was led by the Clinical Reference Group for Major Trauma, and there was no wish to duplicate it.

- In the meantime, service provision for specialist rehabilitation varied widely across the country due to differing levels of investment and development and the lack of nationally agreed commissioning arrangements and tariffs. Patients with highly complex needs often remained in the MTCs for several months before transfer to rehabilitation, and this was where the main blockage was felt to be.

Therefore the first 3 years of NCASRI was focused on the specialist rehabilitation pathway. This is a low volume audit focused on the needs of a small number of patients in a complex area of care that required a rich dataset. However, if successful it was anticipated that the two strands of work could come together in Years 4-5 allowing roll out of a simpler core dataset to capture the need for, and provision of, rehabilitation services to a larger number of patients, which could feasibly be embedded into clinical practice going forward.

5.1.2 Data collection

At baseline, there were no agreed datasets for determining rehabilitation needs or directing patients to the appropriate service as they left the MTC.

Although a minimum RP dataset was included in the TARN dataset, the 4 fields of data related to rehabilitation were insufficient to identify patients with complex needs.

The more detailed SpRP offered the potential to collect much more detailed information but had not yet been implemented to any significant degree. It was acknowledged that collection of all five tools would not be sustainable in the long term, but it was not yet clear which elements would be most useful. It was therefore agreed to collect the full SpRP with a view to selecting a reduced, more sustainable dataset going forward.

Working with the MTCs and other stakeholders in the first 2 years of NCASRI, a reduced core dataset has been identified for future rounds of the audit. Time points for data collection in the MTCs have been agreed, and the optimal time for data linkage. In the meantime, the full SpRP dataset collected in this first round will provide a critical body of information on access to and outcomes from rehabilitation.

Patients, members of the public and clinicians all emphasised that the rehabilitation needs of all trauma patients (not just Category A and B) should be considered. Integrating aspects of the audit into the standard RP would ensure less duplication in data collection and reduce clinician burden but requires further work in the next stages of development.

5.1.3 Recruitment within the MTCs

The fact that the datasets and tools to support data collection within this audit were developed from scratch within the first year gave only a very short timescale in which to identify the data requirements, agree the data collection and train staff in the use of tools.

For some MTCs, the tight timescale proved too challenging, and despite their willingness in principle to participate, the logistics defeated them. Some did not start data collection until more than 6 months after the start of the recruitment period in July 2016 and 6/22 (one third, 27%) of MTCs felt unable to participate at all.

5.1.4 Timescale for data linkage

A further challenge was the timescale for the prospective audit, which allowed just 18 months to recruit a 12-month cohort and perform data linkage to ascertain the proportion of patients with complex needs for rehabilitation who actually received the support required.

Data from the retrospective analysis of UKROC data in Element 1 suggested that patients may take up to 12 months post injury to appear in the UKROC database, which is longer than originally projected. The reason for this was that these most severely injured patients often spent longer in the MTCs and, even after their initial treatment there was complete, many were still medically unstable and not fit to engage in rehabilitation for several weeks. The upper quartile for the delay between referral and admission was 3 months, following which patients may stay up to 6 months in rehabilitation on the standard contract, although 10% stayed longer. In addition, data are only reported to UKROC after the end of the episode and (allowing for a 1 month 'flex and freeze' period for data corrections) reliable episode discharge data do not appear in UKROC until 2 months after discharge for the rehabilitation service.

Taken together, this meant that the planned data linkage just 3½ months after the end of recruitment in the MTCs might capture only a proportion of the patients who actually received specialist rehabilitation. It was therefore recommended that future rounds of audit should be planned on the basis of a 2-year timescale, to allow 12 months for patients to complete specialist rehabilitation and so maximise capture of eligible patients.

5.2 Recommendations for extension of the NCASRI audit

In the light of the above challenges, the following proposals for a second round of prospective audit were supported by the NCASRI Programme Board.

1. Prospective data collection starting on 1st September 2017 should include just the reduced core dataset consisting of the **Complex Needs Checklist (CNC),** and the **Rehabilitation Complexity Scale for Trauma (RCS-ET**), alongside the **clinical category of rehabilitation needs,** collected by any suitably experienced member of the MD Team at the time when patients were ready for transfer from the MTCs **for all patients who still required further in-patient rehabilitation at that point.** (See Appendix 2).

2. This second round of audit should have an extended scope, including patients with Category C and D needs, and be conducted over a **two-year time scale** to maximise the chance of complete capture of patients who received specialist rehabilitation by the data linkage.

3. All **MTC data should be collated within the TARN database to simplify future data linkage**. Locally-used databases and electronic patient records should provide data in a form that can be accessed by TARN data coordinators and entered onto the TARN platform for future linkage with the UKROC database.

4. The other SpRP tools to remain available within the TARN data platform for MTCs to complete on an optional basis as many MTC teams reported that they found the tools useful for clinical decision-making.

5. Continued work with the Rehabilitation Prescription Task and Finish Group to integrate the reduced core dataset described in point 1 above into the standard RP to ensure less duplication in data collection and reduce clinician burden in any future rounds of NCASRI.

A contract extension request was submitted to extend the NCASRI audit for a further two years in order to fulfil these recommendations. Unfortunately this was not granted. Although the panel recommend a limited extension of 6 months to support complete data capture for Round 1 only, this was not possible in isolation of the rest of the programme for both funding and logistical reasons, and alternative routes were explored to complete the linkage. Therefore, the NCASRI audit terminated at the end of this first round. Figures 5.1 and 5.2 illustrated the planned work that will not now be delivered under the NCASRI programme.

Figure 5.1: NCASRI programme plan if contract had been extended
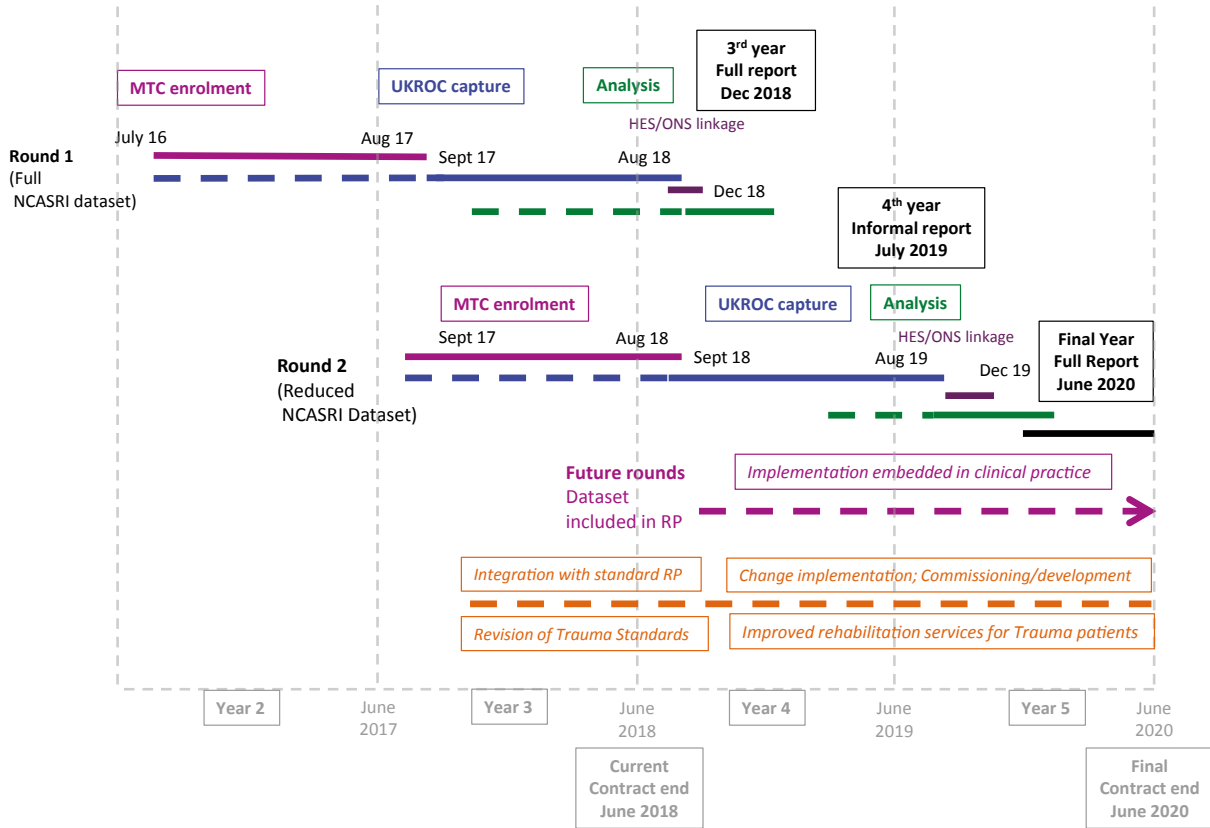
Figure 5.2: NCASRI programme plan without extension to Year 4-5 – items in grey will not be delivered
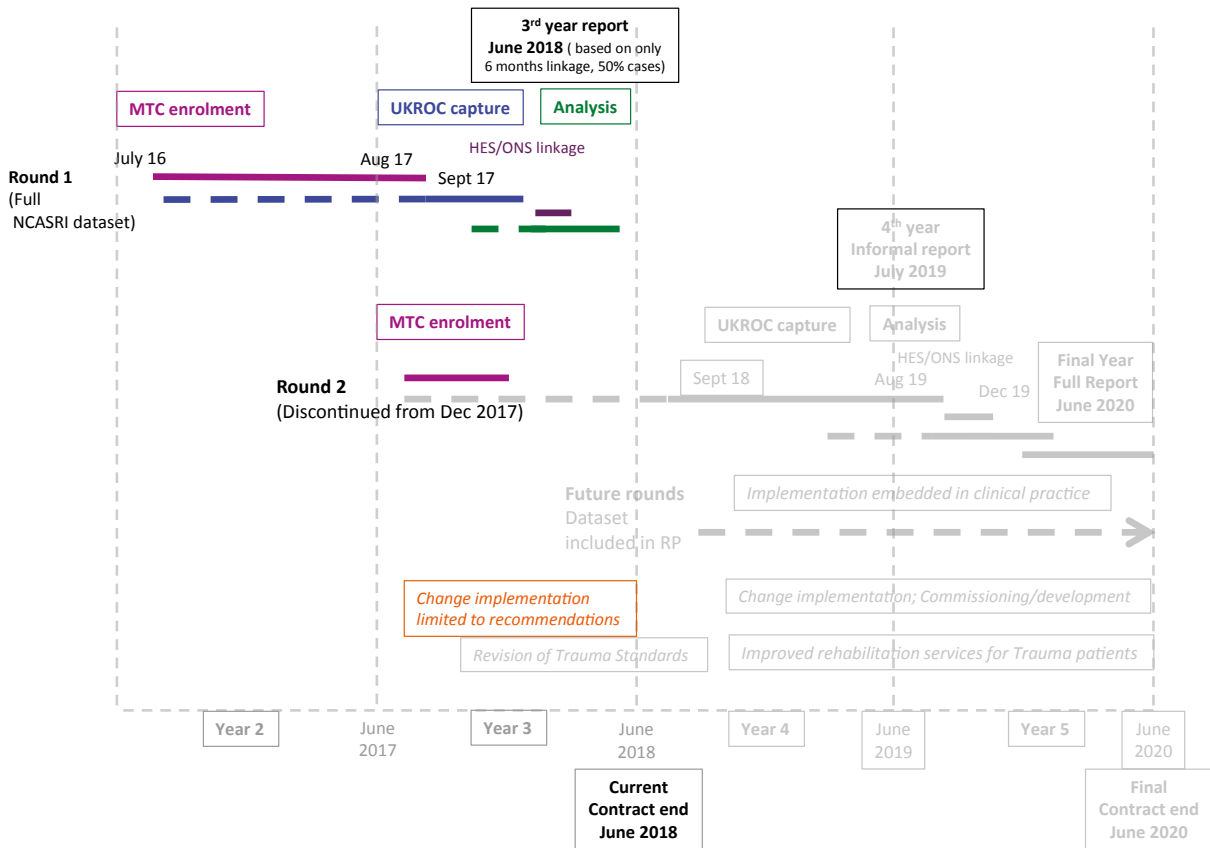
5.2.1 Key impacts of terminating the NCASRI programme in Year 3.

Key impacts that arise from terminating the NCASRI programme at the end of Year 3 include the following:

5.2.1.1 With respect to the analysis and report of the first audit round

- Because the final data linkage between TARN and UKROC had to be completed in December 2017, the proportion of patients accessing specialist in-patient rehabilitation may be under-estimated, as many of the recruited patients will not yet have completed their rehabilitation and appeared in the UKROC database. The results must therefore be interpreted with caution.

5.2.1.2 With respect to Round 2 and further audit cycles

- Recruitment for Round 2 (which started in September 2017) was discontinued in December 2017, as there was no point in recruiting patients who could not be followed through to data linkage.

- The further essential steps to embed NCASRI into clinical practice may not take place

- Any future possibility of capturing the information and extending the work to include the wider group of patients through integration with the RP must now take place outside of NCASRI.

Nevertheless some useful lessons have been learned that may serve to inform future audit and service evaluations around this important area of clinical practice.

6 ELEMENT 2:
THE PROSPECTIVE AUDIT

Our findings from Element 1 of NCASRI confirmed that BSRM standards for specialist rehabilitation within the major trauma pathway were aspirational.

In an ideal world, patients requiring further specialist inpatient rehabilitation would be identified in the MTCs and transferred promptly to a Level 1 or 2 rehabilitation unit as soon as they are ready to leave the MTCs (the so-called 'Transfer Ready' (TR) point). In reality, due to insufficient capacity, patients are often repatriated to their local trauma unit (TU) or district general hospital to wait for a specialist rehabilitation bed to become available.

At the outset of NCASRI, there was no way to track these patients to determine whether they actually received the specialist rehabilitation they required, or what the outcomes were. We suspected that many patients never actually got to the Level 1 or 2 services, but we did not know why. It may be that their needs changed and they no longer needed these services. Some may have died, or received rehabilitation elsewhere. Others may simply have got lost in the system.

Elements 2 and 3 attempt to examine these questions further by systematically identifying the patients with Category A and B needs and linking data from the TARN, UKROC and other NHS datasets. This has enabled us not only to track patients in their journey from the MTCs to the specialist rehabilitation services but also to start to determine the extent to which the pathways are explained by patient needs or by service capacity and provision.

In other words, NCASRI has performed the usual roles of a national clinical audit, by examining performance of current service against the expected standards and performance indicators. In addition, by including an element of service evaluation, it has provided important information to improve our understanding of the clinical pathways and trajectory of recovery for a group of patients about whom little was known at the start of the audit.

6.1 Key aims of the prospective audit in NCASRI

NCASRI

NCASRI KEY AIMS AND OBJECTIVES

NCASRI aimed to enrol all adult patients in England requiring specialist inpatient rehabilitation to maximise their recovery from severe injury following acute treatment in an MTC.

Eligible patients were severely injured adults (16+ years with ISS ≥9) who required specialist in-patient rehabilitation (Category A or B needs) at the Transfer Ready (TR) point or on discharge from an MTC.

Key objectives were:

- To determine the proportion of eligible patients who were subsequently admitted to a Level 1 or Level 2 specialist rehabilitation service.

- To examine how well their needs were met and the outcomes from rehabilitation in terms of functional gain and cost-efficiency.

Unfortunately it was beyond the scope of the audit, as commissioned, to determine in detail what happened to those patients who required specialist rehabilitation but did not subsequently receive it. However, we explored the feasibility of obtaining information about alternative pathways of care (i.e. the other forms of inpatient rehabilitation that patients access) from existing NHS datasets (e.g. Hospital Episode Statistics (HES) and ONS mortality data). We also examined the extent of unmet need for specialist rehabilitation, so far as it was possible to do so.

6.2 Methods

The audit methods are detailed in the Analysis Plan published in Appendix 2 of our **Second Year report.**

6.2.1 Identification of eligible patients.

The NCASRI audit built on the existing mandated data collection within the TARN and UKROC datasets, but added a limited set of tools to identify and describe patients with complex rehabilitation needs in the MTCs, adapted from the **BSRM Core Standards for Rehabilitation following Major Trauma** (3).

Figure 6.1 summarises the patient pathway and data collection for this first year of the NCASRI audit

Figure 6.1 summarises the patient pathway for the NCASRI audit

Admission to Major Trauma Centre
Injury severity Scale (ISS) ≥ 9
- Rehabilitation Prescription required
- TARN minimum dataset

MTC team start standard Rehabilitation Prescription.

TARN data

If likely to be category A or B:
Review by **Consultant in RM (if available)**
To confirm complexity and expedite onward referral

Assessment of rehabilitation complexity:
- Patient Categorisation tool (Category A, B, C, or D needs)

If Category A or B needs confirmed – Around R point
Complete **Specialist Rehab Prescription SpRP**
- Rehabilitation Complexity Scale (RCS-E Trauma)
- NIS-Trauma
- NPDS
Refer down Level 1/2 specialist rehabilitation pathway

Other services

Post acute rehab: Level 1/2
- NPDS – cost efficiency
- FIM+FAM – outcome

HES data
ONS data

TARN data

NCASRI linked Dataset

UKROC data

This data collection was operationalised within the actual patient pathway as follows:

- Patients admitted to the MTCs with severe injury (Injury Severity Score ISS ≥9) require a Rehabilitation Prescription (RP) which is recorded on TARN as part of the minimum dataset to receive Best Practice Tariff as an MTC.

- The RP should be commenced within the first 48 hours, but it is often completed once the rehabilitation needs of the patient have been assessed and defined, to enable referrals to appropriate rehabilitation units, or at discharge from the MTC.

- The TARN minimum dataset for the RP required four questions to be answered:
  – Does the patient have a) Physical, b) Cognitive/Mood or c) Psychosocial problems?
  – And do they have rehabilitation needs requiring an RP?

  These were the only four data fields required to receive best practice tariff.

- For the NCASRI audit, MTC staff were requested to complete the **Complex Needs Checklist (CNC)** for patients whom they considered to have complex rehabilitation needs requiring further in-patient rehabilitation.

- If the CNC indicated that the patient was likely to have Category A or B needs, then they requested assessment by a Consultant in Rehabilitation Medicine (RM), if available.

- The RM Consultant (or designated deputy) would use the **Patient Categorisation Tool (PCAT)** to confirm whether or not the patient has complex needs requiring further in-patient rehabilitation in a Level 1 (Category A needs) or Level 2 (Category B needs) specialist rehabilitation unit.

- Subsequently, the rest of the **specialist rehabilitation prescription (SpRP)** was completed for patients with Category A or B needs at the 'R point' (when the patient was ready to leave the MTC and be transferred to rehabilitation).

- The SpRP describes and quantifies their impairments, level of dependency, types of need for rehabilitation; and their requirements for medical, nursing and therapy input. These were collected using validated standardised tools:
  – The **Rehabilitation Complexity Scale for Trauma (RCS-ET).**
  – The **Neurological Impairment Set for Trauma (NIS-Trauma)**.
  – The **Northwick Park Dependency Score and Care Needs Assessment (NPDS/NPCNA).**

- At the TR point, patients with Category A or B needs requiring further inpatient rehabilitation should ideally be transferred directly to the specialist rehabilitation unit. In practice, they are frequently repatriated to their local hospital or Trauma Unit to relieve pressure on MTC beds while they wait to be admitted for inpatient specialist rehabilitation.

- Patients who are subsequently admitted to a specialist Level 1 or 2 rehabilitation service have the UKROC dataset completed on admission and discharge, as a commissioning requirement for these services. This includes evaluation of their outcome from rehabilitation in terms of:
  – Change in their levels of functional independence (measured using the **UK Functional Assessment Measure (UK FIM+FAM).**
  – Reduction in the on-going costs of caring for them in the community (measured using the **Northwick Park Dependency Score and Care Needs Assessment (NPDS/NPCNA).**
  – **Cost efficiency** - measured in terms of the time taken for savings in on-going care to offset the cost of the rehabilitation episode.

6.2.2   The SpRP tools

The SpRP tools each have a different purpose:

- The **Complex Needs Checklist (CNC)** is designed as a screening tool to assist the clinical team to identify patients with complex needs who may require referral for further specialist in-patient rehabilitation.

- The **Patient Categorisation Tool (PCAT)** (21, 22) details the types and complexity of rehabilitation need in accordance with the NHSE service specification criteria. Completion of the PCAT is a requirement for admission to Level 1 and 2 services and is often used by those services as part of their pre-admission assessment. It provides the definitive classification of Category A and B needs.

- The **Rehabilitation Complexity Scale for Trauma (RCS-ET)** (24) is a measure of resource requirements (medical, nursing and therapy inputs) to meet the complex needs for rehabilitation. While it correlates with the PCAT and CNC, it describes the **service elements**, rather than **individual patient characteristics**. It cannot be used alone to describe category of need. However serial collection of the RCS-ET Medical score can be used to identify the 'Transfer Ready' (TR) point – the point at which the patient's medical needs could be met in a rehabilitation setting as opposed to an MTC or trauma unit.

- The **Neurological Impairment Set for Trauma (NIS-Trauma)** (23) details the type and severity of impairment. It is generally acknowledged that the Injury Severity Score (ISS) recorded by TARN does not capture the range of impairments that are typically the target for rehabilitation. The NIS-Trauma records neurological and musculoskeletal impairments and their impact on function. It also records co-morbidities.

- The **Northwick Park Dependency Score and Care Needs Assessment (NPDS/ NPCNA)** (37) details nursing and care needs and estimates the ongoing costs of care in the community. It is used to demonstrate the cost benefits of rehabilitation – and in this context to help us estimate the cost to the NHS of not providing timely specialist rehabilitation.

   The SpRP tools are available for download on the NCASRI website (38).

6.2.3   Inclusion/exclusion criteria for recruitment

Patients were recruited if:

- They were aged 16 years and over.

- They were admitted to an MTC in England with an ISS≥9.

- They were identified as having (or possibly having) complex (Category A or B) needs requiring further in-patient rehabilitation in a Level 1 or 2 specialist rehabilitation unit.

- All conditions were eligible, including musculoskeletal, vascular, neurological and non-neurological conditions including amputation.

- The complexity of rehabilitation need was identified with the Complex Needs Checklist and further confirmed with the Patient Categorisation Tool (PCAT) score where available.

Recruitment within the MTCs ran from 1st July 2016 to the end of August 2017. A 14 month period was necessary to accommodate late additions to the cohort.

6.2.4   Data collection

6.2.4.1 MTC data:

The data items collected for NCASRI within the MTCs are detailed in **Appendix 1.**

The survey in Element 1 revealed wide variation in the implementation of rehabilitation prescriptions and the methods used to collect and collate data within the MTCs. In order to maximise response rates for this first round, NCASRI supported data collection using a range of methods including:

- Electronic data collection using the TARN database.
- Electronic data collection using the Integrated Rehabilitation Management Application (IRMA) platform.
- Paper forms which were entered into the UKROC database by the NCASRI staff.

Staff at each MTC uploaded data onto TARN or IRMA via a secure web-based data entry portal.

For paper data entry, a courier collected anonymised copies containing the NHS number but no other identifiable information and delivered them directly to the UKROC team.

6.2.4.2 UKROC data:

Registration with UKROC and submission of the UKROC dataset for each patient episode are mandated as a commissioning requirement for all specialist Level 1 and 2 units. The dataset records patient level data on needs, inputs and outcomes from rehabilitation using a standard set of measurement tools as detailed in **Appendix 1**.

Data are entered into the dedicated UKROC software by staff at each unit and extracts are transmitted securely through NHS mail to the central UKROC database at Northwick Park Hospital.

6.3   Data linkages – permissions and timing

Linkage of the UKROC and TARN datasets enabled tracking of patients with complex needs from the MTCs to the Specialist Level 1 and 2 services and the examination of their outcomes.

Patients who were identified as requiring Level 1 or 2 in-patient rehabilitation, but did not receive this, may receive alternative treatment in their local acute hospital, trauma unit (TU) or Level 3 services. We explored the feasibility of data linkage through the HES and Office of National Statistics (ONS) mortality datasets to identify where patients (who survive their initial injuries) were admitted and what information could be gathered from existing NHS data regarding their rehabilitation and outcomes.

The NCASRI audit was granted Section 251 (s251) permission by the Health Research Authority (HRA) Clinical Advisory Group, which enables the use of identifiable data (the NHS number and date of birth) for the purpose of this data linkage, which are summarised in **Appendix 3.**

As noted in Section 5.1.4, there is an expected lag between MTC data collection and data appearing in UKROC for patients that are admitted to rehabilitation, so the last MTC patient may therefore only appear in the UKROC database 12 months after recruitment. In order to allow time for data cleaning and analysis within the 3-year period of this contract, data linkage between TARN and UKROC was completed in December 2017. This meant that a significant number of patients may not yet have come through to UKROC and so the proportion of patients receiving specialist rehabilitation would be under estimated. In addition, due to the challenges described in Section 5.1, there was a strong possibility that recruitment in the MTCs had failed to capture all of the patients with Category A/B needs. For this reason, linkage was performed both forwards and backwards to identify all the patients who received specialist rehabilitation, whether or not they had been identified as having Category A/B needs in the MTC.

6.4 Data extraction, linkage and cleaning to form the NCASRI dataset

The NCASRI audit included data collected on the TARN/IRMA and the UKROC databases. Data were extracted, linked and assimilated into a single dataset for analysis as described below.

6.4.1 TARN and ORION datasets collected between 1.7.2016 and 31.8.2017

- All adult patients (16+ years) admitted to MTC with ISS ≥9, identified as having (or possibly having) complex needs for rehabilitation through:
    - Completion of checklist suggesting Category A or B needs *or*
    - Completion of SpRP or PCAT tool by a consultant in RM or experienced therapist o*r*
    - Recommendation for Level 1 or 2 rehabilitation on discharge.

6.4.2 UKROC dataset collected between 1.7.2016 and 31.12.2017

- All adult patients (16+ years) admitted to Specialist Level 1 and 2 Rehabilitation units.

6.4.3 Data linkage between UKROC and TARN:

Linkage was achieved by matching of NHS numbers and date of birth between the datasets for the two periods where an admission to an MTC pre-dates an episode of specialist rehabilitation. Matching was conducted both forwards and backwards to pick up:

a. Patients with complex rehabilitation needs identified in the MTCs who did and did not subsequently receive specialist rehabilitation.

b. Patients who received specialist rehabilitation who may or may not have had their needs identified in the MTC.

The total group made up the patients **'enrolled'** for NCASRI.

6.4.4 Other data linkage (for patients identified as having complex needs who did not enter rehabilitation)

Linkage was also conducted with HES and ONS mortality data by matching of NHS numbers from either data source to identify:

a. Those patients who did not survive.

b. In-patient episodes (with dates of admission, discharge and HRG codes) during this period in order to track patient journeys through other hospital facilities.

The list of data fields included from the TARN/IRMA, UKROC and HES datasets, together with their purpose within the analysis is given in Appendix 1.

Data from the three sources were assimilated into a custom-made database, and once the linkages were made the database was pseudonymised and the identifiable data deleted. Data were then exported into Microsoft Excel and SPSS for analysis.

6.5 Data quality

Overall data quality was examined in terms of case ascertainment, completeness and accuracy.

Interim analysis took place in May/June 2017 (see Second Year Report) to allow feedback to MTCs about the completeness and the quality of their data. This helped to identify any issues that needed to be addressed to maximise full data sets for subsequent analysis and linking.

6.5.1 Case ascertainment

Case ascertainment is defined as the number of patients **recruited** into the NCASRI audit compared to the number **eligible**. Examination of case ascertainment helps to inform the generalisability of the reported outcomes and was originally approached as follows:

6.5.1.1 Definitions of the patient groups for case ascertainment

*   Patients **eligible** for the NCASRI audit were adults (16+ years) who were admitted to an MTC in England following major injury (ISS >=9) (identified from the TARN database) and who had (or were likely to have had) complex (Category A or B) needs requiring specialist in-patient rehabilitation on discharge from the MTCs.

*   Patients **recruited** for the NCASRI audit were those of the above for whom data were collected and reported by the MTC, through any of the methods described in Section 6.2.4.1.

*   The **rehabilitation** group was the subset of patients who were subsequently admitted to specialist rehabilitation services (Level 1 and Level 2), identified from the UKROC database.

*   The **non-rehabilitation** patient group was the subset who were identified as having complex needs on discharge from the MTC, but who were not admitted to a specialist Level 1 or 2 rehabilitation service (and so did not appear on the UKROC database).

These case ascertainment groups are illustrated in Figure 6.2.

Figure 6.2: Case ascertainment groups
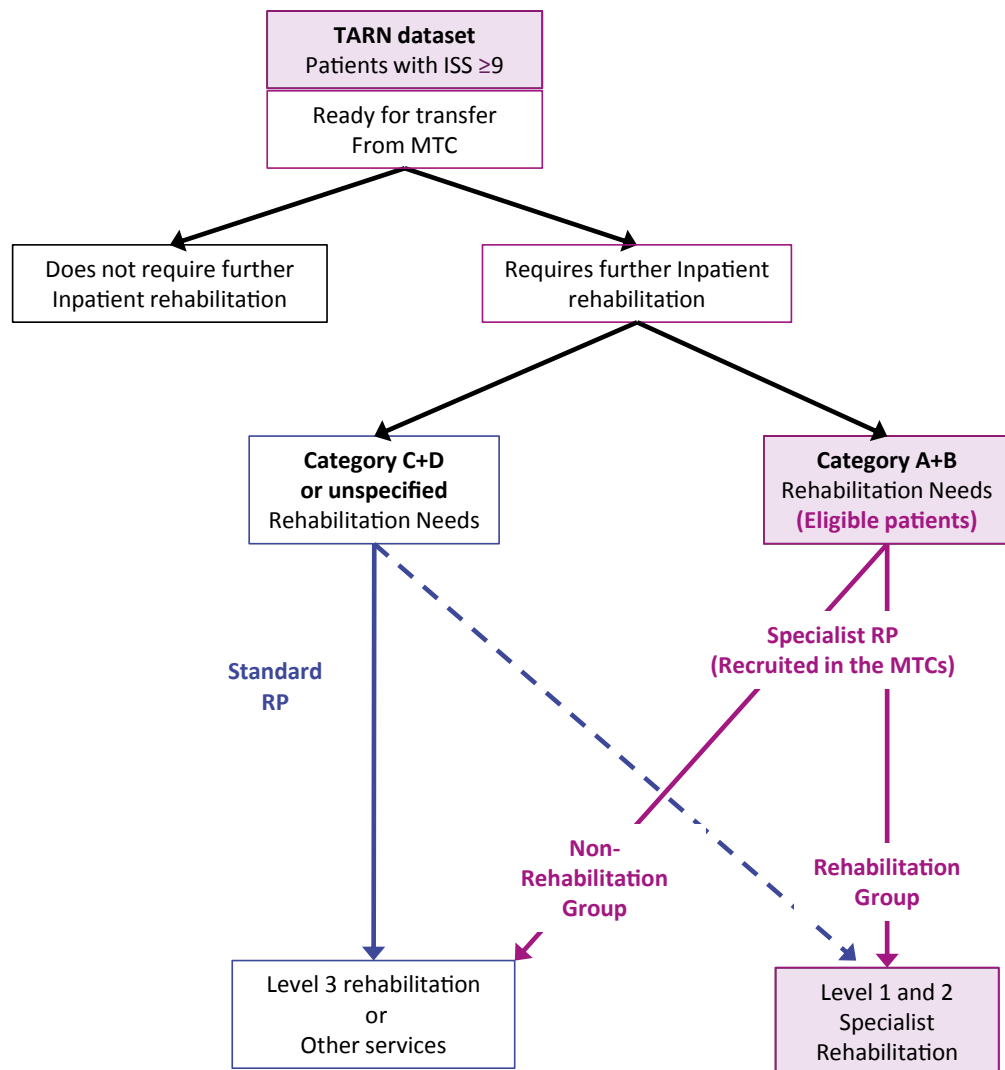
6.5.1.2   Revised case ascertainment plan

According to the NHSE service specification, the need for specialist rehabilitation should be confirmed by a consultant in rehabilitation medicine (RM). However, in MTCs with little or no RM consultant input, there was no established mechanism to confirm Category A and B needs.

Furthermore, the patient may only develop complex needs for rehabilitation after leaving the MTC. This meant that a proportion of **eligible** patients might not be **recruited**, even within the participating MTCs. The service evaluation elements of NCASRI in particular required as complete data capture as possible.

For these reasons, NCASRI did not follow the traditional method of most audits, but took a slightly different approach in order to maximise recruitment and case ascertainment. The following revised case ascertainment was signed off in the NCASRI analysis plan in Year 2:

- Patients could be included if the MTC team believed them to have Category A or B needs on the basis of the **Complex Needs Checklist (CNC)** and **RCS-ET.**

- Where a consultant in RM was not available, experienced members of the MTC clinical team could complete the other SpRP tools if they felt able to do so.

- Data linkage between UKROC and TARN was performed both forwards and backwards, to include any patients who may have developed complex needs only after leaving the MTC. This capture/recapture supported the identification of potentially eligible patients who were missed in the MTCs. The **rehabilitation** group therefore comprised two subgroups:
  - The **recruited rehabilitation group** – those identified as having complex (Category A/B) needs for rehabilitation in the participating MTCs.
  - The **non-recruited rehabilitation group** who were not identified as having complex rehabilitation needs in the MTCs but were subsequently admitted. These included patients who were admitted to non-participating MTCs. (Patients in this group were therefore not expected to have had the NCASRI tools collected in the MTC.)

It was possible that inclusion of patients on the basis of the **CNC** alone may lower the threshold for inclusion in comparison to centres recruiting on the basis of the **PCAT** tool. In order to explore this, where both tools were completed for the same patients, we examined agreement between them in terms of the % of patients thought to have complex needs (using the CNC) who were subsequently confirmed as Category A/B using the PCAT tool.

6.5.2   Data completeness and accuracy:

Complete data are required for accurate analysis and reporting. Without complete data, indicator values for units may be unrepresentative of actual practice.

Where relevant to the standards, the percentage completeness of data items is reported for each participating centre, and presented with a RAG (Red Amber Green) rating for visual impact.

Within this report, the following colour-codes, similar to those used in the Sentinel Stroke National Audit Programme (SSNAP) (30), are used in tables to report the percentage of episodes meeting the standards:

Colour-code	<65%	65–74%	75–79%	80–89%	90–100%

Outliers in terms of data quality and completeness were identified by named service provider.

6.6   Data analysis and reporting

The demographics of the patient groups are described for age, gender ratio, trauma diagnosis etc. and are reported for **recruited** patients, and separately for the **rehabilitation** and **non-rehabilitation** groups.

Percentage (%) achievement of performance indicators against the pre-defined standards are presented for each participating service with a RAG rating as described above.

Data are reported for each service/provider on a named basis. Care is taken to ensure that no individual patients are recognisable, except with their specific written consent.

Although statistical comparisons are typically not indicated in an audit programme, the NCASRI programme included elements of service evaluation as noted above.

Statistical comparisons are therefore relevant in some instances – for example to demonstrate significant gains in independence or to compare different cohorts. Where these are indicated we adopted the following approach:

- Descriptive summary statistics use the mean and 95% confidence intervals (bootstrapped with samples of n=1000 where necessary) or median, IQR (25th-75th percentile) and range.

- Within-and-between-groups analyses use parametric statistical techniques for interval or long-ordinal data where the distribution approximates to normal, or non-parametric methods for short-ordinal or highly skewed data – especially in small numbers.

- Categorical data are compared using Chi-squared tests.

6.7   Case-mix adjustment and outliers

Any comparison of providers must take account of differences in the mix of patients between providers by adjusting for known, measurable factors that are associated with the process or outcome indicator.

Specialist rehabilitation covers a range of **programme types** with differing goals and activities including:

1. Restorative rehabilitation to improve independence.

2. Complex disability management to support long term care.

3. Assessment and diagnosis of Prolonged Disorders of Consciousness.

4. Neuropalliative and end of life care.

These different programme types are not fully captured in UKROC so the proportions are not known.

Case-mix adjustment will not allow the detection of outliers in this audit for the following reasons:

- There are few specialist rehabilitation centres, and those that exist are heterogeneous in terms of case-mix and the types of programme offered.

- The number of patients with trauma in each centre is very small, and patients are heterogeneous both in terms of the trauma sustained and the nature and severity of their impairments (e.g. physical, cognitive, and behavioural).

- Commissioning practices also vary between centres.

- Even in larger datasets with good information, adjustment is difficult in the face of this diversity.

Traditional quantitative statistical models for case-mix adjustment are therefore not appropriate for identifying outliers in any robust sense.

Instead we use descriptive statistics for each service, covering demographic and injury data, process data and outcome data. Where comparison seems reasonable, we highlight similarities and differences. The data draw attention to areas where further investigation to explore opportunities for service improvement may be required.

Although outliers are not identified in relation to outcomes, they are still identified in terms of quality of data reporting and process indicators. Detection and management of outliers are described in the **NCASRI Outlier Policy,** but have not been fully implemented due to the limited time-frame.

7 CASE ASCERTAINMENT FOR SPECIALIST REHABILITATION

As noted in Section 6.5.1 above, the NCASRI programme took a slightly different approach to case ascertainment from most audits.

Enrolment included both forward and backward linkage between the TARN and UKROC datasets, to capture both the patients who were identified during their stay in the MTCs, and those who were identified retrospectively having completed a specialist rehabilitation programme.

In this section we present the findings from forward and backward selection. The various other sections of this report present data for different groups of patients, depending on where they are in the pathway. For ease of reference, Table 7.1 provides a summary of the group definitions.

Table 7.1: Group definitions for NCASRI

Group	Definition
Principal groups	
Enrolled group (n=4021)	The total group of patients identified through forward and backward linkage between the TARN and UKROC datasets for the audit period as described in Section 6.4.
'Eligible' patients (n=1468)	Adults (16+ years) who were admitted to an MTC in England following major injury with ISS ≥9 (identified from the TARN database) who had (or were likely to have had) complex (Category A or B) needs requiring specialist in-patient rehabilitation on discharge from the MTCs.
Recruited group (n=1381)	Those of the above for whom data were collected and reported by the MTC, through any of the methods described in Section 6.2.4.1.
Rehabilitation group (n=1154)	All patients who were admitted to specialist rehabilitation services (Level 1 and Level 2), following treatment in an MTC during the recruitment period, identified from the UKROC database.
Sub-groups	
Recruited rehabilitation group (n=550)	The subset of recruited patients with Category A/B needs who were subsequently admitted to specialist rehabilitation services (Level 1 and Level 2), identified from the UKROC database.
Recruited non-rehabilitation group (n=604)	The subset who were identified as having complex needs on discharge from the MTC, but who were not admitted to a specialist Level 1 or 2 rehabilitation service.
Non-recruited rehabilitation group (n=831)	Patients who were admitted to a Level 1/2 specialist rehabilitation unit but who were not identified in the MTC as having Category A/B needs.

7.1 All MTCs

A total of 4021 patients were admitted to the MTCs during the recruitment period who met at least one of the following linkage criteria:

- All adult patients (16+ years) admitted to MTC with ISS ≥9, identified as having (or possibly having) complex needs for rehabilitation through one or more of the following:
  - Completion of checklist suggesting Category A or B needs **or**
  - Completion of SpRP or PCAT tool by a consultant in RM or experienced therapist **or**
  - Recommendation for Level 1 or 2 rehabilitation on discharge from the MTC.

- All adult patients (16+ years) admitted to Specialist Level 1 and 2 Rehabilitation units between 1.7.2016 and 31.12.2017.

These 4021 patients represent **20%** of the total number admitted to MTCs with ISS ≥9 requiring a standard RP (**n=19,659)** during this period.

Of these:

- **3436 (86%)** had ISS scores ≥9.

- **3665 (91%)** were admitted to one of the 16 participating MTCs.

- **1545 (38%)** were identified as having Category A/B needs (identified by any method –including the PCAT, the CNC or clinical patient categorisation in TARN).

- **1154 (29%)** were admitted to a Specialist (HA Level 1 or 2) rehabilitation service.

Eligible patients were those with **ISS scores ≥9** who were identified as **having (or possibly having) Category A or B** needs:

- There were **1468 eligible patients** across all MTCs.

- Of these, **629** (**43%**) were admitted for specialist rehabilitation in a hyper-acute or Level 1 or 2 service.

7.2 Forward selection in participating MTCs

This method of selection identified **recruited** cases according to the original plan following the forward selection tree:

- Of the **3665** patients admitted to participating MTCs, **3096** had ISS scores ≥9.

- **1381 (45%)** of these were identified as having complex (Category A/B) needs.

- Of these **550 (40%)** were admitted for specialist rehabilitation.

- This left **831 (60%)** patients with Category A/B needs who were not admitted to specialist rehabilitation (i.e. the **non-rehabilitation group**) for whom only HES data were available regarding their further hospital treatment and outcomes.

Case ascertainment from forward selection was therefore as follows:

- Of **1468 eligible** patients, **1381 (94%)** were **recruited** for the NCASRI audit.

- **43% of the eligible** sample and **40% of the recruited** sample were admitted to specialist rehabilitation.

Case ascertainment within the MTCs was therefore 94% and the similar admission rates for specialist rehabilitation (40 and 43%) provide evidence that the recruited sample is reasonably representative of the total MTC population of interest, even though only 16/22 MTCs participated in this audit round.

7.3 Backward selection – from within the rehabilitation services

However, as noted above, a proportion of patients may not have been identified as having complex rehabilitation needs during the acute phase of their management, but were subsequently found to require specialist rehabilitation at a later stage in the pathway and were subsequently admitted.

A total of **1154 patients** were admitted to specialist rehabilitation following admission to an MTC

Of these:

- **641 (56%)** had Category A/B needs identified in the MTC.

- **99 (9%)** were identified as having Category C/D needs in the MTC.

- **414 (36%)** had no identified need for rehab (which may have meant that they still required acute care on discharge from the MTC or that they simply were not assessed).

- **886/1154 (77%)** had come from participating centres which represent 73% of the adult MTCs.

- **1128 (98%)** had ISS scores ≥9.

Of 1154 patients admitted for specialist rehabilitation, just over half (56%) were identified as having category A/B need in the MTCs.

By extrapolation, if only **56%** of people who required specialist rehabilitation were identified as having Category A/B needs in the MTCs, this suggests that the true eligible population would be **44%** greater (i.e.=**2621**).

This figure represents about **13%** of the total patients with ISS scores ≥9 requiring a standard RP (as opposed to the **7%** identified through forward selection alone).

7.3.1 In summary

Case ascertainment is summarised in Table 7.2 and Figure 7.1.

- Prospective identification in the MTCs revealed a total **1545** patients as having or possibly having complex (A/B) needs for rehabilitation (1468 of them with ISS ≥9), of which **641** were subsequently admitted for specialist rehabilitation (629 with ISS ≥9).

- However a further **513** were subsequently admitted for rehabilitation even though they had not been identified as having complex needs, giving a total of **1154** who received specialist rehabilitation.

- By contrast, just **1381** patients were recruited in the MTCs with ISS ≥9 and Category A/B needs, of which **550** received rehabilitation.

These findings emphasise the need for a more systematic approach to the assessment of needs for rehabilitation within the MTCs.

Further analysis will explore whether there is any difference between the patients who:

• Received rehabilitation (n=1154), but who were and were not recruited (550 vs. 604).

• Were recruited (n=1381), but who did and did not receive rehabilitation (550 vs. 831).

Table 7.2: Summary of case ascertainment based on forward and backward selection

Participating	Case Ascertainment on criteria			
	ISS≥9	AB Needs confirmed	UKROC Level 1 or 2 service	Number Meeting all 4 criteria
Overall numbers				
All: 4021	3436/4021 (86%)	1545/4021 (38%)	1154/4021 (29%)	
Forward selection				
Eligible patients				
All centres: 4021	3436/4021 (86%)	1468/3436 (38%)	629/1648 (43%)	**629/4021 (16%)**
Recruited patients				
Participating centres: 3665/4021 (91%)	3096/3665 (84%)	1458/3665 (40%)	886/3665 (24%)	**550/3665 (15%)**
Following the selection tree	3096	1381/3096 (45%)	550/1381 (40%)	
Backward selection				
All 4021	1128/1154 (98%)	641/1154 (56%)	**1154/4021 (29%)**	

Figure 7.1: Summary of case ascertainment

Flowchart:

TARN dataset — Patients with ISS ≥9, **N=3436**, Ready for transfer From MTC

Branches to:
- Does not require further Inpatient rehabilitation
- Requires further Inpatient rehabilitation

"Requires further Inpatient rehabilitation" branches to:
- **Category C+D or unspecified** Rehabilitation Needs
- **Category A+B** Rehabilitation Needs **N=1468** (N=1381 recruited in participating MTCs)

Standard RP

N=525 — N=831 — N=629 (N=550 recruited in participating MTCs)

Non- Rehabilitation Group

Rehabilitation Group

- Level 3 rehabilitation or Other services
- Level 1 and 2 Specialist Rehabilitation **N=1154**
  - **N=604** Non-recruited
  - **N=550** Recruited from participating MTCs

8 REQUIREMENTS FOR REHABILITATION IDENTIFIED IN THE MTCs

This section presents the data collection from the participating MTCs in order to:

a. Understand the different types of need that patients have for specialist rehabilitation following major trauma.

b. Examine the extent to which the relevant standards for process were met within the MTCs.

8.1 Enrolment and data completion rates

As noted in our **Second Year Report**, consensus from the MTC workshop in June 2017 led to some relaxation of the criteria for identifying the category of need. This was due to the lack of RM consultant input in many of the centres, which led to concern that patients with Category A/B needs would go unidentified.

Instead of requiring the full 5-tool SpRP dataset collected by a consultant in RM, patients could be enrolled using a **minimum SpRP dataset** comprising only:

• The **Complex Needs Checklist (CNC)**

• The **Rehabilitation Complexity Scale (RCS-ET)**

• The **clinical category of rehabilitation needs.**

SpRP tools were completed by RM consultants in just four of the centres. In the remainder, they were completed by other members of the multidisciplinary team (see Table 8.1).

In addition, as noted in Section 6.4.3, the final linked dataset comprised episodes that were enrolled either through forward and backward linkage to include patients whose needs were not captured in the MTC, but who subsequently required specialist rehabilitation and were admitted to a Level 1 or 2 rehabilitation unit.

In this section we report the completion rates for each of the tools within the MTCs. Because of the above relaxation of recruitment criteria, we expected to find lower rates of tool completion in the final **recruited** dataset than were reported in our preliminary analysis of MTC data (**see Appendix 2 of the Second Year Report**).

In order to qualify for the enhanced best practice tariff, MTCs must complete a standard Rehabilitation Prescription (RP) for all patients with ISS ≥9. The majority of these patients will not require ongoing in-patient rehabilitation when they leave the MTC, and so are not expected to be enrolled or recruited in NCASRI. The data are given, however, as they relate to Standard 1.1 (*"Patients with ISS scores ≥9 should have an RP"*). In addition they provide a point of reference against which to compare enrolment and recruitment rates.

Table 8.1 shows the mode of data collection and who collects the data in the 16 participating centres, which represent 73% of the MTCs. Nine MTCs submitted data through TARN; two through IRMA (ORION); and five on paper.

Although 9/16 MTCs started recruitment for the prospective audit in July 2016 as planned, three did not start until September. Extension of the recruitment period to the end of August enabled a full 12 months of data to be captured in these 12 centres. However the remaining MTCs collected data for less than a year in this first round of NCASRI. The average data collection period was 11 months.

Table 8.1: Major Trauma Centres participating, start date and who collected the data for the NCASRI Round 1 prospective audit.

	Major Trauma Network (MTN)	Major Trauma Centre (MTC)	MTC Short name	RM consultant sessions (Number of PAs)	Data collection	
					Start Date	Data collected by
1	Northern (Newcastle, North East & Cumbria)	Royal Victoria Infirmary, Newcastle	Newcastle	Yes (6)	July 16	RM Consultant
2	Northern (Middlesbrough and South)	James Cook University Hospital, Middlesbrough	Middlesbrough[1]	Yes (5)	July 16	RC
3	North Yorkshire and Humberside	Hull Royal Infirmary	Hull[1]	Yes (2)	July 16	RC
4	Greater Manchester	Manchester Collaborative MTC	Manchester	Yes (12)	July 16	MDT
5	Cheshire and Merseyside	Liverpool Collaborative MTC	Liverpool[1]	Yes (1)	Feb 17	RC and Therapists
6	South Yorkshire	Northern General Hospital Sheffield and Royal Hallamshire	Sheffield	Yes (10)	Oct 16	RC
7	Birmingham, Black Country, Hereford and Worcester	Queen Elizabeth Hospital Birmingham	Birmingham	Yes (10)	Sept 16	RM Consultant and Therapists
8	Central England	University Hospital Coventry	Coventry[1]	Yes (4)	Sept 16	RC
9	East Midlands	Queen's Medical Centre, Nottingham	Nottingham	Yes (5)	July 16	RC and RM Consultant
10	East of England	Addenbrookes, Cambridge	Cambridge	Yes (10)	July 16	RM Consultant
11	Severn	Southmead Hospital, Bristol	Bristol	Yes (10)	July 16	RC and RM Consultant
12	North West London	St Mary's Hospital, London	NW London[1]	Yes (1)	July 16	RM Consultant and Therapists
13	South West London and Surrey	St George's Hospital, London	SW London[1]	None (0)	Nov 16	Therapists
14	Wessex	Southampton General Hospital	Southampton[1]	Yes (1)	Dec 16	RM Consultant
15	Peninsula	Plymouth Derriford	Plymouth	Yes (6)	July 16	RM Consultant
16	North West Midlands and North Wales	University Hospital of North Staffordshire, Stoke-on-Trent	Stoke-on-Trent	Yes (11)	Sept 16	Multidisciplinary team
17	West Yorkshire	Leeds General Infirmary	Leeds	Yes (5)		N/A
18	Lancashire and South Cumbria	Royal Preston Hospital	Preston	Yes (5)		N/A
19	Thames Valley	John Radcliffe Hospital, Oxford	Oxford	Vacant (10)		N/A
20	North East London and Essex	Royal London Hospital	NE London	None (0)		N/A
21	South East London, Kent & Medway	King's College Hospital, London	SE London	None (0)		N/A
22	Sussex	Royal Sussex County Hospital, Brighton	Brighton	Vacant (?)		N/A

1 MTCs that did not meet the standard for input from consultants in Rehabilitation Medicine
  RM consultant = Consultant in Rehabilitation Medicine; RC= Rehabilitation Co-ordinator; MDT = Multi-disciplinary team;
  PA= 'programmed activity' or 4 hours of consultant time

8.1.1   SpRP completion rates

Table 8.2 shows the number of patients enrolled within each MTC, and the completion rates for the various tools. Data for a total of 3665 patients were collated across the 16/22 centres, 3096 of whom had ISS scores ≥9.

Overall there was some classification of rehabilitation needs in 2925/3665 (88%) patients, including 408 patients who were recorded to have no rehabilitation needs or who required continued acute care.

- **1653 (53%)** had a **CNC** recorded (either directly or derived from a PCAT score).

- **2045 (66%)** had an **RCS-E score** (either RCS-T or RCS-E v 12).

The more detailed SpRP tools were only expected for patients who were considered to have complex (Category A or B) needs, on basic screening.

As noted in our **Second Year Report**, the MTC in Bristol enrolled a much larger number of patients than any of the other MTCs recording just the CNC and RCS-ET at a slightly anomalous time point (within 72 hours of admission, rather than at the 'Transfer ready' point). The category of needs was identified with clinical reference to the PCAT at discharge, although they did not actually record the PCAT. Through this simpler but systematic approach, this MTC identified many more patients with Category A/B needs than the other MTCs, which may skew the data. In Table 8.2 we have therefore given the % of SpRP tool data collection both including and excluding the Bristol patients.

- Across the 16 units, **1,458/3,665 (40%)** of patients had **Category A/B needs.**
- Completion rates for the SpRP tools in this group were:
- PCAT **n=865 (59%),** NPDS **n=742 (51%)** and NIS **n=606 (42%).**
- (Excluding Bristol completion rates were: **PCAT (69%), NPDS (59%)** and **NIS (48%)).**

Table 8.2: SpRP Tool completion rates for the 16 participating MTCs

	Major Trauma Centre (MTC)	No. of enrolled episodes[1]			Category of need**				SpRP tools collected[4]				
		Total	ISS≥9		A/B	% A/B	C/D	Other/ Missing[2]	CNC[3]	RCS-ET[4]	PCAT	NPDS	NIS
1	Newcastle	276	237	86%	136	49%	90	50	0 (52)	243	52	51	49
2	Middlesbrough	51	50	98%	41	80%	6	4	36	36	36	34	37
3	Hull	85	82	96%	36	42%	10	39	12	28	0	0	0
4a	Manchester Salford	205	174	85%	155	76%	28	22	1 (109)	(113)	109	118	60
4b	Manchester RI	29	27	93%	8	28%	3	18	2 (4)	(6)	4	5	3
4c	Manchester South	9	9	100%	1	11%	0	8	0	0	0	0	0
5a	Liverpool Walton	82	81	99%	48	58%	6	28	41	42	0	0	0
5b	Liverpool Aintree	480	228	48%	16	3%	15	449	54	351	1	0	8
6	Sheffield	114	111	97%	72	63%	23	19	4 (40)	3	40	13	24
7	Birmingham	189	183	97%	133	70%	1	55	0 (132)	146	132	120	63
8	Coventry	90	87	97%	76	84%	0	14	69	46	68	45	40
9	Nottingham	140	137	98%	69	49%	24	47	63	63	63	63	63
10	Cambridge	158	149	94%	141	89%	5	12	1 (137)	138	137	119	101
11	Bristol[3]	1245	1061	85%	203	16%	823	219	786	1195	1	0	0
12	NW London	129	121	94%	106	82%	3	20	79	77	73	74	64
13	SW London	77	67	87%	46	60%	3	28	36	36	29	27	22
14	Southampton	113	109	96%	53	47%	1	59	50	50	30	25	25
15	Plymouth	108	101	94%	72	67%	14	22	10 (57)	75	57	14	15
16	Stoke-on-Trent[4]	85	82	96%	46	54%	4	35	33	33	33	34	32
	TOTAL	**3665**	**3096**	**84%**	**1458**	**40%**	**1059**	**1148**	**1277 (1653)**	**2681[4]**	**865**	**742**	**606**
	% All Episodes	3665	84%	84%		40%	29%	31%					
	% Episodes ISS>=9	3096				47%	34%	34%	1140 (37%)	2209 (72%)	812 (26%)	561 (18%)	686 (22%)
	% Episodes cat A/B	**1458**							**620 (42%)**	**1078 (74%)**	**844 (58%)**	**700 (48)%**	**568 (39%)**
	% TOTAL Excluding Bristol	**2420**			**1255**	**52%**			**34%**	**61%**	**69%**	**59%**	**48%**

1 Enrolled episodes include those identified either through forward or backward linkage between TARN and UKROC data.

2 Patients with Category A/B needs are expressed as % of the total enrolled episodes. 'Other' categories include "No rehabilitation needs" or "Acute care needs".

3 Where a PCAT is completed de novo, the CNC is not necessary, but can be compiled retrospectively from the PCAT for the purpose of comparison (Total no. given in brackets).

4 Numbers in brackets indicate that no RCS-ET was available but an RCS-E v12 was recorded. As the RCS-Ev12 can be derived from RCS-ET, the total includes the total no. of RCS-E v12 available.

8.1.2 Identifying category of needs

CAPTURING COMPLEX NEEDS

The dataset allows for the category of needs for rehabilitation to be recorded in a number of different ways, including clinical categorisation and use of the CNC or PCAT. To maximise capture of patients with complex needs, individuals were recruited from NCASRI if they were identified as having Category A/B needs on any of the three criteria.

Table 8.3 summarises enrolment and recruitment across the 16 participating MTCs.

A total of **19,659** patients were admitted with ISS ≥9 and who required an RP. The overall completion rate was **90%,** which is very similar to that recorded in our **First Year Report (**89%).

Only a proportion of these, however, might require continued in-patient rehabilitation on discharge from the MTC and so be enrolled in NCASRI. A total of **3096** patients were **enrolled with ISS ≥9.**

- Overall these comprised **16%** of the total episodes with ISS ≥9, although this proportion varied from 6% to 29% across the MTCs (Table 8.3).
    - As expected, MTCs that did not meet the standard for RM consultant input tended to have lower enrolment rates (all ≤10%).
    - Once again, Bristol was an outlier, enrolling 84% of the total episodes.

- **96%** of the enrolled episodes were reported as having a standard RP – range 84-100% across the MTCS with one low outlier (48%).

Of 1381 recruited patients, Category A/B needs were confirmed by the PCAT and/or CNC in 77%, leaving 23% identified by clinical impression only.

A total of **n=1381/3096 (45%)** were identified as having Category A or B needs by at least one of the criteria and were thus **recruited** for the NCASRI audit.

- Of these **806 (58%)** were confirmed by the PCAT tool and a further **19% by the CNC** (**77% in total**) leaving **23%** identified by clinical impression only. Again this proportion varied widely across the MTCs.

Overall, the recruited patients made up 7% of the total patients with ISS ≥9, the proportion ranging from 2-15% across the participating MTCs (see Table 8.3).

The total number actually admitted to specialist rehabilitation from participating centres was 886 (5% of the total patients with ISS ≥9) with the proportion ranging from 1-7% across the MTCs (see Table 8.3).

Table 8.3: Summary of the completion rates for the Standard RP and identification of Category A/B needs in the recruited patients

	Major Trauma Centre (MTC)	Total episodes with ISS ≥9 requiring a Standard RP[2]		Enrolled episodes with ISS ≥9 (see Table 7.2)		Recruited patients Identification of Category A/B needs on SpRP dataset[3]					No. actually admitted to specialist rehabilitation (% of total)
		Total Episodes requiring RP	% with RP recorded on TARN	Enrolled Episodes (% of total)	% RP recorded on TARN	PCAT A/B	CNC A/B	TARN A/B only	Recruited Patients (% of total)	% A/B needs confirmed by PCAT or CNC	
1	Newcastle	907	85%	237 **(26%)**	95%	50	0	70	120 **(13%)**	42%	25 **(3%)**
2	Middlesbrough[1]	741	99%	50 **(7%)**	94%	36	0	5	41 **(6%)**	88%	36 **(5%)**
3	Hull[1]	874	100%	82 **(9%)**	85%	0	9	27	36 **(4%)**	25%	17 **(2%)**
4a	Manchester Salford	2127	96%	174 **(8%)**	97%	82	0	60	142 **(7%)**	58%	156 **(7%)**
4b	Manchester RI	–	–	27 **–**	48%	3	4	4	8 **–**	88%	18 **–**
4c	Manchester South	–	–	9 **–**	98%	0	0	1	1 **–**	0%	6 **–**
5a	Liverpool Walton[1]	346	99%	81 **(23%)**	98%	0	41	7	48 **(14%)**	85%	9 **(3%)**
5b	Liverpool Aintree	783	96%	228 **(29%)**	84%	0	6	8	14 **(2%)**	43%	43 **(5%)**
6	Sheffield	1093	97%	111 **(10%)**	89%	42	1	28	71 **(6%)**	61%	61 **(6%)**
7	Birmingham	1355	95%	183 **(14%)**	95%	129	0	1	130 **(10%)**	99%	51 **(4%)**
8	Coventry[1]	1482	94%	87 **(6%)**	91%	68	1	7	76 **(5%)**	91%	48 **(3%)**
9	Nottingham	1766	90%	137 **(8%)**	89%	63	0	6	69 **(4%)**	91%	91 **(5%)**
10	Cambridge	1227	100%	149 **(12%)**	95%	128	0	4	132 **(11%)**	97%	42 **(3%)**
11	Bristol	1266	98%	1061 **(84%)**	99%	1	175	17	193 **(15%)**	91%	46 **(4%)**
12	NW London[1]	1212	100%	121 **(10%)**	90%	68	6	26	100 **(8%)**	74%	70 **(6%)**
13	SW London[1]	892	100%	67 **(8%)**	84%	25	1	13	39 **(4%)**	67%	42 **(5%)**
14	Southampton[1]	1151	88%	109 **(9%)**	90%	28	22	0	50 **(4%)**	100%	50 **(4%)**
15	Plymouth	1079	93%	101 **(9%)**	88%	51	0	16	67 **(6%)**	76%	55 **(5%)**
16	Stoke-on-Trent	1358	81%	82 **(6%)**	100%	32	0	11	44 **(3%)**	73%	20 **(1%)**
	TOTAL	**19,659**	**90%**	**3,096 (16%)**	**96%**	**806**	**266**	**311**	**1381 (7%)**	**78%**	**886 (5%)**
						58%	**19%**	**23%**			

1 MTCs that did not meet the standard for input from consultants in Rehabilitation

2 The large majority of patients requiring a standard RP are expected to require out-patient therapy only and are not expected to be enrolled in NCASRI

3 Recruited patients are those with ISS>=9 identified as having (or possibly having) Category A or B needs on any criterion (including the TARN criterion)

The highest-level criterion for identification is the PCAT, then the CNC. Patients identified on TARN criteria only are less certain to have Category A/B needs

8.2 Summary of performance against standards for process within the MTCs

The relevant standards are set out below. Standards 1.1 – 1.3 were addressed in Element 1 and reported in our **First Year Report.** As implementation of the Standard RP has continued to develop over the intervening period, Standard 1.1 is re-examined in this final report

1. Process within the MTC		Reported	Source
1.1	*All patients with ISS scores ≥9 should have a Rehabilitation Prescription (RP).*	1st year + Final	**Elements 1 and 2 TARN**
1.2	*Rehabilitation planning (including the commencement of the RP) should start within 48 hours of admission.*	1st year	**Element 1 Survey**
1.3	*A consultant in RM should be involved from an early stage in the patient's trauma pathway (within 3 calendar days) to assess patients with complex rehabilitation needs, to participate in their rehabilitation planning, and to expedite onward referral. This will normally involve a consultant in RM attending the MTC or TU at least 2–3 times per week.*	1st year	
1.4	*Patients thought likely to have complex rehabilitation needs requiring specialist in-patient rehabilitation should have the following completed by the MTC team:* • *Rehabilitation Complexity Score (RCS-ET).* • *Checklist of complex needs.*	Final	**Element 2 TARN**
1.5	*If the checklist suggests the patient is likely to have Category A or B needs, they should be reviewed by a consultant in RM or their designated deputy.*	Final	**Element 2 TARN**
1.6	*The consultant in RM (or designated deputy) should complete:* • *The PCAT tool – to confirm Category A or B needs* *If Category A or B needs are confirmed, a Specialist Rehabilitation Prescription (SpRP) should be completed before discharge from the MTC including:* • *The Northwick Park nursing Dependency Scale (NPDS);* • *The Neurological Impairment Set – Trauma (NIS-Trauma);* • *Details of referral to one or more named Level 1/2 service;* • *Discharge destination.*	Final	**Element 2 TARN/ UKROC**

8.2.1 Standard 1.1: Patients with ISS scores ≥9 should have a RP

In 2014/15 recording of the RP was already well established, with all but two of the participating MTCs achieving recording rates of over 80% in patients with ISS ≥9.

In this 2016/17 cohort, the overall rate of recording a standard RP was similar at 90%, with all centres achieving over 80%. The rates were slightly higher for patients enrolled in NCASRI (96%).

Recording rates across the individual MTCs ranged from **81-100 %** (see Table 8.3).

8.2.2 Standard 1.4: Patients thought likely to have complex needs should have a CNC and an RCS-ET.

As presented in Table 8.3:

- The proportion of patients identified as likely to have complex (Category A or B) needs for rehabilitation who had a CNC recorded (or a PCAT to derive a CNC) was **77%** (58% +19%).

- 23% had a clinical evaluation only.

- The proportion who had an RCSE was **74%** (Table 8.2).

8.2.3 Standard 1.5: If the CNC suggests complex needs, patients should be reviewed by a consultant in RM or their designated deputy

As noted in our **first and second year reports**, many MTCs had little or no input from consultants in RM, which has impacted on the ability of MTCs to participate in the NCASRI audit.

- Table 8.1 demonstrates that, at the outset of this audit, four of the six non-participating MTCs had no consultant input during the recruitment period, either because of lack of allocated sessions (n=2) or inability to fill vacant posts (n=2).

- For the 16 participating centres, one had no input at all and four had minimal input (≤2 consultant sessions per week).

- A further survey in Year 3 revealed no significant change in RM consultant input.

8.2.4 Standard 1.6: The RM consultant or their designated deputy should complete the PCAT tool and, if Category A or B needs are confirmed, they should complete the remainder of the SpRP tools

Even when RM consultants were well-represented in the MTC, it was mainly the rehabilitation coordinators or the MTC therapy teams who completed the SpRP tools. Therefore, from May 2017, the requirement for completion of the SpRP by a consultant in RM or their designated deputy was dropped for this and any future rounds of the NCASRI audit.

In addition, following agreement of a core minimum dataset SpRP, **Standard 1.6** has been replaced by a requirement to collect this minimum dataset only. In this round of audit, just **462/1381 (33%)** of the recruited patients had a complete SpRP minimum dataset. We have not presented a breakdown by MTC, however, as this was not a requirement at the outset of the audit.

In summary

The compliance with data collection was only moderate in this first round of NCASRI – which is not surprising given the low starting base of this audit as described in Section 5.1.

Nevertheless, this first round collected a detailed dataset comprising all five SRP tools for a substantial number of patients, which is not likely to be repeated. This dataset provides a uniquely rich resource that will help us to understand the complex rehabilitation needs of this severely injured group of patients.

In **Appendix 4** we present a more detailed analysis of the content of the tools collected within the MTCs and their added value to the standard RP, but a brief overview is presented in the next section including:

- A description of the different types of needs for rehabilitation.
- A quantitative analysis of the severity of impairment and dependency, and complexity of the rehabilitation needs.

8.3 Understanding the rehabilitation needs of MTC patients

8.3.1 Descriptive analysis of data from the Complex Needs Checklist (CNC)

Prior to NCASRI, the TARN minimum data set for the RP included just four questions:

- Does the patient have rehabilitation needs requiring an RP?
- Do they have a) Physical, b) Cognitive/Mood or c) Psychosocial problems?

The CNC provides further breakdown under these three headings, offering enhanced insight into the types of rehabilitation needs that patients have as they leave the MTCs. Data were available for this part of the CNC in 1018 patients, and the findings are summarised in Table 8.4.

Table 8.4: The breakdown of different types and subtypes of needs within the Complex Needs Checklist (CNC).

	Total patients with CNC data: 1018	Category C/D needs		Category A/B needs	
		n	%	n	%
Type	**Complex physical needs**	**269**	**62%**	**503**	**87%**
Sub-types	Complex musculoskeletal management	198	**46%**	210	**36%**
	Complex neuro-rehabilitation	63	**14%**	376	**65%**
	Complex amputee rehabilitation needs	4	**1%**	20	**3%**
	Profound disability/neuropalliative rehabilitation	30	**7%**	76	**13%**
	Complex pain rehabilitation	22	**5%**	69	**12%**
	Re-conditioning/cardiopulmonary rehab	0	**0%**	19	**3%**
Type	**Complex cognitive/emotional needs**	**99**	**23%**	**408**	**70%**
Sub-types	Complex communication support	7	**2%**	147	**25%**
	Cognitive assessment/management	43	**10%**	328	**57%**
	Complex mood evaluation/support	59	**14%**	179	**31%**
	Challenging behaviour management	18	**4%**	115	**20%**
	Evaluation of low awareness state	0	**0%**	66	**11%**
Type	**Complex psychosocial needs**	**89**	**20%**	**298**	**51%**
Sub-types	Complex discharge planning	74	**17%**	226	**39%**
	Major family distress/support	29	**7%**	122	**21%**
	Emotional load on staff	2	**0%**	49	**8%**

Many patients had multiple areas of need. Amongst the patients with Category A/B needs:

- **87%** had **complex physical needs** of which the most common was the requirement for complex neurological (65%) or musculoskeletal (36%) rehabilitation.

- **70%** had **complex cognitive or emotional needs**, including cognitive assessment (57%) and mood evaluation (31%). A quarter of patients required complex communication support and a fifth had challenging behaviours.

- **51%** had **complex psychosocial needs,** including complex discharge planning (39%) or major family support (21%).

Figure 8.1 shows the percentage of each of the six principal CNC items ticked in patients within each category of need from the TARN data. As expected the proportions are highest in patients with Category A and B needs.

Figure 8.1: The percentage of each principal CNC item ticked within each category of need
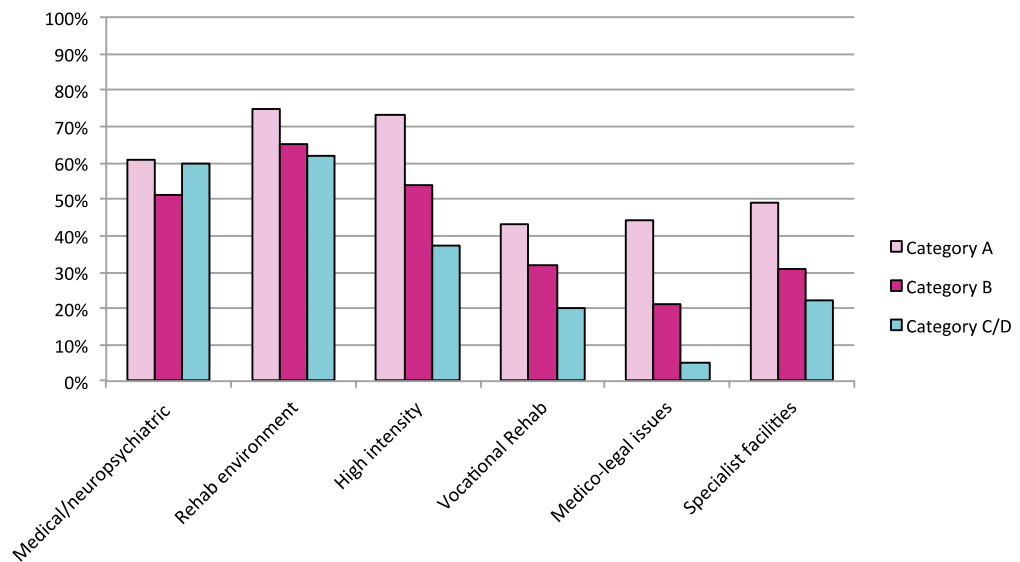
Patients with Category C or D may also have complex needs in some areas.

It is important, however, to note that a significant number of patients with Category C or D needs also have requirements under one or more principal items of the checklist (especially needs for medical/psychiatric input or a dedicated rehabilitation environment), emphasising the requirement for provision of suitable Level 3 services in addition to specialist rehabilitation units.

Table 8.5 gives a breakdown of the frequency of the six principal items in the CNC checked to indicate a requirement for further inpatient rehabilitation. The most common requirements were for:

- Ongoing specialist medical/psychiatric intervention (62%).

- Coordinated inter-disciplinary input (74%).

- Longer stay in rehabilitation – 3 months or more (47%).

Table 8.5: A breakdown of the frequency of the six principal items in the CNC checked (n=1018)

Item	Description	n	% within item	% of whole
1	**Specialist rehab medical (RM) or neuropsychiatric needs**	751	100%	74%
Details	Ongoing specialist investigation/intervention	634	84%	62%
	Complex or unstable medical/surgical condition	312	42%	31%
	Complex psychiatric needs	54	7%	5%
	Risk management or treatment under section of the Mental Health Act (MHA)	32	4%	3%
2	**Specialist rehabilitation environment**	854	100%	84%
Details	Co-ordinated inter-disciplinary input	757	89%	74%
	Structured 24 hour rehabilitation environment	338	40%	33%
	Highly specialist therapy/rehab nursing skills	353	41%	35%
3	**High intensity**	700	100%	69%
Details	1:1 supervision	197	28%	19%
	4 or more therapy disciplines required	315	45%	31%
	High intensive programme (>20 hours per week)	238	34%	23%
	Length of rehabilitation likely to be 3 months or more	478	68%	47%
4	**Specialist Vocational Rehabilitation**	422	100%	41%
Details	Specialist vocational assessment	205	49%	20%
	Multi-agency vocational support (for return to work etc.)	251	59%	25%
	Complex support for other roles (e.g. single parenting)	59	14%	6%
5	**Medico-legal issues**	333	100%	33%
Details	Complex mental capacity/consent issues	141	42%	14%
	Complex Best Interests decisions	128	38%	13%
	Deprivation of Liberty (DoLs)/Protection of Vulnerable Adults (PoVA) applications	141	42%	14%
	Litigation issues	68	20%	7%
6	**Specialist facilities and equipment**	431	100%	42%
Details	Customised/bespoke personal equipment needs	217	50%	21%
	Specialist rehabilitation facilities	261	61%	26%

As described in our **Second Year Report**, the total CNC proved to be a useful indicator of the category of need as confirmed by the PCAT. Figure 8.2 shows a box and whiskers plot depicting the median, interquartile range and full range of the total CNC score across the three categories of need. It demonstrates reasonable separation of cases with Category A, B and C/D needs.

When the total CNC score was plotted against the category of need in a Receiver Operating Characteristic (ROC) curve, the area under the curve was 0.73. A cut-point of 3/4 identified patients with Category A/B needs with 68% sensitivity and 70% specificity.

When the individual CNC items were entered stepwise into a multiple regression model, the strongest predictors of Category A needs were requirements for medicolegal input (e.g. Mental Capacity assessment, Deprivation of Liberty assessment), a high-intensity programme, the requirement for coordinated inter-disciplinary intervention, and special equipment and facilities. Together these accounted for 53% of the variance.

Conversely, the TARN clinical categorisation of rehabilitation needs identified just 38% of patients who were subsequently confirmed as having Category A/B needs, and identified 31% of them as having Category C/D (25%) or no (6%) rehabilitation needs. In other words it was incorrect as often as it was correct.

At the current time, therefore, the TARN clinical categorisation performs no better than chance as an identifier of complex rehabilitation needs and cannot be relied upon for this purpose.

Figure 8.2: Box and whiskers plot of the total CNC score across the three categories of need
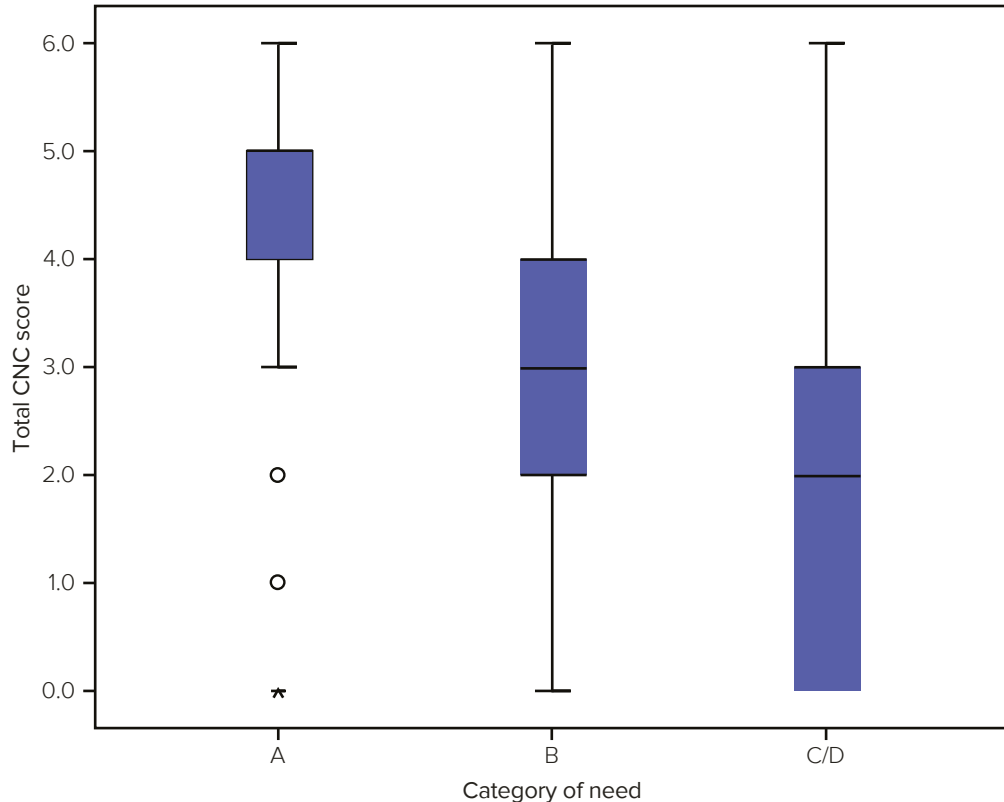
8.3.2 Quantitative analysis of SpRP data

Table 8.6 shows the summary statistics for the SpRP tools across the different categories of need. Median and interquartile range (IQR) are presented alongside the bootstrapped mean and 95% confidence interval.

Table 8.6: Summary statistics for the SpRP tools across the different categories of need

SpRP Tool – Total scores	Category A		Category B		Category C/D	
	Median (IQR)	Mean 95% CI[1]	Median (IQR)	Mean 95% CI	Median (IQR)	Mean 95% CI
Complex Needs Checklist (CNC)	n=356		n=264		n=604	
Median (IQR) Range	**5** (4-5) 0-6	**4.3** 4.1, 4.3	**3** (2-4) 0-6	**3.3** 3.2, 3.5	**2** (0-3) 0-6	**1.8** 1.7, 1.9
Patient categorisation tool (PCAT)	n=462		n=382		n=20	
Median (IQR) Range	**36** (32-39) 19-48	**35.6** 35.0, 36.1	**28** (31-35) 17-40	**27.9** 27.4, 28.3	**22** (20-23) 19-36	**22.9** 21.1, 25.2
Rehabilitation Complexity Scale (RCS-Ev12)[1]	n=581		n=567		n=923	
Median (IQR) Range	**15** (13-17) 3-20	**14.4** 14.2, 14.7	**12** (10-14) 0-20	**11.6** 11.4, 11.9	**9** (5-11) 0-18	**8.4** 8.2, 8.7
Neurological Impairment Set (NIS)	n=300		n=268		n=16	
Median (IQR) Range	**21** (13-24) 2-44	**22.4** 21.1, 23.7	**11** (6-17) 0-41	**12.6** 11.5, 13.6	**5** (2-8) 1-29	**6.4** 3.8, 10.3
Northwick Park Dependency Score (NPDS)	n=404		n=296		n=19	
Median (IQR) Range	**44** (28-55) 0-77	**40.8** 39.0, 42.6	**26** (13-38) 0-70	**26.3** 24.4, 28.0	**18** (3-35) 0-70	**19.9** 11.6, 29.1
Care costs per week (Estimated by the NPCNA)	n=405		n=303		n=19	
Median (IQR) Range	**£1992** (1326-2676) £0-3613	**£1,965** £1894, 2038	**1100** (564-1900) £0-3613	**£1,305** £1201, 1404	**1576** (168-1840) £0-3613	**£1,182** £804, 1580

1 Mean and 95% confidence interval calculated using n=1000 bootstrapped samples.

2 RCS-v12 data are presented instead of RCS-ET to increase representation of the centres that collect only version 12.

As expected, the patients with Category A needs were more severely impaired, with higher dependency and care costs than those with Category B needs. Patients with Category C/D needs had lower scores on all parameters. However, this should be interpreted with caution due to the small numbers other than for the RCS-E and CNC. Although there was considerable overlap of the score ranges, the non-overlapping confidence intervals indicate significant differences between all groups.

The median and IQRs provide a useful indication of the range of scores, reflecting the diversity of the patients. However, it can be seen that the bootstrapped means are very close to the medians, so parametric statistics were used for comparative statistical analyses.

Table 8.7 shows the summary statistics for the SpRP tools in the dataset collected for the recruited patients (i.e. with Category A and B needs).

Table 8.7 Summary statistics for the SpRP tools – Category A/B needs only (Recruited group)

Tool Min-Max	Recruited patients	CNC 0-6	RCS-Ev12 0-20	PCAT 15-50	NIS 0-50	NPDS 0-100	Weekly Care Cost
MTC	n	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
1 Newcastle	120	-	12 (11-15)	31 (28-34)	6 (3-16)	20 (8-41)	£676 (£234-1956)
2 Middlesbrough	41	4 (3-5)	15 (13-18)	35 (30-40)	12 (9-20)	30 (19-46)	£1169 (£1079-1956)
3 Hull	36	4 (2-5)	16 (14-18)	–	–	–	–
4a Manchester Salford	142	–	12 (10-14)	31 (27-37)	10 (4-16)	30 (12-51)	£1876 (£1612- 2764)
4b Manchester RI	8	4 4	13 (11-15)	35 (25-)	14 14	19 (12-)	£1686 (£1612 -)
4c Manchester South	1	–	-	–	–	–	–
5a Liverpool Walton	48	5 (4-5)	16 (15-18)	–	–	–	–
5b Liverpool Aintree	14	3 (2-4)	13 (10-14)	–	10 10	–	–
6 Sheffield	71	2 2	14 (12-14)	26 (24-28)	10 (7-16)	28 (11-43)	£1280 (£421-2021)
7 Birmingham	130	–	12 (10-14)	30 (25-34)	12 (6-19)	39 (27-48)	£1905 (£1100- 2049)
8 Coventry	76	4 (3-6)	14 (13-15)	36 (30-40)	27 (15-38)	49 (37-56)	£2676 (£1620-2768)
9 Nottingham	69	5 (5-6)	18 (16-20)	37 (34-42)	19 (13-27)	32 (21-51)	£1899 (£1100-2301)
10 Cambridge	132	–	10 (9-13)	32 (29-37)	18 (10-30)	35 (22-54)	£1364 (£1100-2676)

Table 8.7 Continued

	Tool Min-Max	Recruited patients	CNC 0-6	RCS-Ev12 0-20	PCAT 15-50	NIS 0-50	NPDS 0-100	Weekly Care Cost
	MTC	**n**	**Median** (IQR)	**Median** (IQR)	**Median** (IQR)	**Median** (IQR)	**Median** (IQR)	**Median** (IQR)
11	**Bristol**	**193**	**4** (3,5)	**13** (10-16)	**23** 23	–	–	–
12	**NW London**	**100**	**4** (3-5)	**13** (11-16)	**32** (28-35)	**17** (14-23)	**38** (27-43)	**£1456** (£1100-1992)
13	**SW London**	**39**	**4** (3-5)	**14** (11-15)	**29** (24-35)	**8** (6-19)	**32** (12-41)	**£1364** (£392-2140
14	**Southampton**	**50**	**4** (3-5)	**14** (13-16)	**29** (28-35)	**12** (8-26)	**42** (26-55)	**£1968** (£782-2751)
15	**Plymouth**	**67**	**5** (1-5)	**14** (11-16)	**31** (26-35)	**11** (8-26)	**20** (12-54)	**£1100** (£1100- 2582)
16	**Stoke-on-Trent**	**44**	–	**14** (12-15)	**37** (32-41)	**29** (17-39)	**37** (24-49)	**£1728** (£1105-2658)
	Totals							
	N	**1381**	**590**	**1078**	**801**	**540**	**663**	**669**
	Median **IQR**		**4** (3-5)	**13** (11-16)	**32** (28-36)	**15** (9-26)	**35** (19-49)	**£1737** (£1100-£2301)

Key findings are as follows:

- There is significant diversity between the MTCs in both impairment (NIS scores) and the complexity of needs (PCAT scores).

- The median RCS-E v12 scores were ≥12 in all but one of the MTCs (Cambridge).

- The median CNC total scores were ≥4 in all but two MTCs (Aintree and Sheffield). The lower scores may suggest a slightly lower threshold for identifying Category A/B needs in these two centres.

- The median NPDS scores were ≥25 for all but three MTCs (Newcastle, Manchester Royal Infirmary and Plymouth) confirming a generally high level of physical dependency requiring two carers for most basic care needs amongst the recruited population.

8.4 Comparison of the Rehabilitation and Non-rehabilitation groups

Table 8.8 compares the characteristics of the recruited patients (n=1381) who did (n=550) and did not (n=831) receive specialist rehabilitation.

Table 8.8 Characteristics of the rehabilitation and non-rehabilitation groups of the recruited patients compared using the SpRP tools.

Access to specialist rehabilitation was determined more by chance than by the complexity of need

	Recruited Rehabilitation group N = 550	Recruited Non-rehabilitation group N = 831	Difference	
	Mean 95% CI	Mean 95% CI	Mean difference	Significance (p value)
Age (n=1381)	50.1 48.5, 51.7	49.5 48.1 50.7	0.4 (-0.7, 1.1)	0.534
Injury Severity Score (ISS) (n=1381)	29.2 28.2, 30.1	26.4 25.7, 27.2	2.7 (-2.1, 2.6)	<0.001
Length of stay in MTC (n=1381)	45.3 41.9, 49.0	35.2 33.3, 37.6	10.1 (5.8, 14.1)	<0.001
RCS-ET Score (n=994)	15.6 15.1, 16.1	14.4 14.0, 14.7	1.2 0.6, 1.8	<0.001
RCS-E v12 Score (n=1078)	13.7 13.4, 14.0	12.8 12.5, 13.0	1.0 (0.5, 1.4)	<0.001
PCAT Score (n=799)	33.7 33.0, 34.4	31.0 30.5, 31.6	2.6 (1.8, 3.5)	<0.001
CNC Score (n=590)	4.3 4.1, 4.5	3.7 3.5, 3.8	0.70 (0.4, 0.9)	<0.001
NIS Score (n=540)	20.6 19.1, 22.1	15.7 14.5, 16.9	4.9 3.1, 6.7	<0.001
NPDS score (n=662)	38.6 36.4, 40.9	31.7 30.1, 33.7)	6.9 4.1, 9.5	<0.001

The non-rehabilitation patients had significantly less severe injury, and shorter stays in the MTC. They had lower levels of impairment and dependency and less complex needs. The gender ratio was approximately 75% Males:25% Females in both groups and their mean age was also similar.

Entered stepwise into a regression model, only the CNC and NIS total scores were included, but accounted for only 8% of the variance, indicating that access to rehabilitation was determined more by chance than by complexity of need or other patient characteristics.

8.4.1 In summary

This first round of the NCASRI audit has provided a uniquely rich body of information about the complexity and nature of rehabilitation needs amongst patients discharged from the MTCs. It has also led to the identification of a shorter 'minimum dataset' to identify patients with complex rehabilitation needs in any future data collection or rounds of audit from which just a 'taster' is presented here to describe the needs of this patient group.

The NCASRI minimum dataset offers a pragmatic and feasible approach for identifying and describing complex rehabilitation needs.

- The findings presented suggest that this minimum dataset offers a pragmatic approach for identifying and describing complex needs for rehabilitation that is feasible for use in routine clinical practice.

- The NCASRI team has therefore recommended its inclusion as part of the dataset for use alongside Standard RP for all patients with Category A/B needs requiring further specialist inpatient rehabilitation on discharge from the MTCs.

In this first round, conducted in 16/22 MTCs, a total of 1381 patients were identified in the MTCs as having Category A or B needs requiring further specialist in-patient rehabilitation. However, for reasons discussed in Section 11, this is likely to represent an under-estimation of the real number of patients with complex needs.

9 ASSESSMENT AND TRANSFER TO SPECIALIST REHABILITATION SERVICES

This section focuses on discharge planning within the MTC, and on assessment and transfer to specialist rehabilitation.

We present discharge-planning data within the MTCs for patients confirmed as having Category A or B needs within the MTC (i.e. the **recruited** patients (n=1381)). Comparative data are presented for each MTC.

Waiting times for assessment and transfer are available only for patients who actually receive specialist rehabilitation and appear in the UKROC database. In our **First Year Report** Standards 2.1 and 2.4 were addressed in general for trauma patients admitted to the specialist rehabilitation services. Response times were reported by service level. Here, we compare performance against the standards for both recruited and non-recruited patients who received rehabilitation. Comparative data are again presented for each MTN. Comparative data for the specialist rehabilitation providers are presented in Section 10.

9.1 Summary of performance against standards for assessment and transfer

2. Assessment and transfer to Level 1/2 service		Reported	Source
2.1	*Following referral, the patients should be assessed by the Level 1/2 service within 10 days.*	1st year + Final	**UKROC[1]**
2.2	*A consultant in RM (or their designated deputy) should complete a Patient Categorisation Tool (PCAT) to confirm that the patient has complex (Category A or B) needs for rehabilitation.*	1st year + Final	**UKROC**
2.3	*If accepted in principle, but the patient is not yet fit for transfer, they may be placed on an inactive waiting list pending further review. Serial recordings of the RCS-ET Medical score may help to determine the 'R-point', at which the patient is Ready for Transfer and placed on the active waiting list.*	Final	**Serial recordings were not used**
2.4	*Patients identified as requiring Level 1/2 in-patient rehabilitation should be transferred to specialist in-patient rehabilitation within six weeks of being fit for transfer.*	Final	**UKROC**

1 UKROC currently only collects these data for patients actually admitted to a Level 1 or 2 service.

9.1.1 Standard 2.1: Following referral, the patients should be assessed by the Level 1/2 service within 10 days.

Overall compliance with the standards for waiting time for assessment for the recruited patients was 54% (see Table 9.6).

Across the MTNs, waiting time compliance ranged from 2-100 % for the recruited patients.

Across the individual rehabilitation providers, compliance ranged from 0-100 % (see Section 10)

Overall, 54% of patients were assessed within 10 days, but compliance ranged from 2-100% across the MTNs.

9.1.2   Standard 2.2: A consultant in RM (or their designated deputy) should complete a Patient Categorisation Tool (PCAT) to confirm that the patient has complex (Category A or B) needs for rehabilitation.

This standard essentially repeats standard 1.6, which has been dropped as a requirement for the reasons explained in Section 8.2.4.

9.1.3   Standard 2.3: If accepted in principle, but the patient is not yet fit for transfer, they may be placed on an inactive waiting list pending further review. Serial recordings of the RCS-ET Medical score may help to determine the 'R-point', at which the patient is Ready for Transfer and placed on the active waiting list.

As noted in our **second year report**, there was some initial confusion about the definition of the 'TR point' – some MTCs were recording the SpR as the point when patients were ready to start engaging in rehabilitation, others at the point when they were ready for transfer, and others at the point of actual discharge from the MTC.

The RCS-ET Medical Score was designed to assist MTC teams to identify the 'transfer ready' which was agreed as the optimum time point for data collection going forward, and is the reference point for standard 2.4 below. In practice, we are not aware that any of the MTCs are using the tool in this way, so we have not been able to report against this standard.

9.1.4   Standard 2.4: Patients identified as requiring Level 1/2 in-patient rehabilitation should be transferred to specialist in-patient rehabilitation within six weeks of being fit for transfer.

91% of patients were transferred to specialist rehabilitation within 6 weeks of being ready, but compliance ranged from 5-100% across MTNs.

Overall compliance with the standards for waiting time for transfer within the recruited sample was 91%.

Across the MTNs, compliance ranged from 5-100%.

Across the individual rehabilitation providers, compliance ranged from 0-100 % (see Section 10).

9.2   Discharge planning data collected within the MTCs

At the outset of NCASRI, there was no systematic data collation in the MTCs to identify which patients were referred to a Level 1 or 2 rehabilitation service; how quickly they were assessed; whether they were discharged directly to a Level 1 or 2 service; and (if so) whether this was within a reasonable time-frame.

During the course of the NCASRI prospective audit, some additional data fields related to discharge planning were added to the TARN database as part of the development of the standard RP.

1.   TARN category of rehabilitation need.

2.   The recommended type of rehabilitation.

3.   The actual type of rehabilitation referred to.

4.   Reason for variance.

5.   Recommended discharge destination.

6.   Actual discharge destination.

Items 1-4 were recorded by the clinical therapy teams in the MTCs whereas items 5 and 6 were recorded by the TARN coordinators – many of whom may not be clinically trained. This may account for the differential reporting rates seen in Table 9.1.

Table 9.1 Reporting rates for completing discharge planning fields in recruited patients

	Major Trauma Centre (MTC)	Recorded by therapy teams in the MTCs				Recorded by TARN coordinators	
		TARN Category of needs[1]	Recommended rehab type	Actual rehab type	Reason for variance	Recommended Discharge destination[2]	Actual Discharge destination
1	Newcastle	99%	99%	89%	92%	80%	70%
2	Middlesbrough	94%	94%	94%	100%	70%	64%
3	Hull	85%	85%	84%	98%	50%	50%
4a	Manchester Salford	97%	97%	96%	90%	1%	54%
4b	Manchester RI	85%	85%	81%	73%	27%	27%
5c	Manchester South	67%	67%	67%	0%	0%	0%
5a	Liverpool Walton	100%	100%	89%	89%	70%	61%
5b	Liverpool Aintree	98%	98%	54%	48%	42%	39%
6	Sheffield	92%	92%	90%	97%	61%	61%
7	Birmingham	95%	95%	91%	23%	1%	0%
8	Coventry	91%	91%	79%	87%	45%	43%
9	Nottingham	91%	91%	67%	87%	43%	43%
10	Cambridge	95%	95%	91%	78%	47%	46%
11	Bristol	100%	100%	92%	94%	46%	47%
12	NW London	90%	90%	90%	95%	41%	35%
13	SW London	94%	94%	93%	86%	35%	31%
14	Southampton	94%	94%	91%	54%	100%	7%
15	Plymouth	89%	89%	87%	94%	44%	30%
16	Stoke-on-Trent	82%	82%	82%	76%	38%	38%
	TOTAL % All Episodes	**96%**	**96%**	**87%**	**73%**	**37%**	**36%**

1 Percentages of the total no. of episodes admitted to participating MTCs with ISS>=9

2 Percentages of the total no. of episodes admitted to participating MTCs with identified needs for further inpatient rehabilitation (Category A, B or C/D)

These fields had not been included as part of the reporting standards for NCASRI as they were added after the standards were drawn up. We did not therefore expect a high rate of data reporting. Table 9.1 shows the reporting rates for these five fields across the participating MTCs.

We also explored the overall information provided within these fields for the **recruited** patients, to determine how well they contribute to our understanding of discharge planning for patients with complex needs for rehabilitation on discharge from the MTCs.

9.2.1 Overall findings from the TARN discharge planning data for recruited patients

Table 9.2 illustrates the percentages of recommended and actual types of rehabilitation recorded for the recruited patients (n=1381). These were all supposedly patients who had been identified as having Category A/B needs, so it was surprising that only 62% were recommended for Level 1/2 specialist in-patient rehabilitation. The other recommendations are shown in Table 9.2.

Surprisingly, only 62% of these Category A/B patients were recommended for Level 1 /2 specialist in-patient rehabilitation.

Table 9.2: Recommended and actual types of rehabilitation

Types of rehabilitation recorded in TARN discharge planning fields	Recommended		Actual	
	n	%	n	%
Level 1 or 2 specialist in-patient rehabilitation	853	**62%**	642	**46%**
Level 3 in-patient rehabilitation	217	**16%**	266	**19%**
Community or out-patient rehabilitation	21	**2%**	130	**9%**
No rehabilitation required	54	**4%**	25	**2%**
Unknown or missing data	236	**17%**	318	**23%**
	1381		**1381**	

Reasons for variance between the recommended and actual types of rehabilitation (if applicable) are listed in Table 9.3. A total of 583 (42%) patients were reported to receive the recommended rehabilitation. The most common reported reasons for variance were insufficient capacity (7%) or that rehabilitation was required further down the pathway (5%).

Table 9.3: Reasons for variance between recommended and actual types of rehabilitation

Reasons for variance recorded	n	%
Patient transferred to recommended destination	583	**42%**
Service does not exist	12	**1%**
Service exists but insufficient/access delayed	98	**7%**
Rehabilitation required further down the pathway	75	**5%**
Not eligible for rehabilitation	3	**0.2%**
Patient/carer declined	3	**0.2%**
Patient needs have changed	12	**1%**
Not applicable	358	**36%**
Reason for variance not known/documented	237	**17%**
	1381	

Even though Table 9.1 records reasonable compliance (73%) in reporting reasons for variance, these fields were not necessarily reliably completed.

- For example, variance was recorded as 'Not Applicable' in 358 (36%) episodes, despite the fact that 183 of these patients were recorded as requiring Level 1 or 2 rehabilitation of which only just over half (n=100) were recorded as receiving this.

It therefore appears that further training is required for MTC teams and TARN data coordinators to ensure that these potentially useful fields provide consistent and reliable data in the future.

Nevertheless, the findings from the TARN discharge planning data may be summarised as follows:

- As noted above, of the **1381** patients recruited in participating centres and identified as having Category A/B needs for specialist rehabilitation, a total of **853 (62%)** were documented as requiring a Level 1 or 2 rehabilitation unit within the TARN dataset.

- It is not possible to identify from the TARN/UKROC datasets how many were actually referred for specialist rehabilitation while still in the MTC, but **642 of the 853 (75%)** were identified in the TARN dataset as receiving this.

However, the UKROC dataset tells a slightly different story:

- Of the **853** who had a Level 1 or Level 2 service as their recommended discharge destination, **442 (52%)** subsequently appeared in the UKROC dataset (plus a further **108** for whom either no recommendation for rehabilitation was made (n=55), or a recommendation for other services (principally non-specialist rehabilitation services n=53)) – giving **550** in total.

- Of the **642** identified in TARN as receiving this specialist rehabilitation, just **368 (57%)** had appeared in the UKROC dataset by the time the data linkage was conducted.

There are a number of possible reasons for this discrepancy:

- It is possible that the staff who entered the TARN data were not fully aware of the designation of the rehabilitation services that patients were referred/discharged to.

- However, if the TARN data is indeed accurate, this would suggest that data linkage may have been conducted prematurely and up to 40% of recruited cases may have yet to be discharged from rehabilitation and so do not appear in the UKROC database.

In our **Second Year Report** we highlighted that patients may take up to 12 months after discharge from the MTC to appear in the UKROC database, and for this reason we recommended that any future audit rounds should be conducted using a 2-year time frame. These findings would seem to support that recommendation. The implications of this finding are that this first round of the NCASRI audit may have under-estimated the proportion of patients who eventually received specialist rehabilitation by as much as 40%. Further linkage of this dataset in autumn 2018 was recommended to ascertain whether this is the case or not. Until that linkage is conducted, the results from this first round of NCASRI audit should be interpreted with caution.

Table 9.4 provides a breakdown by MTN of the numbers (%) of patients recruited, recommended for specialist rehabilitation and completing rehabilitation.

Overall 40% of the recruited patients with Category A/B needs had completed a course of specialist rehabilitation by the time of linkage. Patients with complex neurorehabilitation needs were proportionately represented (40% of them receiving rehabilitation) whereas only 34% of patients with complex musculoskeletal rehabilitation needs received the recommended specialist rehabilitation, suggesting a particular shortfall of beds for this group of patients.

Table 9.4: Number of patients for whom specialist rehabilitation was recommended, and who completed a specialist rehabilitation programme

	Major Trauma Centre (MTC)	Recruited patients Total N= 1381							
		N (%) of patients Recruited[1]		N (%) for whom specialist rehab recommended in TARN		N (%) recorded as receiving specialist rehab in TARN		N (%) who completed specialist rehab programme (UKROC)	
1	Newcastle	120	43%	74	62%	62	52%	9	8%
2	Middlesbrough	41	80%	27	66%	20	49%	30	73%
3	Hull	36	42%	30	83%	21	58%	9	25%
4	Manchester	142	69%	137	96%	138	97%	126	89%
4a	Manchester RI	8	28%	5	63%	4	50%	6	75%
4b	Manchester South	1	11%	1	100%	1	100%	1	100%
5a	Liverpool Walton	48	59%	43	90%	34	71%	6	13%
5b	Liverpool Aintree	14	3%	9	64%	6	43%	4	29%
6	Sheffield	71	62%	59	83%	42	59%	39	55%
7	Birmingham	130	69%	1	1%	0	0%	23	18%
8	Coventry	76	84%	48	63%	41	54%	45	59%
9	Nottingham	69	49%	19	28%	22	32%	37	54%
10	Cambridge	132	84%	58	44%	43	33%	33	25%
11	Bristol	193	16%	150	78%	77	40%	40	21%
12	NW London	100	78%	83	83%	53	53%	61	61%
13	SW London	39	51%	24	62%	15	38%	21	54%
14	Southampton	50	44%	2	4%	6	12%	4	8%
15	Plymouth	67	62%	60	90%	32	48%	46	69%
16	Stoke-on-Trent	44	52%	21	48%	20	45%	10	23%
	TOTAL % All Episodes	1381	38%	851	62%	637	46%	550	40%

1 Recruited patients were those identified as having Category A/B needs in a participating MTC

9.3 Assessment and transfer times for recruited and non-recruited patients.

As noted earlier, because the systems for identification of patients with complex needs for rehabilitation in the MTCs were still in development during this initial prospective round of NCASRI, we used forward and reverse linkage to capture both patients identified as requiring specialist rehabilitation while still in the MTC and those who presented for rehabilitation further down the pathway. This latter group also includes patients from non-participating MTCs.

The rehabilitation population (n=1154) therefore includes both patients who were recruited in the MTCs (n=550) and also non-recruited patients (n=604). In theory, one might expect that patients who were identified as having Category A/B needs in the MTCs might be transferred more quickly than patients whose needs were only identified at a later stage. We therefore compared the mean times and the standards for admission and transfer in the two groups.

Table 9.5 summarises the mean waiting times for assessment and transfer (median and IQR are also included as the data are skewed). The mean time since onset at admission to rehabilitation was **70 days** (95%CI 58-90), but with a long tail of more than 6 months for a minority (4%) of patients. A proportion of this time, however, was taken with stabilising the patient before they were ready for rehabilitation.

The mean overall time from referral to assessment was 6 days, and 20 days from assessment to admission. The mean waiting time once the patient was ready for admission to rehabilitation, however, was just 7 days (but again the distribution had a long tail with range 0-152).

Although there were no significant differences in waiting times for assessment between the recruited and non-recruited groups, the non-recruited group waited slightly longer between assessment and admission, so that the overall mean difference from referral to admission was 6.3 days (95% CI 1.0, 11.7) which just reached significance (p=0.04).

Table 9.5: Waiting times for assessment and transfer, with comparison of the recruited and non-recruited group

	Recruited group n=550		Non-recruited group n=604		Total Rehab Group n=1154	
	Mean 95% CI	Median (IQR)	Mean 95% CI	Median (IQR)	Mean 95% CI	Median (IQR)
Time from onset to referral	**34** 33, 82	**22** (13-38)	**56** 33, 91	**25** (14-43)	**22** -2, 57	**24** (13-41)
Waiting times:						
Referral to assessment	**5.8** 3.6, 7.6	**4** (0-9)	**5.5** 2.8, 7.6	**3** (0-8)	**5.6** 3.9, 7.1	**3** (0-8)
Assessment to admission	**17.7** 14.8, 21.0	**8** (1-22)	**23.0** 19.4, 27.1	**12** (3-28)	**20.5** 18.0, 23.1	**9** (1-26)
Transfer Ready to admission	**4.5** 1.5, 7.8	**0** (0-5)	**9.4** 5.1, 15.7	**3** (0-10)	**7.1** 4.3, 10.8	**1** (0-8)
Overall waiting time from referral to admission	**18.8** 16.1, 21.1	**11** (1-25)	**25.1** 21.0, 31.0	**14** (5, 32)	**6.3** 1.0, 11.7	**12** (3-28)

Of a total of 1154 patients (see Figure 9.1):

- **660 (57%)** were assessed within 10 days of referral.
- **927 (86%)** patients were transferred to specialist rehabilitation within 6 weeks of referral.
- **1047 (91%)** were admitted within 6 weeks of being ready for transfer.

Comparing the recruited and non-recruited groups:

- 54 % vs. 60% were assessed within 10 days.
- 91% of both groups were transferred within 6 weeks of being ready for transfer for rehabilitation.

Identification of complex (Category A/B) needs within the MTC shortened the overall transfer time by about 6 days.

The results therefore suggest that, although the waiting times for assessment were similar, the identification of complex (Category A/B) needs within the MTC shortened the overall transfer time by about 6 days.

Table 9.6 reports the extent to which standards for assessment and transfer times are met within the different MTNs.

The MTCs that did not meet the standard for input from a consultant in rehabilitation medicine tended to have slightly lower compliance rates with waiting times for assessment, compared to those that met the standard. However, there was no significant difference in mean waiting times for assessment or transfer between the two groups.

A comparison of the rehabilitation service providers with respect to standards for assessment and transfer is presented in Section 10.

Just 54% of the Recruited Rehabilitation Group were assessed within 10 days.

Figure 9.1: Pie charts of performance against standards for response times

Assessed within 10 days — 57% / 43%
Admitted within 6 weeks of Referral — 86% / 14%
Admitted within 6 weeks of being Ready for transfer — 91% / 9%
Met / Not met
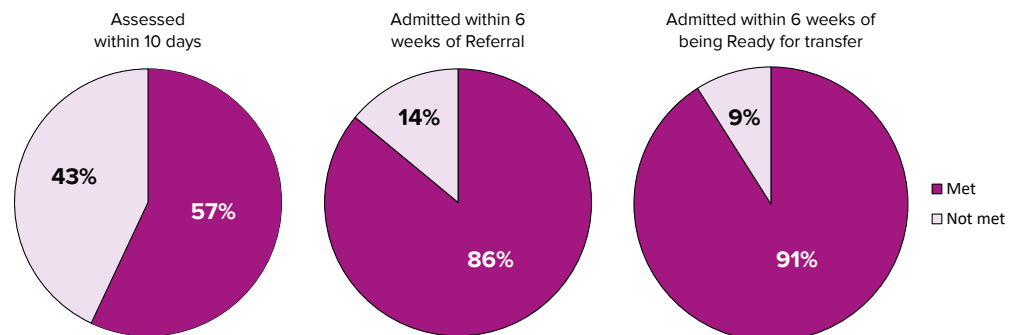
Table 9.6: Waiting times for admission for the recruited and the non-recruited patients within the rehabilitation population.

	Major Trauma Centre (MTC)	Recruited Rehabilitation Group Total n=550								Non-recruited Rehabilitation Group Total N = 604				
		% assessed within 10 days		% admitted within 6 weeks		% transferred directly to the rehab service[2]				N	N % assessed within 10 days		% admitted within 6 weeks	
1	Newcastle	7	78%	9	100%	4	44%			16	12	75%	15	94%
2	Middlesbrough[1]	19	63%	28	93%	1	3%			6	4	67%	6	100%
3	Hull[1]	1	11%	3	33%	5	56%			8	6	75%	6	75%
4	Manchester	3	2%	108	86%	70	56%			30	4	13%	24	80%
4a	Manchester RI	1	17%	5	83%	3	50%			12	3	25%	8	67%
4b	Manchester South	1	100%	1	100%	1	100%			5	0	0%	3	60%
5a	Liverpool Walton[1]	5	83%	6	100%	3	50%			3	2	67%	3	100%
5b	Liverpool Aintree	3	75%	4	100%	3	75%			39	37	95%	38	97%
6	Sheffield	26	67%	36	92%	34	87%			22	17	77%	21	96%
7	Birmingham	21	91%	16	70%	3	13%			28	12	43%	25	89%
8	Coventry[1]	28	62%	44	98%	26	58%			3	3	100%	3	100%
9	Nottingham	26	70%	36	97%	20	54%			54	47	87%	52	96%
10	Cambridge	27	82%	33	100%	29	88%			9	8	89%	9	100%
11	Bristol	21	53%	32	80%	26	65%			6	1	17%	6	100%
12	NW London[1]	45	74%	3	5%	38	62%			9	7	78%	8	89%
13	SW London[1]	16	76%	20	95%	9	43%			21	13	62%	19	91%
14	Southampton[1]	3	75%	3	75%	1	25%			46	32	70%	39	85%
15	Plymouth	40	87%	46	100%	29	63%			9	7	78%	8	89%
16	Stoke-on-Trent	6	60%	10	100%	6	60%			10	9	90%	10	100%
	TOTAL % All Episodes excluding Bristol	299	54%	443	91%	311	62%			336	12	60%	15	91%
Non-participating centres														
17	Brighton[1]									44	0	0%	38	86%
18	SE London[1]									51	33	65%	50	98%
19	Leeds									43	17	40%	42	98%
20	Oxford[1]									31	17	55%	21	68%
21	Preston									46	37	80%	45	98%
22	NE London[1]									53	33	62%	50	94%
	TOTAL									268	137	51%	246	92%

1   Units that did not meet the standard for input from consultants in Rehabilitation Medicine

2   According to the TARN dataset

10 SPECIALIST LEVEL 1 AND LEVEL 2 IN-PATIENT REHABILITATION SERVICES

This section presents the data for the extended **rehabilitation** patient group (n=1154) who were actually admitted to rehabilitation services. This includes:

- The recruited patients (who were identified in the MTCs as having Category A/B needs).

- The non-recruited patients who were not identified as requiring specialist rehabilitation by the MTCs (either because their needs were not recognised, or because they were too sick to engage in rehabilitation).

We examine the relevant standards with respect to assessment and transfer times, recording of outcomes measures and cost-efficiency – and once again we present a quantitative analysis.

10.1   Relevant standards

3. Specialist Level 1 and 2 in-patient rehabilitation services		Reported	Source
3.1	*All Level 1 and 2 services should be led by a consultant in RM and/or neuropsychiatry, depending on caseload.*	1st year	**Element 1 Service profiles**
3.2	*All Level 1 and 2 services should meet at least the minimum standards for safe and effective staffing levels as laid down in the BSRM standards.*	1st year	
3.3	*All Level 1 and 2 services should be registered with UKROC and contribute the full UKROC dataset for every patient enrolled under the NHSE-commissioned rehabilitation programme.*	1st year	
3.4	*Assessment of function and rehabilitation needs should be documented within 10 days of admission and within the last 7 days before discharge, including RCS-E, NPDS and UK FIM+FAM.*	1st year	**Element 1 UKROC**
3.5	*By discharge, all patients should have achieved some measurable gain or goal achievement, as measured by UK FIM+FAM, NPDS or GAS T-score (or other approved measure) or the reason for no gain is recorded. Discharge destination should also be recorded.*	1st year + Final	**Elements 1 and 2 UKROC**
3.6	*Cost-efficiency data[1] should be reported in all episodes. It was originally suggested that (excluding patients who remain in prolonged disorders of consciousness at discharge) cost-efficiency for trauma patients should be within two standard deviations of the mean within each service group for 85% of patients. As yet there is no robust data to inform whether this is an appropriate means to identify outliers.*	1st year + Final	**Elements 1 and 2 UKROC**

1 Measured in the time to offset the costs of rehabilitation by savings in on-going care, as estimated by the Northwick Park Dependency Score (NPDS/NPCNA)

Standards 3.1-3.3 were addressed in Element 1 of NCASRI and are reported on in our **First Year Report** and are not re-examined here. The report also examined Standards 3.5 and 3.6 in general for trauma patients admitted to the specialist rehabilitation services as part of the retrospective analysis of UKROC data. The findings were broken down by service level but not by provider.

Here we examine the proportion of the **rehabilitation group** (n=1154) who achieve some functional gain, and examine cost-efficiency. Comparative data are now presented for each rehabilitation service provider. Reporting rates for the various measures compared for the retrospective analysis in Year 1 and the prospective cohort in Year 2 is compared, to determine whether data reporting has improved.

10.2 Summary of performance against standards for specialist rehabilitation

10.2.1 Standard 3.4: Assessment of function and rehabilitation needs should be documented within 10 days of admission and within the last 7 days before discharge, including RCS-E, NPDS and UK FIM+FAM.

Appendices 5a and 5b show the RAG rated % of reporting across the various specialist rehabilitation providers for the retrospective analysis in Year 1, in comparison to the prospective audit in Year 2. The improvement in reporting is evident from visual inspection.

Of a total of 1154 patients, 1044 episodes were completed at the time of linkage.

The proportion with assessments on both admission and discharge were:

- RCS-E-12**: 993/1044 (95%).**

- UKFIM+FAM: **907/1044 (87%).**

- NPDS/NCNA: **NPDS: 889/1044 (85%) / NPCNA: 773/1044 (74%).**

10.2.2 Standard 3.5: By discharge, all patients should have achieved some measurable gain or goal achievement, as measured by UK FIM+FAM, NPDS or GAS T-score (or other approved measure) or the reason for no gain is recorded. Discharge destination should also be recorded.

Amongst the 1044 completed episodes at the time of linkage, overall compliance with the standard for achieving some measurable gain was 94% (984/1044).

Within the individual providers, compliance ranged from 0-100 % (see Table 10.1).

Discharge destination was recorded in 99% of cases across all providers.

10.2.3 Standard 3.6: Cost-efficiency data should be reported in all episodes

Overall compliance with the standards for reporting cost-efficiency was 75% (see Table 10.1).

Cost efficiency is marked as invalid where the mean cost of care increased from admission to discharge. This is not uncommon, and may occur, for example, when patients emerge into consciousness and develop agitated behaviours requiring increased levels of nursing and supervision or when catheters are removed and patients require regular toileting to maintain continence.

Figure 10.1 shows the overall % completion of outcomes and % recording of discharge destination and some functional gain and cost efficiency in this prospective audit compared with the pre-audit performance described in the first year report. Recording rates were already high, even before the prospective audit. There has been some further marginal improvement.

Figure 10.1: Overall performance against standards 3.4-3.6: Comparison of Pre-audit and Prospective audit performance.
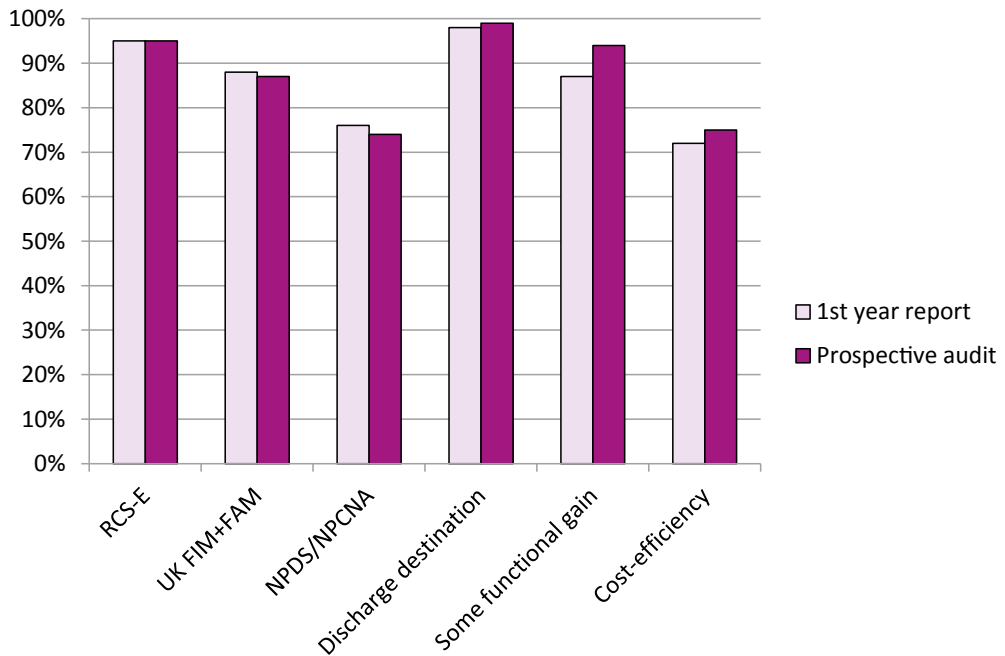
Table 10.1: Achievement rates of the key standard parameters by rehabilitation service provider

| | Rehabilitation service provider | Total completed episodes | Pre-admission | | % Assessed on admission and discharge | | | Outcomes and cost-efficiency | | |
			% assessed within 10 days	% admitted within 6 weeks	RCSE-12	UK FIM+FAM	NPDS/ NPCNA	% cases with some functional gain	Mean length of stay (days)	Mean cost efficiency* (months)
Hyper-acute										
H1	Lipton Walton Centre	11	100%	100%	100%	100%	91 %	100%	101	Invalid
H2	Salford - TRU	132	2%	87%	92%	80%	11%	91%	37	42
	Total	**143**	**10%**	**88%**	**93%**	**72%**	**17%**	**92%**	**42**	**43**
Level 1a										
1a.1	Norfolk, Coleman Hospital	15	94%	100%	100%	100%	100%	100%	112	23
1a.2	Northwick Park (Level1a/HA)	22	57%	100%	100%	95%	100%	100%	103	19
1a.3	Walkergate, Newcastle	12	67%	87%	100%	100%	100%	100%	104	31
1a.4	Leicester Brain Injury Unit	18	95%	100%	100%	100%	100%	100%	39	5
1a.5	RHN Putney	23	52%	97%	100%	100%	100%	100%	117	Invalid
1a.6	Salford - Ward C2	32	3%	81%	94%	81%	3%	79%	64	Invalid
1a.7	Oxford Centre for Enablement	–	–	–	–	–	–	–	–	–
	Total	**122**	**54%**	**94%**	**98%**	**94%**	**75%**	**97%**	**87**	**15**
Level 1b										
1b.1	Birmingham (wards 8 & 9)	28	77%	80%	100%	100%	100%	100%	89	18
1b.2	Homerton - RNRU	17	52%	100%	94%	94%	94%	94%	99	22
1b.3	Walton Centre - CRU	4	60%	80%	100%	100%	100%	100%	105	23
1b.4	Royal Leamington Spa	36	62%	100%	100%	86%	100%	94%	83	16
1b.5	Preston Fell View Unit	14	75%	100%	100%	93%	100%	93%	99	18
1b.6	Frenchay Brain Injury Unit	28	53%	94%	100%	96%	100%	100%	131	21
	Total	**127**	**64%**	**94%**	**99%**	**94%**	**99%**	**98%**	**99**	**10**
Level 1c										
1c.1	Lishman Unit	4	40%	100%	100%	100%	100%	100%	174	Invalid
1c.2	Blackheath – TBIRU	7	50%	100%	86%	86%	86%	86%	101	24
1c.3	Walkergate Newcastle	0	100%	100%	-	-	-	-	-	Missing
	Total	**11**	**53%**	**100%**	**91%**	**91%**	**91%**	**91%**	**127**	**–**

1 Cost-efficiency figures represent the number of months taken for savings in the cost of on-going care in the community to offset the cost of the rehabilitation episode. Invalid data are recorded where mean care costs for the service increase, rather than decrease

Table 10.1 Continued

	Rehabilitation service provider	Total completed episodes	Pre-admission			% Assessed on admission and discharge			Outcomes and cost-efficiency		
			% assessed within 10 days	% admitted within 6 weeks	RCSE-12	UK FIM+FAM	NPDS/NPCNA	% cases with some functional gain	Mean length of stay (days)	Mean cost efficiency[1] (months)
Level 2a											
2a.1	Manchester Royal	2	100%	100%	100%	100%	100%	100%	82	7
2a.2	Poole	13	69%	100%	100%	85%	69%	85%	50	9
2a.3	Portsmouth	9	100%	100%	100%	78%	100%	100%	73	23
2a.3	Leeds	20	100%	100%	100%	100%	100%	100%	70	16
2a.4	Osborn	48	67%	94%	90%	79%	0	90%	32	2
2a.5	Sussex	45	100%	87%	84%	84%	87%	96%	49	12
2a.6	Stoke-on-Trent	14	93%	100%	100%	100%	100%	100%	58	8
2a.7	UCLH	2	50%	100%	100%	100%	100%	100%	99	12
2a.8	Lincoln Ashby Unit	17	72%	72%	100%	100%	94%	100%	49	31
2a.9	Leicester YDU	12	100%	100%	100%	100%	100%	100%	47	10
2a.10	Plymouth	37	88%	100%	100%	97%	100%	100%	52	6
2a.11	Blackheath - HNDU	4	100%	100%	100%	50%	100%	75%	107	38
2a.12	Wolfson Thomas Young	24	64%	86%	100%	92%	79%	96%	70	21
2a.13	Salford - Ward B3	8	100%	25%	25%	38%	0	25%	16	Missing
	Total	**255**	**57%**	**91%**	**93%**	**88%**	**72%**	**93%**	**52**	**31**
Level 2b											
2b.1	Cambridge, Lewin and J2	10	80%	100%	70%	40%	30%	60%	70	32
2b.2	Robertson Unit, Willesden	9	78%	100%	100%	100%	100%	100%	66	13
2b.3	Hume unit, Sunderland	10	80%	100%	100%	100%	100%	100%	88	15
2b.4	Kings Lodge, Derby	14	75%	100%	100%	100%	93%	100%	59	6
2b.5	East Kent NRU	11	92%	100%	91%	100%	100%	109%	45	9
2b.6	Rakehead	22	91%	96%	100%	95%	100%	100%	67	11
2b.7	Alderbourne Unit, Hillingdon	30	85%	97%	100%	100%	100%	100%	62	12
2b.8	King's College, FCRU	4	67%	100%	100%	100%	100%	100%	98	34
2b.9	Pinderfields, Wakefield	11	64%	86%	82%	0%	100%	82%	63	7
2b.10	Linden Lodge, Nottingham	37	73%	100%	100%	97%	100%	100%	71	10
2b.11	Royal Berkshire, Reading	9	64%	73%	100%	78%	0	78%	63	
2b.12	Donald Wilson, Chichester	5	100%	100%	100%	100%	80%	100%	79	9
2b.13	Snowdon Unit, Southampton	19	43%	62%	95%	89%	89%	100%	43	6
2b.14	Bradley unit, Woking	9	80%	100%	100%	78%	100%	100%	53	11

Table 10.1 Continued

	Rehabilitation service provider	Pre-admission			% Assessed on admission and discharge			Outcomes and cost-efficiency		
		Total completed episodes	% assessed within 10 days	% admitted within 6 weeks	RCSE-12	UK FIM+FAM	NPDS/ NPCNA	% cases with some functional gain	Mean length of stay (days)	Mean cost efficiency[1] (months)
Level 2b continued										
2b.15	Somerset Centre, Taunton	10	20%	30%	100%	90%	100%	100%	52	13
2b.16	Floyd Unit	4	50%	75%	100%	100%	100%	100%	119	122
2b.17	Coventry and Warwick	11	77%	93%	55%	73%	9%	55%	43	Invalid
2b.18	Clatterbridge unit, Wirral	5	60%	100%	100%	80%	100%	100%	76	30
2b.19	West Park	7	0%	57%	86%	71%	71%	86%	39	8
2b.20	Taylor Unit, Leigh Infirmary	1	100%	100%	100%	100%	0	0%	21	Missing
2b.21	Royal Free NRC	9	89%	78%	100%	89%	100%	100%	51	11
2b.22	James Cook Hospital	31	61%	100%	97%	100%	100%	100%	38	4
2b.23	Barnsley	13	86%	100%	100%	100%	100%	100%	63	9
2b.24	Mardon Unit, Exeter	6	100%	100%	100%	50%	100%	100%	101	Invalid
2b.25	Ward 5 Broadgreen, Liverpool	17	94%	100%	94%	94%	94%	94%	54	6
2b.26	Elyn Lodge, St Helens, Liverpool	13	100%	100%	100%	100%	100%	100%	64	17
2b.27	Roehampton	3	40%	60%	100%	33%	100%	67%	91	16
New centres for Year 3										
2b.28	Buckinghamshire NU, Amersham	8	0%	0%	88%	75%	25%	88%	64	218
2b.29	Pine Cottage, Norfolk	1	100%	100%	100%	100%	100%	100%		3
2b.30	St Michael's Hale, Truro	4	100%	100%	100%	0%	0	50%	37	Missing
2b.31	FCRU– Orpington (2b service)	5	100%	100%	100%	100%	100%	100%	47	24
2b.32	Preston – Bleasdale unit	11	10%	100%	100%	100%	100%	100%	63	12
2b.33	Goole	10	29%	50%	90%	100%	90%	100%	87	11
2b.34	Walton Centre, Level 2	0	100%	100%	–	–	–	–	–	Missing
2b.35	Charing Cross Hospital	15	94%	100%	100%	100%	100%	100%	80	25
2b.36	Frenchay BIU, Level 2	2	75%	100%	100%	100%	100%	100%	104	23
	Total	**386**	**73%**	**89%**	**95%**	**86%**	**88%**	**94%**	**62**	**19**
	All		57%	91%						
	Episode complete at the time of linkage									
	TOTAL	**1044**			**95%**	**87%**	**74%**	**94%**	**65**	**17**

NB. Signposting for service levels changes from time to time. Units are presented according to their signposting in 2016/17

1   Cost-efficiency figures represent the number of months taken for savings in the cost of on-going care in the community to offset the cost of the rehabilitation episode. Invalid data are recorded where mean care costs for the service increase, rather than decrease

10.3 Performance by individual provider

Electronic appendices 5-7 break down the performance of individual providers, subdivided by service level and region.

- **Appendix 5a and 5b** show the reporting rates for the primary outcomes by service provider, comparing Year 1 and Year 3 reporting rates.

- **Appendix 6** summarises the actual data by service provider.

- **Appendix 7** shows the key standards by region.

10.4 Analysis of the needs and outcomes from rehabilitation

10.4.1 Demographics

- The mean age of the total group was **50 years** (range 16-92).

- The Male/Female ratio was **74:26%.**

- The mean ISS score was **28 (range 4-75).**

The mean length of stay was **65 (SD 56) days**, but with a range of 2-399 days.

The demographics for the rehabilitation population (recruited, non-recruited and total) are shown in Table 10.2. There were no significant differences between the recruited and non-recruited groups.

Table 10.2: Demographics for the population – mean and 95% CI

	Recruited group n=550		Non-recruited group n=604		Total Rehab Group n=1154	
Parameter	**n**	**%**	**n**	**%**	**n**	**%**
Male: Female ratio	412:137	**75:25%**	442:160	**73:27%**	854:297	**74:26%**
Type of injury						
Acquired brain injury	444	**81%**	497	**82%**	941	**82%**
Spinal cord injury	27	**5%**	35	**6%**	62	**5%**
Multiple trauma	73	**13%**	83	**14%**	156	**14%**
Musculoskeletal Amputation	1	**0.2%**	9	**1.5%**	9	**0.8%**
	4	**0.7%**	2	**0.3%**	6	**0.5%**

	Mean 95% CI	Median (IQR)	Mean 95% CI	Median (IQR)	Mean 95% CI	Median (IQR)
ISS score	**29** 28, 30	**25** (25-35)	**28** 27, 29	**25** (24-34)	**28** 28, 29	**25** (25-34)
Age (Years)	**50** 49, 52	**51** (33-66)	**50** 29, 52	**51** (34-67)	**50** 29, 52	**51** (34-67)
Time between onset and admission	**58** 51, 63	**43** (24-70)	**82** 59, 111	**45** (25-77)	**71** 60, 90	**44** (25-74)
Length of stay in rehabilitation (days)	**62** 57, 67	**44** (22-88)	**68** 63, 73	**51** (25-95)	**65** 61, 61	**48** (22-91)

10.4.2 Change in category of need between MTC and rehabilitation

In Section 8.4 we examined the needs for the recruited group (n=1381) and compared data for the rehabilitation (n=550) and non-rehabilitation (n=831) subgroups of the recruited population.

Here, we examine category of need identified in the MTC for those patients who were actually admitted for rehabilitation (n=1154), and compare the data for those who were and were not recruited (n=550 and 604 respectively).

Table 10.3 shows the category of rehabilitation needs identified in the MTCs for both the recruited and the non-recruited groups. By definition all of the recruited group (n=550) had Category A/B needs identified in the MTC by one of the three parameters:

- **342 (62%)** had been identified using the PCAT.

- **50 (9%)** using the CNC.

- **158 (29%)** using the TARN clinical category.

In the non-recruited group, just 15% were identified as having A/B needs.

Table 10.3: Category of need identified in the MTC

Parameter	Recruited group n=550		Non-recruited group n=604		Total Rehab Group n=1154	
	n	%	n	%	n	%
Category A/B						
PCAT	342	**62%**	10	**1.7%**	352	**31%**
CNC	50	**9%**	1	**0.2%**	51	**4%**
TARN category	158	**29%**	80	**13%**	238	**21%**
Any of the above	550	**100%**	91	**15%**	641	**56%**
Category C/D						
PCAT	0	**0%**	11	**1.8%**	11	**1%**
CNC	0	**0%**	1	**0.2%**	1	**0.1%**
TARN category	0	**0%**	87	**14%**	87	**8%**
Any of the above			99	**16%**	99	**9%**
Specialist rehabilitation recommended in MTC						
Level 1	235	**43%**	76	**13%**	311	**27%**
Level 2/other Sp Rehab	207	**38%**	53	**9%**	260	**23%**
Level 3	54	**10%**	100	**17%**	154	**13%**
'No rehabilitation needs'	0	**0%**	38	**6%**	38	**3%**
None documented	0	**0%**	295	**49%**	295	**26%**

Overall for the rehabilitation group:

- Just over half **641 (56%)** were identified in the MTCs as having Category A/B needs, for which specialist rehabilitation was recommended for 90% (n= 571, amounting to 50% of the total).

- 99 (9%) had been thought to have Category C/D needs, and 154 (13%) had been recommended for Level 3 services.

- 3% were thought to have no rehabilitation needs (possibly because, at that stage, they were still too sick).

- Just over a quarter (26%) had no rehabilitation needs documented in the MTC.

10.4.3 Main measures at recruitment with paired admission scores

Within the MTC:

- The median CNC score for this rehabilitation group (n=204) was 4.5 (IQR 3-5; range 0-6).

- The median Neurological Impairment Set (NIS) score (n=235) was 18 (IQR 10-30; range 1-42: (Max score 50).

Table 10.4 summarises the means and 95% confidence intervals for main measures within the MTC at recruitment compared with those recorded on admission to rehabilitation. Between discharge from the MTC and admission to rehabilitation there was a small but significant reduction in impairment, dependency and care costs, which was reflected in a small reduction in complexity of need. However, between admission and discharge from rehabilitation there were substantial further improvements.

No significant differences were seen between the recruited and the non-recruited rehabilitation groups in age, length of stay, or dependency on admission. Therefore analysis of outcomes and cost efficiency was conducted for the total sample.

Table 10.4: Main measures at recruitment with paired admission scores for the n=550

Measure	Within the MTC n=	Within the MTC Mean 95% CI	Admission to rehabilitation n=	Admission to rehabilitation Mean 95% CI	Difference from MTC to admission for rehabilitation Mean 95% CI	Difference from MTC to admission for rehabilitation P	Discharge from rehabilitation n=	Discharge from rehabilitation Mean 95% CI	Difference from admission to discharge from rehabilitation Mean difference	Difference from admission to discharge from rehabilitation P
PCAT	313	**33.5** 32.8, 34.1	313	**32.4** 31.7, 33.1	**1.1** 0.4, 1.8	**0.001**	–	–	–	–
RCS-E v12	305	**13.7** 13.3, 14.1	305	**12.1** 11.7, 12.4	**1.6** 1.2, 2.1	**<0.001**	279	**9.8** 9.5, 10.2	**2.1** 1.6 2.5	<0.001
NPDS	269	**38.2** 36.0, 40.5	269	**32.8** 30.5, 35.2	**5.4** 3.5, 7.4	**<0.001**	246	**321.4** 18.7, 24.1	**10.7** 9.0, 12.3	<0.001
NPCNA estimated:										
Care hours/ week	194	**48.1** 45.6, 50.4	194	**40.6** 37.7, 43.3	**7.5** 5.3, 9.8	**<0.001**	172	**25.0** 22.0, 8.5	**14.7** 12.2, 17.1	<0.001
Care costs per week	194	**£1902** £1792, 2008	194	**£1669** £1539, 1805	**£234** 105, 361	**<0.001**	172	**£941** £806, 1084	**£695** £5 73, 818	<0.001

Table 10.5 summarises the main measures on admission and discharge for rehabilitation. Between admission and discharge there were significant improvements in both cognitive and motor function as measured by the UK FIM+FAM. These were reflected in a reduction in care needs and on-going care costs.

Therapy inputs did not reduce – indeed if anything there was a slight increase from 19.8 hours per week (95%CI 190, 20.5) on admission to 20.4 (19.6, 21.1) on discharge. This is a well-recognised phenomenon as patients' ability to engage in rehabilitation typically improves through the programme, and the intensity of therapy input often increases around the time of discharge.

Table 10.5: Main outcome measures for admission

	Admission Mean 95% CI[1]	Admission Median (IQR) Range	Discharge Mean 95% CI	Discharge Median (IQR) Range	Change Mean[1] 95% CI	Change P value[3]
Rehabilitation needs and complexity						
PCAT[2] (n=963)	**32.2** 6.8	**32** (27-38), 16-48	–	–	–	–
RCS-E v12 (n=997)	**12.6** 12.4, 12.7	**9.7** (11-15), 0-20	**9.7** 9.4, 9.9	**10** (7-12), 0-20	**2.9** 2.6, 3.1	**0.001**
Functional gain and reduced dependency						
UK FIM+FAM n=914						
Total score	**108.9** 105.7, 112.2	**107** (60-147), 30-208	**151.0** 147.5, 154.5	**173** (118-193), 30-210	**42.1** 39.8, 44.4	**<0.001**

	Admission		Discharge		Change	
	Mean 95% CI[1]	Median (IQR) Range	Mean 95% CI	Median (IQR) Range	Mean[1] 95% CI	P value[3]
Motor Subscale	**56.5** 54.5, 58.7	**49** (25-83), 16-112	**81.9** 79.8, 84.1	**96** (57-108), 16-112	**25.4** 23.8, 26.9	**<0.001**
Cognitive Subscale	**52.4** 50.8, 53.9	**52** (29-2), 14-98	**69.1** 67.4, 70.7	**79** (52-89), 14-98	**16.7** 15.6, 17.8	**<0.001**
NPDS (n=894)						
Total score	**30.2** 28.9, 31.7	**31** (13-47), 0-80	**19.3** 18.2, 20.6	**12** (3-33), 0-79	**10.9** 9.9, 11.9	**<0.001**
Basic Care Needs	**22.0** 20.9, 23.0	**22** (8-37), 0-59	**13.8** 14.7, 16.0	**7** (1-25), 0-56	**8.2** 7.5, 8.9	**<0.001**
Special Nursing Needs	**8.2** 7.8, 8.7	**5** (0-15), 0-35	**5.5** 5.1, 6.0	**5** (0-10), 0-35	**2.7** 2.3, 3.1	**<0.001**
Cost of care						
NPCNA (n=778)						
Care hours/week	**40.0** 38.5, 41.3	**39** (25-60), 0-81	**26.0** 24.5, 276	**19** (9-39), 0-56	**14.0** 12.8, 15.2	**<0.001**
Care costs/week	**£1537** 1466, 1604	**£1612** (928-2257), 0-3613	**£1000** £934, 1069	**£836** (150-1652), 0-3613	**£536** 477, 596	**<0.001**

1   Bootstrapped using samples of n=1000

2   PCAT scores are recorded only on admission.

3   Significance of change on Paired T tests.

Table 10.6 summarises the cost-efficiency for the overall sample, separated into the three groups of dependency – high, medium and low.

- Highly dependent patients (NPDS ≥25) require two carers for most tasks on admission.

- Medium dependency patients (NPDS 10-24) generally require assistance from one carer.

- Low dependency patients (NPDS 0-9) are moving on towards independence.

Mean cost per episode was £39,398, and the mean saving in the ongoing cost of care was £536 per week.

The overall mean cost per episode was £39,398, and the mean savings in the ongoing cost of care was £536 per week. This meant that the cost of rehabilitation was offset by savings in on-going care costs within about 17 months. The cost-efficiency was greatest in the high and medium dependency groups.

The average age of this sample was 50 years, which means that the population (and society) have many years over which to benefit from these cost savings, even though expectancy is reduced in severely disabled patients. The main factors that limit life expectancy are mobility and swallowing ability. The US Life Expectancy Project (39, 40) has published life expectancy figures from two large US datasets, subdividing patients into 4 groups based on their FIM scores for walking and eating. Life expectancy for each group is compared with that of the reference population or each decade of life. These life expectancy calculations are now built into the UKROC database in order to estimate life-time savings (41) arising from rehabilitation.

Applying these estimations, the mean net life-time savings after deducting for the cost of the rehabilitation programme amounted to £504,106 per patient, which would generate a total saving of £582 million from this one short cohort alone. Few interventions in healthcare have the potential to generate this level of potential cost savings.

Table 10.6 Cost efficiency – analysed by dependency group on admission

Parameter	Dependency group on admission			Total
	High NPDS >25 n=415	**Medium NPDS 10-24 n=197**	**Low NPDS <10 n=159**	**Any NPDS n=771**
	Mean 95% CI[1]	**Mean 95% CI**	**Mean 95% CI**	**Mean 95% CI**
Length of Stay (Days)	**91** 86, 97	**55** 49, 62	**48** 41, 57	**73** 69, 77
Episode cost (£)	**£49,123** £45,697, 52,565	**£28,658** £24,985, 32,375	**£27,324** £21,743, 35,141	**£39,398** £36,846, 42,121
Mean saving in weekly cost of care (£)	**£721** 633, 805	**£478** 376, 580	**£126** 39, 220	**£536** 477, 596
Time to offset rehabilitation (months)	15.7	13.8	50.0	17.0
Mean remaining life expectancy[2]	**15.7** 14.6, 16.7	**23.5** 21.4. 25.5	**26.5** 20.4, 28.7	**19.5** 18.6, 20.5
Mean annual saving in cost of care	£37,492	£24,856	£6,552	£27,872
Mean Estimated net life time savings[3]	£539,501	£555,458	£146,304	£504,106

1   Bootstrapped using samples of n=1000

2   Based on life expectancy analysis from Brooks et al 2017

3   Estimated life time savings after deduction of the cost of rehabilitation

10.4.4 Discharge destination

Table 10.7 shows the distribution of discharge destination. Overall, 55% were discharged home.

Table 10.7 Discharge destination

Discharge destination	n	(%)
Discharge to home or temporary accommodation	632	**55%**
Continued rehabilitation	159	**14%**
Nursing or residential home care	104	**9%**
Acute hospital	90	**8%**
Other/unknown	52	**5%**

10.5   Case-mix and breakdown by service

Table 10.8 summarises the distribution of programme type. Overall, 72% of admissions were for active goal-orientated rehabilitation. Assessment and management of prolonged disorders of consciousness (PDOC) accounted for 4%, but was mainly conducted in the Level 1 services.

However, a surprisingly high proportion of programmes were listed as specialist multi-disciplinary assessment. This category is designed for short admissions of up to two weeks. In fact the mean length of stay in this category was 44 (SD35) days. It is therefore possible that a significant proportion of these were misclassified programmes for disability management or PDOC assessment.

Table 10.8 Programme types and its distribution across service levels

Programme type	Total	(%)	Distribution across service level					
			HA	1a	1b	1c	2a	2b
Specialist Multi-disciplinary Assessment	256	**22%**	7%	19%	4%	27%	30%	30%
Active goal-oriented rehabilitation	830	**72%**	92%	52%	89%	73%	69%	67%
Prolonged disorders of consciousness	51	**4%**	–	28%	6%	–	–	–
Disability/slow stream management	2	**0.2%**	–	1%	–	–	–	–
Other/missing	16	**1%**	1%					3%
Total	1154		144	140	156	15	274	423

The UK FIM+FAM profile provides an evaluation of independence on admission and discharge, which can be helpful for describing and comparing case-mix. The 'FAM-Splat' provides graphic presentation of the disability profile in a radar chart.

FAM-splats may be used to depict individual scores, or the median scores for a given cohort.

Figure 10.2 shows a "FAM-splat" of the median scores for the 30 UK FIM+FAM items on admission and discharge for the whole rehabilitation group (n=1154).

Figure 10.2: A FAM-splat of the median scores on admission and discharge from rehabilitation
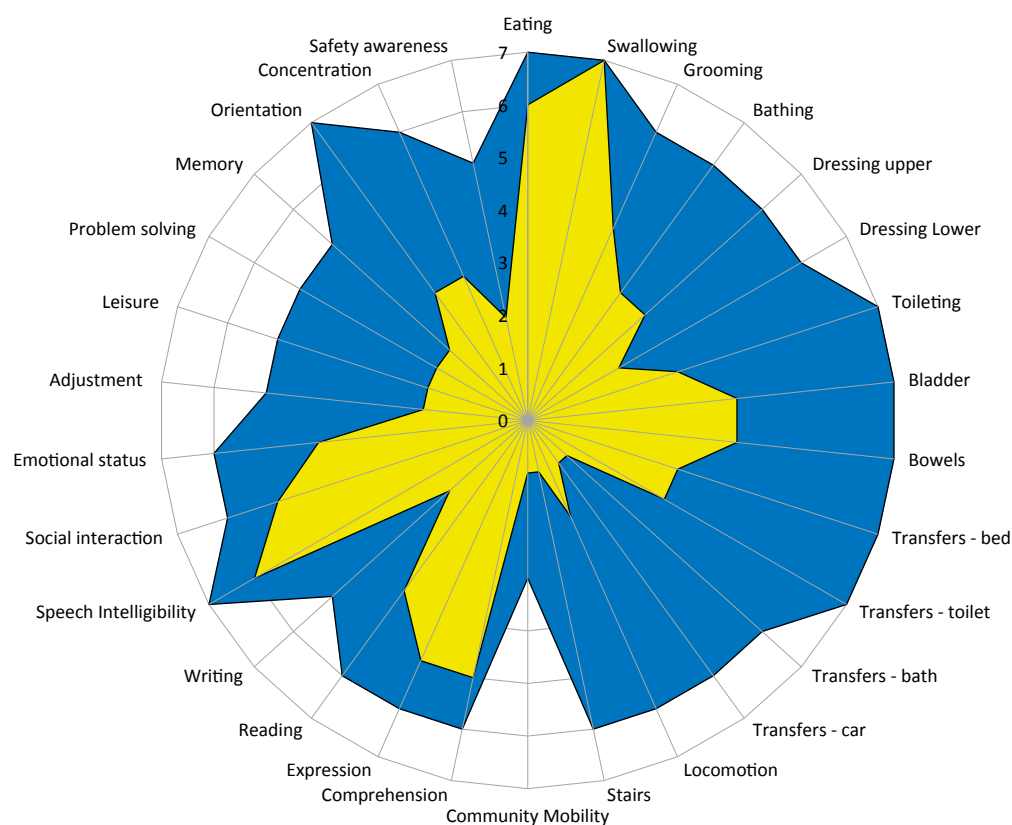
The 30 items are arranged as spokes of the wheel and the levels from 1 (total dependence) to 7 (total independence) run from the centre outwards. Thus a perfect score would be demonstrated as a large circle.

Within this and successive FAM-splats, the yellow-shaded area depicts the admission scores and the blue-shaded area represents the change in item scores between admission and discharge.

By way of comparison, Figure 10.3 illustrates the FAM-splats for the different service levels. It can be seen that the Level 1a and 1b services generally take on a more disabled group of patients than the Level 2 services.

FAM profiles vary widely between services depending on case-mix and programme type.

However, there is wide diversity of physical and cognitive disability, not only across the different service levels, but also within the various levels, depending on case-mix and programme type.

Figure 10.4, for example, shows the FAM profiles for the six Level 1a services. The majority of patients in the units at Northwick Park and RHN Putney were there for assessment of prolonged disorders of consciousness, whereas the other Level 1a units took a greater proportion of patients for active goal-orientated rehabilitation.

Meaningful comparison of outcomes would clearly require adjustment for case-mix and programme type. However, as had been anticipated, the numbers within each centre were too small in this cohort to make this adjustment. Further attempts at case-mix adjustment to define outliers were therefore not attempted.

Figure 10.3: FAM-splats broken down by service level

Level 1 Hyperacute n=113
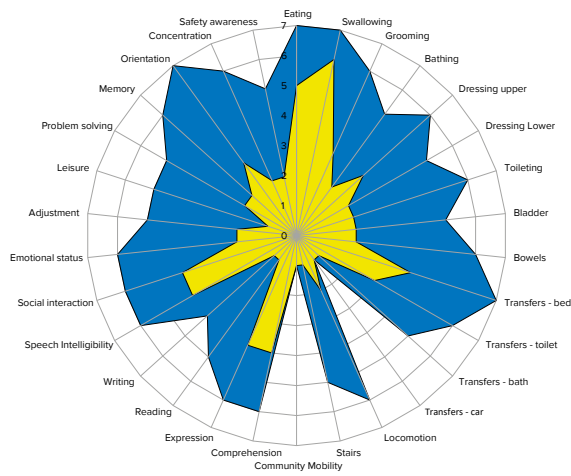
Level 1c n=14
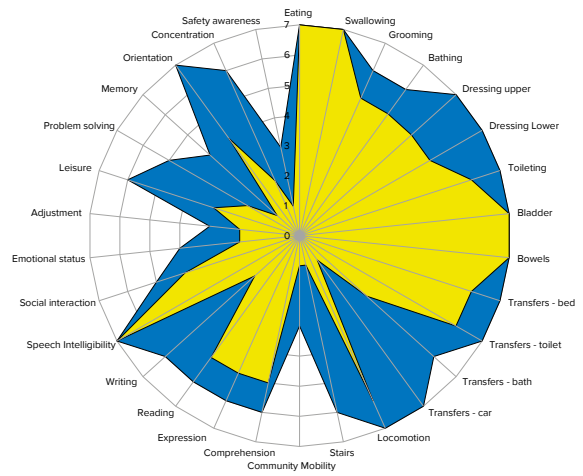
Level 1a n=113
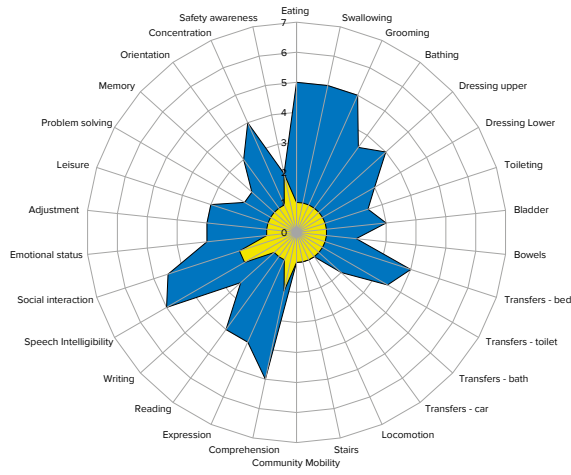
Level 2a n=252
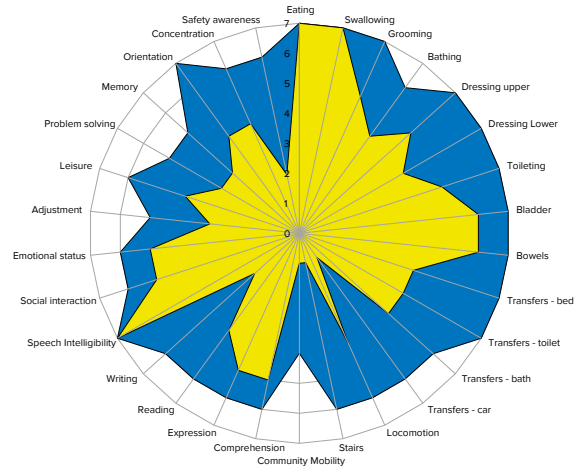
Level 1b n=153
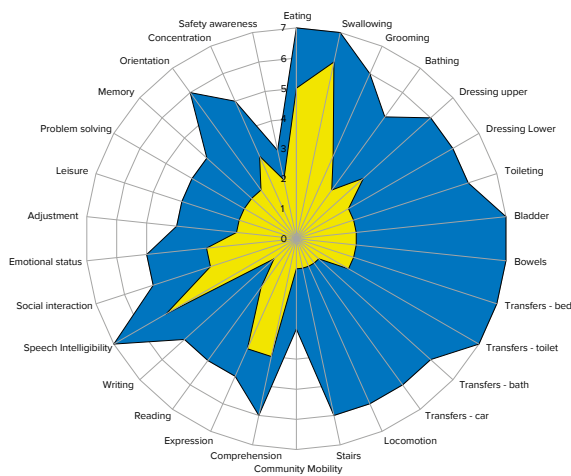
Level 2b n=377
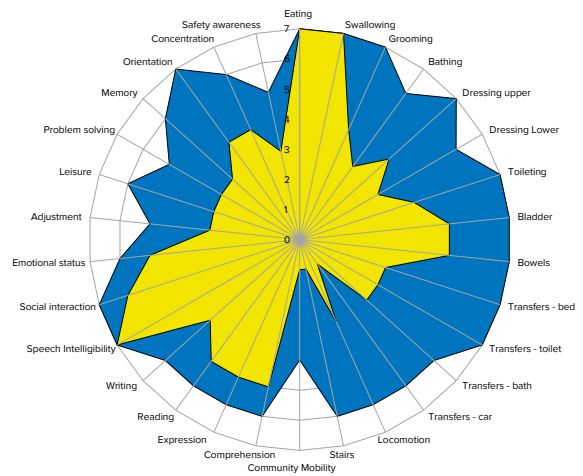
Figure 10.4: FAM-splats for the six Level 1a units

RHRU Northwick Park N=28
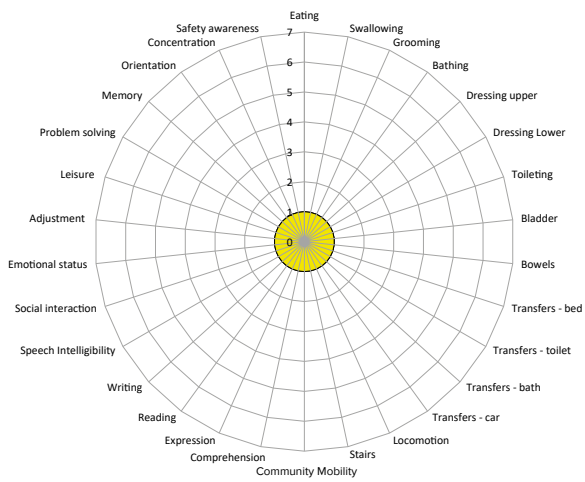
Putney N=27

Salford Ward C2 N=27
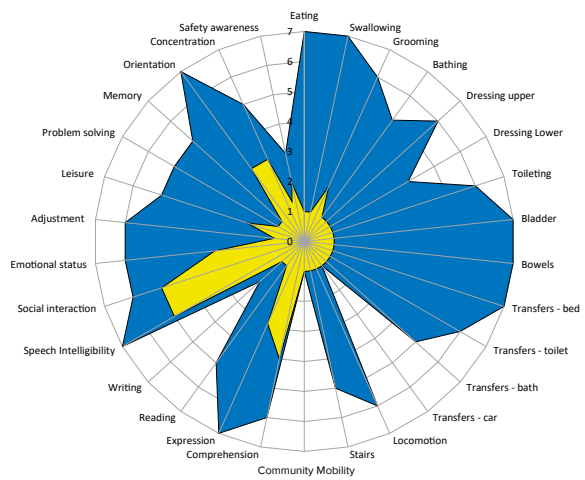
Norfolk N=17
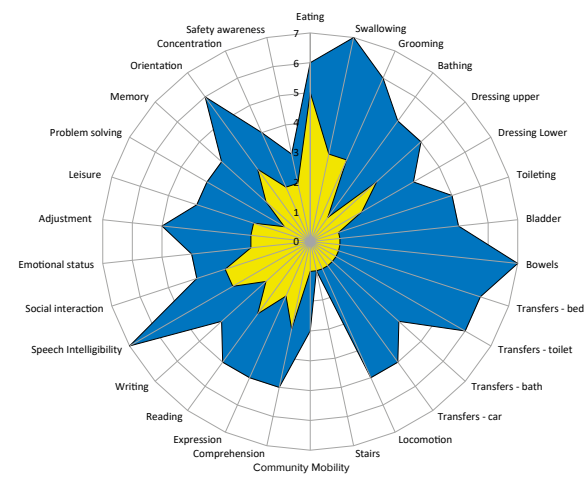
Leicester BIU N=19
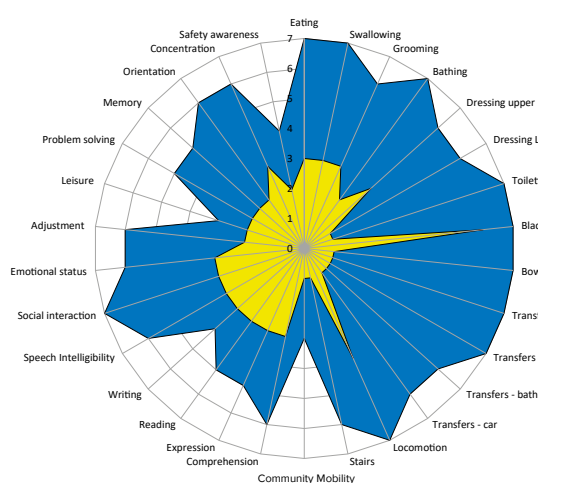
Walkergate Physical N=15
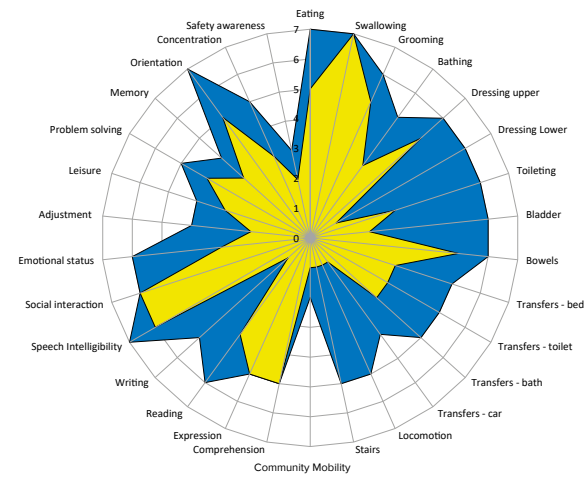
11 IMPLICATIONS FOR SPECIALIST REHABILITATION BED CAPACITY

A key underpinning question for NCASRI was whether the existing bed capacity for specialist in-patient rehabilitation was sufficient to meet demand within the patient population with complex rehabilitation needs following major trauma, and if not to estimate the bed capacity that would be required.

Unfortunately, with only a single audit cycle that probably represents incomplete capture (both in terms of recruitment and data linkage) we do not have robust data on which to estimate the shortfall in capacity to meet demand. However, from the data that we do have we can make some broad estimations as set out below.

11.1 Number of patients requiring specialist rehabilitation.

Of 1381 patients **recruited** in the 16 participating centres just **550 (40%)** completed a specialist in-patient rehabilitation programme and a broadly similar proportion of the **eligible** patients (629/1468 = 43%).

Required capacity to meet demand may crudely be estimated at approximately 2.5 times existing capacity.

This suggests that the existing capacity (1154 admissions) catered for about 40% of patients with Category A/B needs who required specialist rehabilitation – allowing for the fact a substantial number were admitted who had not been identified as requiring specialist rehabilitation when they were in the MTCs. In that case, the total capacity required to meet demand may crudely be estimated at approximately 2.5 times the existing capacity to cater for approximately 2885 patients per year.

We acknowledge that premature data linkage in this round of the NCASRI audit may have under-estimated the proportion of patients who actually received specialist rehabilitation, and if so this may have inflated the estimation of shortfall in current capacity.

On the other hand, for the reasons described in Section 6.3, this first round of audit almost certainly under-identified the number of patients with Category A/B needs.

- Although data were gathered over a 14-month period, many centres started late and recruited for well under a year (see Table 8.1). In fact, the mean recruitment period across the 16 centres was only 11 months.

- Furthermore, as acknowledged in our **Second Year Report**, the requirement to collect the detailed SpRP dataset may have deterred recruitment. Although the mean recruitment rate was 7% of the total patients with ISS≥9 requiring an RP, some of the better organised MTCs captured up to 15%.

Therefore we consider that these two factors probably cancel each other out and that the above estimation of 2885 patients per year is a reasonable one.

11.2   Total existing bed capacity in specialist rehabilitation

The **total number of patients** who actually received specialist rehabilitation from the prospective audit was 1154.

This figure is very similar to the findings from the retrospective audit in Year 1, which estimated that Level 1 and 2 services admit approximately 1000 trauma patients per year.

The **total bed occupancy** for that group of **1154** was **75,839 bed days**. This amounts to a total provision of **219 beds** at 95% bed occupancy or **3.3 per million population**.

11.3   Potential implications for increased bed capacity

CAPACITY TO MEET DEMAND

By multiplication based on the above occupancy figures:
- The **specialist rehabilitation bed capacity** in England (at 95% bed occupancy) required to accommodate **2885 patients per year** would be **547 beds** i.e. an increased provision of **328 beds** bringing the total average bed numbers **to 8.2 per million population**.

It is important to note that this figure represents the bed numbers needed for adult trauma patients only – it does not cover the bed requirement for specialist rehabilitation following other conditions. Trauma patients make up only about 20% of the patients reported to UKROC each year.

Also as noted in Section 9.1.1, patients with complex musculoskeletal rehabilitation needs were even less likely to receive in-patient specialist rehabilitation than those with neurorehabilitation needs, suggesting a particular shortfall of bed capacity for these patients.

In summary:

The current shortfall in Level 1 and 2 rehabilitation bed capacity can be estimated at approximately 330 beds.

The above figures suggest that the current shortfall in specialist Level 1 and Level 2 rehabilitation bed capacity for major trauma patients across England is approximately **330 beds**. The provision of these beds would bring the total average to approximately **8 beds per million population** for adult trauma patients.

The mean length of stay in this population was approximately 91 days and mean episode cost £39,398 (see Table 10.6). Each bed would therefore accommodate on average 4 patients per year and cost approximately £160K. The total annual cost of this increased capacity would be circa £53m.

The net recurring annual cost benefit of investment in these additional rehabilitation beds would still be in excess of £500m.

For this, or indeed any, investment to be made, it is necessary to demonstrate significant cost savings arising from rehabilitation. Applying the life expectancy algorithm that is now integrated into the UKROC dataset to the figures suggests that this one-year cohort alone generated estimated life time savings of over £582m, so that the net recurring annual cost benefit of investment in these additional rehabilitation beds would still be in excess of £500m.

A potential counter-argument for this computation is that while the NHS invests in these rehabilitation services the benefits of reducing care costs largely accrue to social services. This may be true to some extent, but the benefits to society as a whole should not be in dispute, and in light of the government's ambition towards closer integration of health and social services, the distinction should become less important in the future. Moreover, it can be seen from Table 10.6, that the biggest share of the total savings would fall in the high dependency group, which made up over half of the analysed cohort. A significant number of these patients would qualify for 100% NHS-funded continuing care, so that there would also be direct savings to the healthcare budget.

12 THE NON-REHABILITATION GROUP

It was already known that NHS Digital does not reliably collect data regarding specialist rehabilitation activity or outcomes outside of UKROC – which is one of the reasons that NHSE commissions UKROC to provide the national commissioning dataset. However, although access to UKROC is unrestricted, very few Level 3 rehabilitation services contribute data.

The purpose of this feasibility study was to explore the extent to which HES data could be used to identify patients who received further rehabilitation in the Level 3 services.

The non-rehabilitation group consisted of **831** patients with confirmed complex needs who were not admitted to a Level 1/2 specialist rehabilitation service.

Out of these patients **89** were identified as having received rehabilitation in other services registered with UKROC, leaving **742** patients for whom data was requested from NHS Digital's Data Access and Request Service (DARS).

12.1   Information from UKROC for non-Level 1 or Level 2 services

In addition to the sign-posted Level 1 and 2 units, there are also units reporting regularly to UKROC that provide slower stream rehabilitation or new services awaiting sign-posting and designation. The 89 patients in the non-rehab recruited group were admitted to one of ten services in this group – 49 of them to services awaiting signposting, potentially as Level 1 acute services, and the remaining 40 to Level 3 or slow-stream rehabilitation services.

The information set out below illustrates what can be gleaned from the data collated in UKROC.

12.1.1   Referral

In most cases (53/89, 60%) patients were referred directly from the MTC, with a further 27 (30%) being referred from a tertiary neuroscience centre. The mean response and waiting times were as follows:

- Total mean time from onset to admission was 36 days (SD 31 days) (range 0-236 days).
- Mean time from referral to assessment was 3 days (SD 6, range 0-31).
- Mean time from assessment to admission was 10 days (SD 15, range 0-95).

12.1.2   Length of stay and discharge destination

The mean length of stay was 52 days (SD 46 days) although there was a wide variation from 3-256 days. Table 12.1 summarises the discharge destination for this group. Over 40% were discharged home, but 28% were referred back to the acute hospital and 16% to further residential rehabilitation.

Table 12.1: Discharge destination for the 89 patients in rehabilitation services registered with UKROC, but not signposted to Level 1 or 2 during the recruitment period

Discharge destination	Potential Level 1 (n=49)	Slow stream (n=40)	N	(%)
Home (including temporary accommodation)	9 (18%)	28 (70%)	37	(41%)
Acute Hospital Trust	25 (51%)	0	25	(28%)
Other residential rehabilitation	11	3	14	(16%)
Nursing/residential care	2	3	5	(6%)
Other/still in hospital	2	6	8	(9%)

Table 12.2 summarises the complexity and functional gain for this group of patients, so far as this was reported.

As with the Level 1 and 2 services, patients made significant functional gains. Some of the patients had similar levels of complexity and dependency to those in the designated Level 1 and 2 services, suggesting that there are additional rehabilitation units out there that would be eligible for designation and commissioning as a Level 1 or 2 service.

This analysis demonstrates the feasibility of capturing information on caseload complexity and functional outcome, so long as this is collected and reported systematically.

Table 12.2: Main Outcome Measures

	Admission	Discharge	Change	
	Mean 95% CI[1]	Mean 95% CI	Mean[1] 95% CI	P value[3]
Rehabilitation needs and complexity				
PCAT[2] (n=63)	**34.8** 33.4, 36.2	-	-	-
RCS-E v12 (n=80)	**13.6** 13, 14.2)	**11.5** 10.2, 12.7	**4.1** 3.3,4.9	**0.001**
Functional gain and reduced dependency				
UK FIM+FAM (n=75)				
Total score	**89.5** 78.5,101.3	**148.7** 135.6, 161.2	**59.2** 49.7, 68.2	**<0.001**
Motor Subscale	**47** 40.6, 54.1	**78.4** 70, 86.7	**31.4** 25.6, 37.2	**<0.001**
Cognitive Subscale	**42.5** 36.7, 48.6	**70.3** 64.5, 76	**27.8** 22.9, 32.6	**<0.001**

1 Bootstrapped using samples of n=1000

2 PCAT scores are recorded only on admission.

3 Significance of change on Paired T tests.

12.2   Information from HES and ONS mortality data

Data were requested through NHS Digital's Data Access and Request Service (DARS) for information for the **742** patients identified as having Category A or B needs in TARN where a match had not been found in the UKROC dataset.

Data were received from DARS for **706 (95%)** of these patients.

Potential reasons for information not being available about the remaining **36** patients include:

- Missing or invalid NHS numbers recorded in TARN.

- Missing information in HES.

- Patients having registered a Type 2 opt-out preventing release of their data by DARS.

12.2.1   The patient pathway

Within the Hospital Episode Statistics (HES) dataset, each in-patient stay within a single provider is referred to as a 'spell', with each spell made up of one or more episodes.

Where specialist rehabilitation takes place, this should occur as an episode within the same or a subsequent spell as the MTC activity depending on whether the same provider was involved and whether the patient was discharged in the meantime.

Two example pathways are shown in Figure 12.1 below:

Figure 12.1: Example patient pathways recorded in in HES
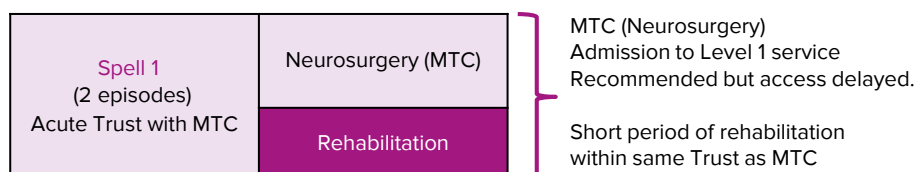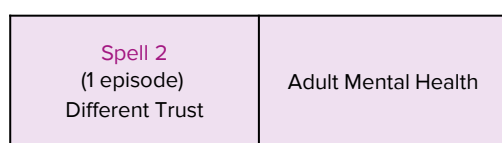
Example 1

Example 2:
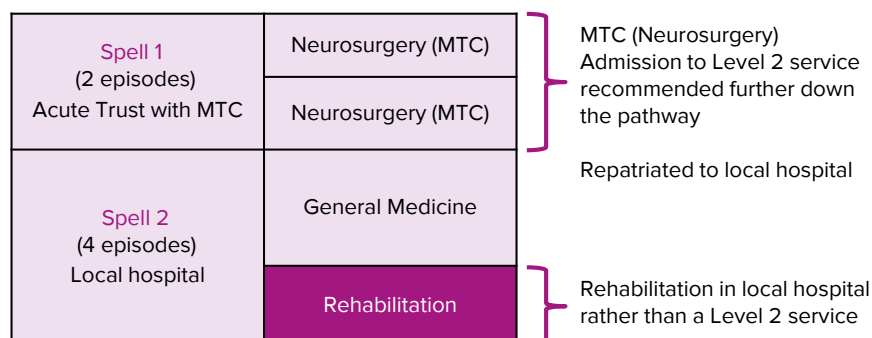
12.2.2 Further hospital treatment and discharge destination

Twenty-nine (4%) patients had died within 180 days (6 months) of discharge from the MTC, leaving 677 patients to trace. At the time of linkage in December 2017, a further 10 (total 39 (6%)) had died.

62% of patients had further inpatient treatment after leaving the MTC. The mean length of stay was approximately 6 weeks.

Table 12.3 summarises the further stay in hospital during the 6 months after discharge from the MTC. A total of 420 (62%) had further inpatient treatment after leaving the MTC. The mean length of stay was about 6 weeks (46 nights) – with a mean range of 14-63 across the different regions.

Table 12.3 Further in-patient stay in hospital after discharge from the MTCs by MTN

MTC Network	Patients	Further in-patient treatment		Mean Nights (if yes)
		No	Yes	
Newcastle	110	57	53	51
Middlesbrough	10	3	7	14
Hull	10	1	9	44
Manchester Salford	16	2	14	52
Liverpool Walton	44	8	36	58
Sheffield	16	8	8	23
Birmingham	88	39	49	44
Coventry	23	9	14	43
Nottingham	29	6	23	47
Cambridge	92	48	44	42
Bristol	126	46	80	40
NW London	35	9	26	56
SW London	17	5	12	33
Southampton	39	13	26	54
Plymouth	20	3	17	63
Stoke-on-Trent	2	0	2	26
Total number of patients	**677**	**257**	**420**	**46**
Overall Percentage	**100%**	**38%**	**62%**	

Table 12.4 shows the overall discharge destination at 6 months post discharge and at the

time of linkage. 466 (61%) had been discharged home or to temporary accommodation by 6 months post discharge. This number had risen to 577 (79%) by the time of data linkage in December 2017, however 10% were still in hospital.

This once again confirms that the status for many of these severely injured patients is still changing more than 6 months post injury, and that a longer follow-up period is therefore needed to capture the true outcomes.

Table 12.4 Discharge destination 6 months post discharge from the MTC and at the time of data linkage

Discharge destination (following most recent in-patient stay)	Up to 180 days post MTC	%	By linkage December 2017	%
Died	29	**4%**	39	**6%**
Usual place of residence or temporary accommodation	466	**61%**	557	**79%**
Still in hospital (NHS or independent)	178	**23%**	70	**10%**
Nursing or residential care home	22	**3%**	27	**4%**
Psychiatric hospital (medium/high security)	5	**1%**	6	**1%**
Penal establishment	3	**0%**	3	**0%**
Unknown	3	**0%**	4	**1%**

12.2.3 Provision of Rehabilitation outside registered UKROC services

There are a number of fields in HES that could potentially be used to identify specialist rehabilitation activity:

12.2.3.1 Health Resource Group Codes

Case-mix within the NHS is normally analysed using Health Resource Group (HRG4+) codes, which are generated using payment grouper software published by the National Casemix Office and NHS Digital each year.

HRG4+ codes include series of HRGs that are designed to identify admission episodes that are solely or predominantly for the purpose of rehabilitation.

- HRG codes relating to specialist rehabilitation are 'unbundled' which means that, rather than appearing as the primary HRG code associated with an episode, they are added as supplementary codes.

- The grouper software optionally takes a number of rehabilitation days as one of its inputs, which is used to adjust the length of stay associated with the primary HRG code for the episode and determine the number of unbundled rehabilitation HRGs that should be added.

Unfortunately, HES does not include details of either the original unbundled HRG codes allocated to each episode, or the number of rehabilitation days, which are only contained within SUS data, to which we did not have access.

As a result, although the grouper software was re-run using the data received from DARS, it was not possible to distinguish between episodes which were <u>solely for the purpose of providing rehabilitation</u> from episodes which were predominantly for some other purpose, but which included an element of rehabilitation.

Nevertheless we identified the episodes that had a specified Rehabilitation HRG. There were 137 such episodes in 112 patients, reflecting 16% of the 677 surviving non-rehabilitation group.

Table 12.5 shows the breakdown of rehabilitation HRGS within the dataset. As expected the most common unbundled rehabilitation HRGs were for spinal cord injury, brain injury and musculoskeletal disorders – the latter presumably reflecting poly-trauma. Together these accounted for three-quarters of the HRG codes – comprising 12% of the surviving non-rehabilitation group.

Table 12.5: Breakdown of episodes with an unbundled HRG for rehabilitation.

HRG	Description	Patients	Episodes
VC08Z	**Rehabilitation for Spinal Cord Injuries**	41	**46**
VC06Z	**Rehabilitation for Brain Injuries**	22	**24**
VC24Z	**Rehabilitation for Other Musculoskeletal Disorders**	18	**18**
VC42Z	**Rehabilitation for Other Disorders**	13	**17**
VC12Z	**Rehabilitation for Other Neurological Disorders**	8	**9**
VC36Z	**Rehabilitation for Other Trauma**	8	**8**
VC04Z	**Rehabilitation for Stroke**	5	**6**
VC14Z	**Rehabilitation for Amputation of Limb**	4	**6**
VC02Z	**Assessment for Rehabilitation, Multidisciplinary, Non-Specialist**	1	**1**
VC16Z	**Rehabilitation for Hip Fracture**	1	**1**
VC26Z	**Rehabilitation for Drug or Alcohol Addiction**	1	**1**
	Total with one or more rehabilitation HRG codes	**112**	**137**

12.2.3.2 Treatment specialty (TRETSPEF)

The treatment specialty (TRETSPEF) indicates the main specialty under which the lead consultant was working during each relevant episode. In the absence of the relevant information needed by the payment grouper to identify the proportion of days that should be allocated to rehabilitation HRGs within an episode, the treatment specialty value provides a possible way of separating out episodes in a rehabilitation service from those in which some rehabilitation was provided as part of an episode primarily occurring for other purposes.

Table 12.6 shows the patients and episodes with a TRETSPEF code for rehabilitation.

TRETSPEF	Description	Patients	Episodes
314	Rehabilitation Service	56	66
344	Complex Specialised Rehabilitation Service	3	4
345	Specialised Rehabilitation Service	0	0
346	Local Specialised Rehabilitation Service	0	0

TRETSPEF codes 344 and 345 are intended for use by Level 1 or Level 2 specialist rehabilitation services. Using the treatment speciality may miss some cases where rehabilitation is routinely provided by other consultants working in other specialties.

The treatment specialty codes suggest that a total of 59 patients (8%) may have been admitted to a Level 3 rehabilitation service. Forty of these (46 episodes) also had one or more unbundled rehabilitation HRG as shown in Table 12.7 but 19 did not.

Table 12.7: Breakdown of HRG codes for patients with a treatment specialty for rehabilitation.

HRG	Description	Patients	Episodes
VC06Z	**Rehabilitation for Brain Injuries**	13	14
VC42Z	**Rehabilitation for Other Disorders**	9	10
VC24Z	**Rehabilitation for Other Musculoskeletal Disorders**	9	9
VC12Z	**Rehabilitation for Other Neurological Disorders**	4	5
VC36Z	**Rehabilitation for Other Trauma**	4	4
VC14Z	**Rehabilitation for Amputation of Limb**	3	5
VC08Z	**Rehabilitation for Spinal Cord Injuries**	1	1
VC04Z	**Rehabilitation for Stroke**	1	1
VC16Z	**Rehabilitation for Hip Fracture**	1	1
VC02Z	**Assessment for Rehabilitation, Multidisciplinary, Non-Specialist**	0	0
VC26Z	**Rehabilitation for Drug or Alcohol Addiction**	0	0
	Total with one or more rehabilitation HRG codes	**40**	**46**
None	**Patients/episodes with no rehabilitation HRG code indicated**	19	24
	Total with TRETSPEF identified as rehabilitation	**59**	**70**

12.2.3.3 OPCS 4 and ICD-10 codes

The unbundled HRG codes for specialist rehabilitation generated by the payment grouper are triggered by the presence of specific OPCS-4 codes (Office of Population Censuses and Surveys Classification of Interventions and Procedures version 4). While each OPCS-4 code has an associated treatment date, there is no indication of the duration of the treatment.

Diagnosis is recorded within HES using ICD10 (International Statistical Classification of Diseases and Related Health Problems 10th Revision). Section XXI (codes Z00-Z99) allows factors influencing heath status and contact with health services to be indicated, with codes Z50.0 – Z50.9 being specifically for "care involving use of rehabilitation procedures".

Table 12.8 shows the patients and episodes with an ICD-10 code related to rehabilitation. However, many of the ICD10 codes in this range relate to a single discipline and are therefore insufficient to indicate specialist rehabilitation settings involving a multi-disciplinary team.

Moreover, these ICD10 Z codes are rarely recorded and are not referred to by the payment grouper for the purpose of allocating unbundled rehabilitation HRG codes.

Table 12.8: Breakdown of episodes with an ICD10 code related to rehabilitation.

ICD-10	Description	Patients	Episodes
Z50.1	**Other physical therapy**	88	111
Z50.7	**Occupational therapy and vocational rehabilitation**	50	57
Z50.8	**Care involving use of other rehabilitation procedures**	22	35
Z50.5	**Speech therapy**	21	25
Z50.9	**Care involving use of rehabilitation procedure, unspecified**	16	23
Z50.4	**Psychotherapy, not elsewhere classified**	7	7
Z50.2	**Alcohol rehabilitation**	3	3
Z50.0	**Cardiac rehabilitation**	0	0
Z50.3	**Drug rehabilitation**	0	0
Z50.6	**Orthoptic training**	0	0
	Total with one or more ICD 10 code in Z50.0-Z50.9 range	**136**	**181**

12.2.4 In summary:

Our findings demonstrate that it was not possible to extract any meaningful data from HES on either the rehabilitation activity or outcomes for patients who had complex needs for rehabilitation, but have not appeared within the UKROC database.

We can tell that, at the time of data linkage in December 2017, 79% of these patients had been discharged home or to temporary accommodation and 4% to nursing or care homes. This left about 17% who were still in some sort of hospital bed.

The data demonstrate that some of these patients spend quite some time in hospital and it is possible therefore that a proportion of them may still be engaged in Level 1/2 specialist in-patient programmes and have yet to appear in the UKROC dataset (which can take up to 2 months post discharge).

However, the majority have now been discharged home and are likely to have received whatever rehabilitation they did either as part of an acute admission or in a Level 3 rehabilitation service.

- Approximately 16% appear to have had at least one episode within their ongoing spell of treatment where rehabilitation was the sole or predominant reason for rehabilitation – but it is not possible to tell which.

- Neither is it possible to attach dates to these episodes so we do not know how long they remained in the rehabilitation service.

- In addition, NHS Digital does not collate any meaningful outcome data for rehabilitation patients, other than simple discharge destination.

Given the time and expense involved in obtaining permission for data linkage with DARS and then obtaining and analysing the data received, we do not consider that any future linkage with these datasets would be effective or worthwhile until the extent of rehabilitation data and outcomes captured by HES improves.

13 LESSONS LEARNED AND THE LEGACY OF NCASRI

13.1 Reflections from NCASRI

NCASRI is unusual for an NCAPOP audit in that it encompasses a very small number of patients with highly diverse needs, managed across an equally diverse range of services. A number of challenges were recognised from the outset that would require the NCASRI team and HQIP to work closely together in problem-solving mode.

One of the founding principles of the NCAPOP programme is to embed audit into clinical practice, so that it may continue to improve clinical practice and outcomes for patients after the end of the funded programme.

A number of challenges have been identified in the course of NCASRI, which were discussed in detail in our **Second Year report**. We listened to the teams on the ground, and to other stakeholders including patients and members of the public, about what was working and what was not, in order to try to incorporate their feedback in our plans for future rounds of the audit. Even though the audit is not continuing we have learned some important lessons, which are summarised below.

13.1.1 The very low starting base of knowledge, data recording and service provision

At the outset we did not know where the services were, how the MTCs and specialist rehabilitation services operated together, nor how many patients required specialist rehabilitation following major trauma. Because some specialist rehabilitation services are commissioned locally by CCGs (Clinical Commissioning Groups) and others centrally by NHS England, little information was shared between them. There was no clear coordinated pathway to identify patients with complex rehabilitation needs or to direct them to the most appropriate rehabilitation service.

- Fewer than half the MTNs complied with the national recommendation for consultants in Rehabilitation Medicine (RM) to be appointed to provide clinical and strategic leadership of acute trauma rehabilitation services, and many MTCs had little or no input from RM consultants at any level.

- A Rehabilitation Prescription (RP) was a requirement for the enhanced 'best practice' tariff in the MTCs, but in the absence of central guidance on what form the RP should take, individual MTCs had each developed their own systems with little commonality between them. Some were using computerised systems, and others paper copies. The mandated data collection comprised just 4 data fields in the TARN database.

- Although the BSRM standards had recommended a Specialist Rehabilitation Prescription (SpRP) to detail the needs of patients requiring further in-patient specialist rehabilitation when they were ready to leave the MTC, few MTCs were using these systematically.

13.1.2 Engagement of MTC teams

During the planning phase, many MTC teams reported that they were clinically overwhelmed and struggled to collect and enter data at any level.

To support enrolment for the prospective audit, the NCASRI team worked with the individual MTCs to try to find solutions that would fit in with their local practice and existing data collection systems to avoid duplication of effort. To reduce burden on clinicians, we accepted data from all the existing platforms and undertook computer data entry for this first round. However, this is not sustainable going forward. Any future linkage will include only data entered onto the TARN database.

The original model for data collection proposed by the BSRM was that an RM consultant would be responsible for drawing up the SpRP and completing the tools. This did not prove workable, especially in those MTCs that lacked RM consultant input, therefore alternative solutions were explored. Working with the MTC staff, a **minimum core dataset** has been developed that they felt would be manageable and useful. This may be completed by any suitably experienced member of the clinical multidisciplinary team.

Despite these various efforts to facilitate engagement, only 16/22 MTCs participated. Nine started on schedule in July 2016 and seven more joined later in the year. Enrolment was extended until 31st August 2017 to accommodate the late starters with the aim of trying to ensure a full dataset for at least 500 patients. Although some of the later starters collected data for well under 12 months, the average enrolment period across all 16 centres was 11 months.

Despite this somewhat slow start, the majority of MTC teams responded magnificently and increasingly gained momentum. The eventual yield was substantially greater than expected with a total of 1381 patients recruited prospectively. We are extremely grateful to MTC staff for their hard work and enthusiasm despite being clinically over-stretched.

13.1.3 Case ascertainment and completeness of capture

Despite the greater-than-expected numbers, the recruitment process almost certainly missed a proportion of eligible patients with Category A/B needs for several reasons that included:

- The delayed start for 7 MTCs and non-participation of 6 of them.
- The lack of RM consultants in many MTCs to assist with identification of complex needs for rehabilitation.
- The burden of data collection for the full SpRP dataset, which may have deterred recruitment. Although the mean recruitment rate was 7% of the total patients with ISS≥9 requiring an RP, some of the better organised MTCs captured up to 15%.

For these reasons, we undertook both forward and backward data linkage. This revealed that only about 40% of patients with Category A/B needs requiring further specialist in-patient rehabilitation after leaving the MTC had actually received this by the time of data linkage in December 2017.

Once again, the group of patients who received rehabilitation may not have been fully captured because, as noted in our **First Year report**, it can take up to 12 months for patients to complete their rehabilitation programme and appear in the UKROC database. For this audit round, data linkage was conducted just 3½ months after the end of recruitment so some patients may still have been undergoing rehabilitation. The DARS analysis demonstrated that 10% of patients were still in hospital at the time of linkage, so it is possible that patients still in rehabilitation were amongst these. In addition, we know that some patients are actually discharged from acute hospitals (either to home or a nursing home) and subsequently re-admitted for specialist rehabilitation. So it is possible that a proportion of the 584 patients discharged to these destinations may yet have required re-admission. The only way It would be possible to know for certain is by further linkage of the dataset from autumn 2018.

13.1.4   Scope of NCASRI – limitation to a small group of patients

Concerns have been expressed by a number of stakeholders, including our PPI members, about the highly specialised nature of NCASRI, confined as it is to just the small group of patients with highly complex needs, rather than encompassing the wider group with Category C and D needs for whom Level 3 rehabilitation services are also sparse.

As noted in our **Second Year report** the scope of NCASRI was largely out of our hands. The original topic proposal for NCASRI was more widely based, encompassing all three levels of rehabilitation service, but the scope was restricted to Level 1 and 2 specialist rehabilitation by the funders, partly to avoid duplication of the development work on the standard Rehabilitation Prescription (RP) which was on-going through the CRG for major trauma.

However, it was always intended that these parallel streams of work should come together more closely for Years 4-5. Hence, we have worked alongside the RP Task and Finish Group to try to incorporate the lessons learned from this first round of NCASRI to inform a more integrated process of data collection for the future.

13.1.5   Integration with the standard Rehabilitation Prescription (RP)

During the course of this audit, five additional data fields were added to the TARN database related to discharge planning as described in Section 9.1 of this report. These included the category of needs, the recommended and actual types of further rehabilitation required and the recommended and actual discharge destination.

The RP Task and Finish Group has recently produced its recommendations for an expanded dataset to be included as part of the mandated requirement for the enhanced 'best practice tariff' within the MTCs. The proposed mandated dataset includes these discharge-planning fields including the clinical categorisation of rehabilitation needs

Accurate assessment of the category A/B needs requires completion of either the PCAT or the CNC.

These have the potential to be very useful, but as our analysis shows, completion is currently unreliable and inconsistent. In particular the TARN clinically-assisted category of needs proved no better than chance in identifying the category of need as confirmed by either the Complex Needs Checklist (CNC) or the Patient Categorisation Tool (PCAT). Further training and guidance is clearly required for the MTC teams and TARN coordinators to assist accurate reporting of these important data.

The proposed RP fields expand slightly on the types of physical, cognitive and communicative problems that may require rehabilitation, which is a further welcome development. However, they do not provide information on the types of rehabilitation input and resources required. This is essential information that is required to ensure the development of services that meet the range of needs in such a diverse group of patients.

While we recognise the importance of finding a balance between the information required and the burden of data collection, it is important that MTCs continue to have the facility to collect such information for the purpose of local development and service planning.

Patients identified within the standard RP dataset as having Category A/B needs should also have a CNC and RCS-E recorded.

We therefore recommend that patients identified within the standard RP dataset as having Category A/B needs should also have a CNC and RCS-E recorded. This will not only provide important information about rehabilitation resource requirements going forward, it will also help as part of training for MTC teams, to improve awareness of the types of rehabilitation requirements that constitute Category A and B needs for specialist rehabilitation. As this group comprises just 10-15% of the total patients requiring an RP, we do not think this will impose excessive burden on MTC teams.

13.1.6   Capacity requirements for specialist rehabilitation

As noted in Section 11 of this report, a key question underpinning the work of the NCASRI was whether the existing bed capacity for specialist in-patient rehabilitation was sufficient to meet demand within the patient population with complex rehabilitation needs following major trauma,. If this was not the case, we hoped to estimate the bed capacity that would be required.

In the course of this one audit cycle, it has not been possible obtain definitive data on which to make a robust estimation of the shortfall in capacity to meet demand. However, from the data that we have, we estimate that the current total provision of approximately 220 beds in England for specialist rehabilitation (3.3 per million population) represents a shortfall of approximately 330 beds. The total requirement is approximately 8 beds per million population.

Expansion of hyper-acute rehabilitation capacity could help to reduce waiting times for transfer and relieve pressure on the MTCs.

We emphasise that this requirement relates to rehabilitation for adult trauma patients only (which represent about 20% of the total population requiring specialist rehabilitation). Also that the group of patients with complex musculoskeletal injury (including complex pelvic fractures) are particularly poorly catered for in comparison with patients with neurological injuries (e.g. brain and spinal cord injury). In addition, a substantial part of the waiting time for rehabilitation was taken up with stabilising the patients. Hyper-acute rehabilitation services are designed to take patients at an early stage in the pathway when they still have unstable medical needs. Currently there are only 3 registered hyper-acute rehabilitation units in England. Expansion of hyper-acute rehabilitation capacity could help to reduce waiting times for transfer and so relieve pressure on the MTCs.

13.1.7 Looking to the future

This first round of NCASRI has been helpful insofar that it has:

a. Raised awareness of the need for specialist rehabilitation following major trauma.

b. Identified some major gaps in service provision and made recommendations for improvement.

c. Established a manageable minimum dataset for future audit cycles.

The adoption of at least part of the dataset as a mandated requirement for the best practice tariff will provide an opportunity for future audit and data linkage between the TARN and UKROC datasets, provided the appropriate permissions are in place.

The dataset collected for this first round of NCASRI is a uniquely valuable and rich dataset, which includes the detailed information contained within the five SpRP tools. This is the only time that this detailed information will be collected, and it is important to make full use of it to understand the complex needs of patients requiring rehabilitation. Some of these data have been presented within the report, but there is much still to be learned from further exploration.

It is also important not to miss the opportunity for further linkage for this dataset, bearing in mind the likelihood that data linkage within the limited timescale of this first audit round will have missed a proportion of patients who are still undergoing rehabilitation.

To this end we have worked with the HQIP team, TARN and the Health Research Authority Confidentiality Advisory Group to salvage the linked dataset and transfer the data to TARN as data controller after the end of this audit. Thereafter UKROC and TARN will apply for permissions to complete linkage for the data collected within the course of this first round of audit in order to try to maximise the return on all the hard work put in by the clinical teams on the ground and to maximise the benefit for patients. Further opportunities for linkage going forward will be explored subject to future funding and contracting arrangements.

13.2 Benefit to patients

The primary aim of any clinical audit is to improve the quality of care offered to patients. Demonstration of improvement in care from any audit is dependent on completing the audit cycle – or indeed the 'audit spiral' that implies progressive improvement through repeated rounds of audit, rather than simply going round in circles and ending up back where one started (42).

Sadly, termination of NCASRI at the end of the first audit round has prevented the opportunity to do either of these. But can we still demonstrate improvements in patient care that has benefitted patients or could do so in the future?

We believe that answer to both of these is 'yes' – provided that it is accepted that providing timely access to appropriate specialist in-patient rehabilitation for those patients who need it is of benefit to both patients and their families. This is supported by strong evidence from the literature (12) (15-17) that the patients who receive rehabilitation make significant improvements in their ability to function independently (12) with reduced dependency on others to care for them, and so less burden on their families and indeed society in general (15-17). There is also evidence that early access to rehabilitation is associated with improved outcomes (13, 14).

13.2.1 Early identification of rehabilitation needs

The first fundamental step in this process is being able to identify those patients who require specialist rehabilitation. At the outset of NCASRI, the concepts of the RP and specialist RP existed, but they were not systematically implemented in a manner that would support comparison. MTC staff were aware that Level 1 and 2 services existed, but were not sure where they were or how to identify the people with Category A/B needs who required them.

The processes and data collection introduced for this audit have helped to improve the knowledge of staff on the ground about where the relevant services are, who needs them and how to refer. The further development and refinement of the Standard RP that has proceeded alongside NCASRI will undoubtedly help to embed some of this knowledge into clinical practice going forward and improve it further.

13.2.2 Improved access to rehabilitation

Even within the short timeframe of this audit, there is some evidence of earlier access to rehabilitation. In the baseline analysis of specialist rehabilitation for trauma patients presented in our **First Year report,** the mean waiting time from referral to assessment for rehabilitation was 9 days, compared with just 6 days in the NCASRI prospective cohort. Appendices 5a and 5b show clear improvement in reporting standards by the rehabilitation providers, helping to ensure accurate assessments.

The waiting time from referral to admission was reduced by a mean of 6 days when patients were identified as having Category A/B needs while still in the MTCs.

In addition, the total waiting time from referral to admission was reduced by a mean of 6 days in the recruited patients who were identified as having Category A/B needs in the MTCs compared with the non-recruited patients whose needs were either not assessed or not recognised.

These improvements provide at least some evidence that that the process introduced by NCASRI may have produced some measureable clinical benefit, even within this first round.

13.2.3 Future benefits

As the NCASRI programme is not continuing, future developments will depend on the extent to which the findings and recommendations presented in this report are taken up by clinicians and by service planners and commissioners.

We have identified shortfalls in a number of areas, including a dearth of consultants within the MTCs to help identify patients with complex needs and to expedite their referral to appropriate services.

It was recognised that there is insufficient bed capacity within specialist rehabilitation to cater for all the patients who require this level of support. While it is not possible to quantify the shortfall with a high degree of certainty, we have made an estimate of the additional capacity required (330 beds in England) which is credible and resonates with experience.

13.3   Strengths and weaknesses of our approach

We recognise some weaknesses but also some strengths to this first round of NCASRI.

13.3.1   Weaknesses

1. The most obvious weakness is that the programme has been terminated after just one round of audit. The basic quality criterion of any audit is the completion of at least one audit cycle, in order to make recommendations for improvement, implement change and then evaluate the impact of those changes. While we have been able to identify some small benefits in waiting times for assessment and transfer to rehabilitation assessment, simply as a result of the audit taking place, there will be no opportunity to evaluate the wider recommendations for improvement under the programme through continuation of the audit spiral as has been the case in other NCAPOP audits (e.g. the Stroke Sentinel programme).

The time constraint of the programme was a significant weakness.

2. A second weakness is the time constraint of the programme, which meant that linkage occurred just 3½ months after the end of recruitment, when some patients may still be undergoing treatment in the Level 1 and 2 services, and so will not yet have appeared in the UKROC database. This means that we may have under-estimated the extent of specialist rehabilitation provision. In our **Second Year Report** we feared that this might be as much as 50%. However from the HES data linkage it appears that 10-20% may be a closer figure.

3. The third weakness is that the second round of audit, started in September 2017, was terminated in January, after the decision was announced by the funders not to grant an extension for years 4 and 5. This data do not form part of the salvaged dataset and will not now be analysed as part of NCASRI.

    –   We will not now know whether application of the reduced dataset in a wider group of patients would have led to more accurate identification of patients with Category A/B needs.
    –   In addition, our aim to address concerns about the limited scope of the audit in its first 3 years and extend it to wider population of patients with Category C and D needs requiring Level 3 (non-specialist) rehabilitation after trauma will not now be realised through this national audit programme.

13.3.2 Strengths

However the programme has also had some important strengths:

1. Although starting from a very low base of both service provision and data collection, we worked closely with clinical teams on the ground to develop a minimum dataset that would both inform clinical decision-making and embed ongoing data collection into routine clinical practice, so that audit can continue after the end of the programme. We have been working alongside the National Clinical Director for Trauma and TARN to assist with the development of the Standard RP, which has been successful to a degree. It is hoped that the findings and recommendations from this report will continue to inform the development of the Standard RP in order to optimise the provision of rehabilitation for patients according to their individual needs.

The novel approach to case ascertainment with bi-directional data linkage enabled us to make a reasonable estimation of the shortfall of capacity.

2. One of the key questions for NCASRI was whether the existing bed capacity for specialist in-patient rehabilitation was sufficient to meet demand for patients with complex rehabilitation needs following major trauma, and if not, to estimate the bed capacity that would be required. We addressed this question by using a novel approach to case ascertainment with bi-directional data linkage and have managed to make a reasonable estimation of the shortfall of capacity. While a second round of audit would be been helpful to refine this estimation, it is nevertheless a useful start.

3. As a result of the above we have been able to make recommendations towards improvement of services. Some of those recommendations will require MTNs to work closely with commissioners, both in NHSE and CCGs to address the identified shortfall in provision of specialist rehabilitation – both in terms of consultant input into the MTCs and specialist in-patient bed capacity.

14 SUMMARY OF PERFORMANCE AGAINST THE STANDARDS AND RECOMMENDATIONS

Table 14.1 summarises the key findings in relation to the standards set for NCASRI.

Table 1 4.2 sets out the key recommendations.

Table 14.1 Summary of performance against the standards

Structure and organisation	Summary of performance
RM consultants should be closely involved both at a clinical level and in the planning and delivery of all Major Trauma Networks to support and direct rehabilitation for patients with complex needs. • Within each Major Trauma Centre (MTC) an identified RM consultant (or consultants) should be an integral part of the MTC Team. • Involvement of an RM consultant, attending the MTC or TU at least 2–3 times per week. This should be written into their job plan. • At an operational level, key roles for the RM consultant should include rounds of multi-disciplinary wards and team-based planning meetings.	Fewer than half the MTNs complied with the national recommendation for consultants in Rehabilitation Medicine (RM) to be appointed to provide clinical and strategic leadership of acute trauma rehabilitation services. Many MTCs had little or no input from RM consultants at any level. • 10/22 MTCs (**45%**) had less than the 2-3 visits per week from a consultant in RM. • 4 MTCs (**18%**) had no input at all. It was acknowledged that this posed a risk for the prospective audit. • Just **16/22** MTCs participated in this first round of audit. • Four of the six non-participating MTCs had no RM consultant input.

1. Process within the MTC		Summary of performance
1.1	All patients with ISS scores ≥9 should have a Rehabilitation Prescription (RP).	Overall, **90%** of patients with ISS ≥9 had an RP • Compliance rates ranged from **81-100%** across the 22 MTCs.
1.2	Rehabilitation planning (including the commencement of the RP) should start within 48 hours of admission.	The mandated data collection prior to NCASRI comprised just 4 data fields in the TARN database, providing little useful information about rehabilitation needs.
1.3	A consultant in RM should be involved from an early stage in the patient's trauma pathway (within 3 calendar days) to assess patients with complex rehabilitation needs, to participate in their rehabilitation planning, and to expedite onward referral. This will normally involve a consultant in RM attending the MTC or TU at least 2–3 times per week.	• Timing of the start of rehabilitation planning or consultant input is not formally collected on TARN. • As noted above 45% of MTCs had less than 2-3 visits per week.

1. Process within the MTC		Summary of performance
1.4	*Patients thought likely to have complex rehabilitation needs requiring specialist in-patient rehabilitation should have the following completed by the MTC team:* • *Rehabilitation Complexity Score (RCS-ET).* • *Checklist of complex needs (CNC).*	In this first round of NCASRI, of 1,458 enrolled patients with Category A/B needs **74%** had an RCS score and **42%** had a CNC recorded. (NB: The minimum dataset requirements were clarified only during the latter part of data collection for Round 1. As the RCS-E and CNC were part of that agreed minimum dataset, it is likely that reporting rates would have been better in Round 2 had this continued, but this can now only be explored outside of NCASRI).
1.5	*If the checklist suggests the patient is likely to have Category A or B needs, they should be reviewed by a consultant in RM or their designated deputy.*	Even when RM consultants were well-represented, it was mainly the rehabilitation coordinators or the MTC therapy teams who completed the specialist Rehabilitation Prescription (SpRP) tools. Therefore from May 2017, this requirement was dropped for this and any future rounds of the NCASRI audit.
1.6	*The consultant in RM (or designated deputy) should complete:* • *The PCAT tool – to confirm Category A or B needs.* *If Category A or B needs are confirmed, a Specialist Rehabilitation Prescription (SpRP) should be completed before discharge from the MTC including:* • *The Northwick Park nursing Dependency Scale (NPDS).* • *The Neurological Impairment Set – Trauma (NIS-Trauma.)* • *Details of referral to one or more named Level 1/2 service.* • *Discharge destination.*	Following agreement of a core minimum dataset SpRP in Year 2, this standard has been replaced by a requirement to collect this minimum dataset only. • In this round of audit, just **33%** of the recruited patients had a complete SpRP minimum dataset. • Breakdown by MTC was not recorded, as this requirement was only introduced after the audit had started. During Year 2 of the audit, new data fields were also introduced in TARN to record the recommended and actual type of rehabilitation, and the recommended and actual discharge destination. • **96%** of recruited patients had a 'recommended type of rehabilitation' and **87%** had an 'actual type of rehabilitation' recorded. • Just **36%** had an actual discharge destination recorded. However, the accuracy of these data is uncertain, as they were not consistent either internally or in comparison with UKROC data. These fields have the potential to be useful in future but further training is required to ensure accurate completion.

2. Assessment and transfer to Level 1/2 service		Summary of performance
2.1	*Following referral, the patients should be assessed by the Level 1/2 service within 10 days.*	Overall compliance with the standard for waiting time for assessment (< 10 days) was **57%** in the recruited patients.
2.2	*A consultant in RM (or their designated deputy) should complete a Patient Categorisation Tool (PCAT) to confirm that the patient has complex (Category A or B) needs for rehabilitation.*	Just over half (**58%**) of patients had a PCAT tool completed. As noted in 1.6 above, however, while completion of the PCAT tool is still recommended it was no longer a requirement of the Minimum Dataset.
2.3	*If accepted in principle, but the patient is not yet fit for transfer, they may be placed on an inactive waiting list pending further review. Serial recordings of the RCS-ET Medical score may help to determine the 'R-point', at which the patient is Ready for transfer and placed on the active waiting list.*	In practice, we are not aware that any of the MTCs are using the RCS-ET- Medical Score in this way, so we have not been able to report against this standard.
2.4	*Patients identified as requiring Level 1/2 in-patient rehabilitation should be transferred to specialist in-patient rehabilitation within six weeks of being fit for transfer.*	In the Round 1 prospective audit, the mean waiting times were as follows: • Referral to assessment was **6 days**. • Assessment to admission was **19 days** although the waiting time after being clinically ready for transfer was just **7 days**. During the course of the audit there was a modest improvement in response times: • The mean waiting time for assessment reduced from 9 to 6 days between the retrospective and prospective audit. • The overall waiting time from referral to admission was 6 days shorter for the recruited patients. Overall: **86%** of patients were transferred to specialist rehabilitation within 6 weeks of referral. **91%** were admitted within 6 weeks of being ready for transfer.

3. Specialist Level 1 and 2 in-patient rehabilitation services	Summary of performance
3.1 *All Level 1 and 2 services should be led by a consultant in RM and/or neuropsychiatry, depending on caseload.*	**First NCASRI report** – Since 2013/14, specialist rehabilitation services are only designated as Level 1 or 2 if they fulfil this requirement.
3.2 *All Level 1 and 2 services should meet at least the minimum standards for safe and effective staffing levels as laid down in the BSRM standards.*	**First NCASRI report** – The survey in Year 1 demonstrated widespread variation in staffing levels within the Level 1 and 2 services with significant under-commissioning in some areas.
3.3 *All Level 1 and 2 services should be registered with UKROC and contribute to the full UKROC dataset for every patient enrolled under the NHSE-commissioned rehabilitation programme.*	Since July 2015 UKROC has provided the national commissioning dataset for NHSE. Rehabilitation services can only be designated as Level 1 or 2 if they are registered with UKROC. • Completeness of data reporting has improved year-on-year as described in the **First NCASRI report**.
3.4 *Assessment of function and rehabilitation needs should be documented within 10 days of admission and within the last 7 days before discharge, including RCS-E, NPDS and UK FIM+FAM.*	Of a total of 1154 patients, 1044 episodes were completed at the time of linkage. The proportion with assessments on both admission and discharge were: • RCS-E-12: **95%** • UKFIM+FAM: **87%** • NPDS/NCNA: NPDS: 85% / NPCNA: **74%**
3.5 *By discharge, all patients should have achieved some measurable gain or goal achievement, as measured by UK FIM+FAM, NPDS or GAS T-score (or other approved measure) or the reason for no gain is recorded. Discharge destination should also be recorded.*	Of the 1,044 completed episodes: • **94%** showed some 'functional gain' on one or more of the measures • Discharge destination was recorded in **99%** across all providers.
3.6 *Cost-efficiency data[1] should be reported in all episodes. It was originally suggested that (excluding patients who remain in prolonged disorders of consciousness at discharge) cost-efficiency for trauma patients should be within two standard deviations of the mean within each service group for 85% of patients. As yet there is no robust data to inform whether this is an appropriate means to identify outliers.*	The overall reporting of cost-efficiency data by the specialist Level 1 and 2 rehabilitation services was approximately **75**%. Reporting rates for individual providers varied from **0-100%**. Comparison of functional profiles showed wide diversity of physical and cognitive disability, depending on case-mix and programme type. These differences could easily be understood at a clinical level, but (as had been anticipated) they precluded case-mix adjustment to define outliers.

1 Measured in the time to offset the costs of rehabilitation by savings in on-going care, as estimated by the Northwick Park Dependency Score (NPDS/NPCNA)

Table 14.2: Key recommendations for commissioners, policy developers, service providers and clinical teams

	Issue	Recommendations for commissioners and policy developers	Recommendations for service providers and clinical teams
1	Service Organisation and Structure **Background:** • The Major Trauma Networks have now been running for over 5 years. There is a good standard of coordinated frontline care in most areas. However, the integration of rehabilitation services has lagged behind. • Despite some examples of good practice, and the standards set out within the Major Trauma service specification and in this audit, many MTNs have yet to address the rehabilitation needs of trauma patients in any coordinated sense. • Consultants in Rehabilitation Medicine (RM) play a vital role in identifying patients with complex needs for rehabilitation and expediting their transfer to the appropriate specialist services. The NCASRI organisational audit in Year 1 showed that half of the MTCs had less than the recommended input from RM consultants and 4 had none at all. This situation has not improved since Year 1.		
1.1	*Poor integration of rehabilitation medicine within many of the MTNs.* *Current arrangements for commissioning and provision of rehabilitation medicine input are haphazard and continue to vary widely across the country.*	**All MTNs and commissioners should review their processes and referral pathway for rehabilitation following major trauma and ensure that standards for rehabilitation provision and RM involvement in the MTCs are fully met.** **This should form part of regular reviews of the service specifications for Major Trauma and Specialist Rehabilitation.**	**Clinicians and service providers should work with the network leads and commissioners to develop the requisite service improvements.** **Clinicians should contribute to service peer review processes to ensure that the standards are met**
1.2	*The Major Trauma service specification states that patients with complex rehabilitation needs should be seen by an RM consultant within 3 calendar days. This will normally involve an RM consultant visiting the MTC at least 2-3 times per week.*	**MTNs and NHS England service commissioners should work together to ensure that each MTC meets the standards set out in the NHS service specification for Major Trauma.**	**Consultants in RM should work with the service planners and commissioners to provide input and cover for the MTCs as part of their job plan.**
1.3	*There is a shortage of consultants in RM trained in the acute rehabilitation needs of major trauma patients.*	**Workforce planning policies should be reviewed to ensure a sufficient supply of RM consultants.** **In addition, consideration should be given to the development of advanced clinical practice and consultant roles that include AHP and nursing staff to work alongside RM consultants to support implementation of the RP and SpRP.**	**Deaneries and those responsible for RM training programmes should ensure inclusion of acute trauma rehabilitation within the curriculum and training competencies to ensure an adequate supply of suitably trained RM consultants.**
1.4	*This audit has highlighted a shortage of inpatient specialist rehabilitation capacity equating to an estimated 330 beds in England to bring the national provision to at least 8 specialist trauma rehabilitation beds per million population[1].* *Specialist provision for hyper-acute rehabilitation for patients with unstable needs, and for complex musculoskeletal rehabilitation (e.g. complex pelvic fracture) was particularly short.* *(*NB This figure refers to provision for trauma patients only, who make up about 20% of adults requiring specialist rehabilitation)*	**Service commissioners in NHS England and the CCGs should work together with specialist rehabilitation providers to ensure that the bed-base for specialist rehabilitation for adult trauma patients is no less than 8 beds per million population – including enhanced provision for hyper-acute rehabilitation services and for patients with complex musculoskeletal injuries.**	**Clinicians and service providers should work with commissioners to consider opportunities for expansion of specialist rehabilitation capacity to meet this extra demand.**

	Issue	Recommendations for commissioners and policy developers	Recommendations for service providers and clinical teams
2	Identification of patients with complex needs for rehabilitation		
	Background:		
	• There is strong evidence that early intensive rehabilitation is effective as soon as patients are fit to engage. Key steps towards ensuring that patients with complex needs have timely access to specialist rehabilitation involves identifying them at an early stage in the pathway and referring them appropriately.		
	• Systematic identification and reporting of rehabilitation needs has improved during the course of this audit, but is still far from perfect. Mandated data collection and training to improve accuracy are likely to be required for future sustainability.		
	• The new standard RP will go some way towards identifying the rehabilitation needs of patients in the MTCs.		
	• However, clinical categorisation alone proved no better than chance for identifying patients with complex needs for rehabilitation. The current proposal for mandated data collection within the RP will not reliably identify patients with complex needs for specialist rehabilitation		
	• The full SpRP dataset has provided valuable detailed information on the specific rehabilitation needs of the relatively small group of patients requiring specialist in-patient rehabilitation.		
2.1	*The Rehabilitation Prescription (RP) has an important role to play in the early identification of patients with complex needs but further development is required to ensure that it captures the particular needs of this group.*	**Work started within this programme to integrate key elements of the Specialist rehabilitation prescription (SpRP) into the standard RP for patients with complex needs should continue.**	**NHSE has now published an expanded dataset for the RP as a mandated requirement for the best practice tariff. MTC teams should ensure that this is completed for all patients who require further rehabilitation on leaving the MTC**
2.2	*More systematic data recording is needed to identify and describe Category A/B rehabilitation needs.* *(We estimate that patients requiring this additional dataset make up no more than 10-15% of the total number who require an RP. This recommendation should not therefore create an excessive burden.)*	**A minimum Specialist RP dataset consisting of the Complex Needs Checklist (or Patient Categorisation Tool) and Rehabilitation Complexity Scale (RCS-E) should be collected alongside the Clinical Category of Rehabilitation Needs for all patients with Category A needs for whom further specialist in-patient rehabilitation is recommended.**	**Where MTC teams consider that a patient has, or may have, Category A/B needs requiring further specialist in-patient rehabilitation, these should be confirmed by recording the CNC (or PCAT) and RCS-E on the TARN database.**
2.3	*Many clinicians found some of the tools useful for clinical decision-making and expressed a wish to continue to be able to use them.*	**The SpRP tools should continue to be available on the TARN database for clinicians to use in their day-to-day clinical practice should they wish to, and for future more detailed evaluation of rehabilitation requirements in patients with Category A/B needs.**	**Clinicians who wish to continue to use these tools may also wish to consider their use in local audit to improve patient care.**

	Issue	Recommendations for commissioners and policy developers	Recommendations for service providers and clinical teams
3	Response times for transfer to specialist rehabilitation • Even though response times improved in the course of the NCASRI audit, and mean waiting times are now well within the current standard of 10 days for assessment and 6 weeks for transfer, these standards still represent a long delay, creating pressure on the acute services. • Once recommendations 1.2 and 1.4 have been addressed, a revision of standards for response times could form part of contracting for enhanced service provision, to improve the accessibility of rehabilitation services. • It is hoped that the comparative data reporting presented in the report will encourage MTCs and specialist rehabilitation providers to review their performance and continue to work towards meeting the standards.		
3.1	*Once capacity issues have been addressed, the standards for response times will require review.*	**As part of capacity building, NHSE and the specialist societies should review the current standards for response times.**	**Clinicians and service providers should work with commissioners to improve response times.**
3.2	*Continuation of comparative data reporting (e.g. through quality dashboards and other mechanisms) will help to support teams to improve the quality of their services.*	**NHSE and the national database providers TARN and UKROC should work together to develop regular benchmarking and comparative data reporting.**	**Clinicians and service providers should review their data on a regular basis to consider opportunities to improve the quality of their outcomes and the cost-efficiency of their service.**

	Issue	Recommendations for commissioners and policy developers	Recommendations for service providers and clinical teams
4	Future data collection and linkage to maximise the benefits of NCASRI • This first round of the NCASRI audit has produced a rich linked dataset, from which only a fraction of the information has yet been extracted. • Further linkage after the end of this programme may help to answer some of the remaining questions from this analysis.		
4.1	*The NCASRI dataset should be conserved for future linkage and analysis to maximise the benefits of data collated to date.* *Further work is required to perform future linkage between TARN and UKROC to utilise the enhanced dataset within the RP and SpRP tools to address the remaining questions arising from this audit.*	**HQIP to work with TARN and UKROC to arrange transfer of data controllership to TARN**	**TARN and UKROC should work in collaboration to explore future opportunities for data linkage and analysis to maximise the benefit of further data collection from 2.2 and 2.3 above.**

15 LIST OF APPENDICES

15.1 Included within the report:

Appendix 1: List of data items in TARN and UKROC.

Appendix 2: The NCASRI Minimum dataset.

Appendix 3: Data linkages for NCASRI.

15.2 Additional electronic appendices

Appendix 4: A detailed analysis of SpRP data collected within the MTCs.

Appendix 5: Reporting rates for the primary outcomes by specialist rehabilitation service provider.

Appendix 6: Performance on process and outcome data by service provider.

Appendix 7: Performance against the key standards by region.

A PDF copy of this report can be freely downloaded, along with the above electronic appendices, from the Kings College website using the link below:

https://www.kcl.ac.uk/cicelysaunders/about/rehabilitation/National-Clinical-Audit-

16 APPENDIX 1: LIST OF KEY DATA ITEMS IN TARN AND UKROC

16.1   List of key data items from TARN linked to the UKROC database

Data	Fields	Purpose
Identifiers	NHS number	Identification for linkage
	Date of birth	Confirming identification and age
	Age, Gender	Socio-demographic data
Process within TARN	Date of Admission	
	Date of Discharge	
	Length of stay in MTC (days)	
Injury severity	Injury severity score	Confirmation of eligibility for RP. Describing the clinical characteristics of injury
	Glasgow Coma Score on admission	
Rehabilitation Prescription	Presence of RP?	
	If yes: Types of rehabilitation need	
	• Physical needs	
	• Cognitive needs	
	• Psycho-social needs	
	Was a copy of RP given to patient?	
Rehabilitation Needs	Category of needs	Confirming Category A or B needs requiring referral to Level 1 or 2 rehabilitation service
	Complex needs check list[1]	
	Patient Categorisation Tool (PCAT)[1]	
	Rehabilitation Complexity Scale (RCS-ET)[1]	
	Seen by consultant in RM? If not, reason	To identify consultant in RM input
If Category A or B needs: **Specialist rehabilitation Prescription**	NIS-Trauma[1]	Severity of impairments
	Northwick Park Dependency Scale (NPDS/NPCNA)[1]	Nursing dependency and care needs for calculation of ongoing costs of care
Discharge planning on leaving the MTC	Recommended service level	Type of service required
	Service(s) referred to and date	Intended discharge destination
	Recommended discharge destination	
	Actual discharge destination	
	Reason for variance	
Extended RP (optional)	Descriptive information about needs and recommendations for rehabilitation	Will be used where necessary to supplement missing data
Outcomes	Glasgow Outcome Scale (PROMs/PREMs may be explored if available but not part of NCASRI)	

1   Copies of these tools were provided in the data collection pack

16.2 UKROC dataset – list of current data items

UKROC is a hierarchical database, in which different service levels have different reporting requirements. Level 1 (tertiary) services are low volume high cost services that warrant a more exhaustive set of data requirements than the higher volume lower cost Level 2 (local) specialist services.

The table below summarises the minimum data reporting requirements for each service level

UKROC Minimum Data Reporting Requirements Checklist – 2016/17

Items	1*	2a*	2b*	2b	Other	Notes * using weighted bed day tariff
Patient Identification & Demographics						
Patient Name	✓	✓	✓	✓	✓	for local use only
Date of Birth	✓	✓	✓	✓	✓	for age calculations & data linkage
Gender	✓	✓	✓	✓	✓	
Ethnicity						desirable if available
Local Identifier						for local use
Hospital Number						for local use
NHS Number	✓	✓	✓	✓		for future data linkage
Commissioning & Referral						
Funding Source (NHS England, CCG, private etc)	✓	✓	✓	✓	✓	
Service Level (1, 2a, 2b, 3)	✓	✓				if commissioned at several levels
Patient Category (a, b, c, d)	✓	✓	✓	✓		
CCG name or code	✓	✓	✓	✓	✓	
GP Practice name, code and/or postcode	?	?	?	?		may be required by commissioners
GP name and/or code	?	?	?	?		may be required by commissioners
Patient postcode						optional, though useful if available
Referral date	✓	✓	○	○		
Referral source	✓	✓	○	○		
Date of decision (added to active waiting list)	✓	✓	○	○		
Date fit for admission	✓	✓	○	○		
Initial Assessment						
Date of initial assessment	✓	✓	○	○		
Assessed by (uni/multi-disciplinary)	✓	✓	○	○		
Diagnosis						
Onset date (original and/or current)	✓	✓				
Diagnosis category/subcategory	✓	✓	✓	✓	✓	
ICD 10 codes						optional
Admission Details						
Date of admission	✓	✓	✓	✓	✓	
Proposed discharge date	✓	✓	○	○		
Proposed trimpoint date						
Admitted from	✓	✓	○	○		
Admission purpose	✓	✓	○	○		
Interruptions & Extensions						
Interruptions (start & end date, reason)	✓	✓	✓	✓		
Extension date	✓	✓	✓	✓		
Discharge Details						
Date fit for discharge	✓	✓	○	○		
Discharge date	✓	✓	✓	✓	✓	
Reason for delay	✓	✓	○	○		
Discharge mode	✓	✓	○	○		
Discharge destination	✓	✓	○	○		
Discharge postcode						optional, though useful if available
Admission & Discharge Assessments (all assessments should be submitted with fully itemised scores)						
Patient Categorisation Tool (on admission)	✓	✓	✓	✓		complexity measure
RCS-E version 13 – scored retrospectively	✓	✓	✓	✓	✓	complexity measure
FIM+FAM (including NIS)	✓	✓	✓	✓		outcome measure
NPDS-H (used to demonstrate cost efficiency)	✓	✓	✓	✓		outcome measure
Barthel or FIM+FAM or FIM or NPDS-H/NPCNA					✓	outcome measure
Mayo-Portland Adaptability Inventory (MPAI-4)						new in software version 16
Fortnightly Assessments (scored retrospectively for all patients throughout the year based on what was provided)						
RCS-E version 13	✓	✓	✓	○		complexity/inputs measure
Cross-Sectional Data Tranches (all assessments should be scored retrospectively based on what was actually provided) Collected fortnightly for ALL patients until at least 100 sets of matching assessments have been completed						
Matching RCS-E, NPDS-H/NPCNA & NPTDA	✓	✓	✓	○		complexity/inputs measures
RCS-E version 13				✓	✓	complexity/inputs measure
Data Submission Frequency						
Monthly (including all current inpatients)	✓	✓	✓	✓		
Optional – no requirement to participate					✓	ideally submitted monthly or quarterly
Other (submitted annually and following any significant changes to service)						
Service Profile	✓	✓	✓	✓	✓	including staffing levels and costs

○ level 2b services are strongly encouraged to submit these items even though they are not currently mandatory.

April 2016

16.2.1 Key UKROC data items for this audit

Data	Fields	Purpose
Identifiers	NHS number	Identification for linkage
	Date of birth	Confirming identification and age
	Age, Gender	Socio-demographic data
	Diagnosis/nature of injuries	
Response times	Date of referral by MTC	To identify waiting times for assessment and admission to Level 1 or 2 rehabilitation service
	Date of assessment by Rehab unit	
	Date of acceptance for admission	
	Date fit for transfer	If not yet fit for transfer at time of acceptance
Process within the rehabilitation service	Date of Admission	
	Date of Discharge	
	Length of stay in rehabilitation (days)	
Timing of baseline assessment	Dates of completion of the following:	Timeliness of baseline assessments
Rehabilitation Needs on admission	Category of needs (A, B, C, D)	Confirming Category A or B needs requiring treatment in a Level 1 or 2 rehabilitation service
	Patient Categorisation Tool (PCAT)	
	Rehabilitation Complexity Scale (RCS-E)	
Functional independence during rehabilitation (Admission, discharge and change scores)	UK FIM+FAM – (Motor, cognitive and total scores)	Gains from rehabilitation in terms of: • Functional independence • Reduction in care needs • Reduction in on-going care costs Calculation of cost-efficiency
	Northwick Park Dependency Scale (NPDS/NPCNA)[1]	
Optional:	Neurological Impairment Set (NIS) Goal attainment scaling (GAS) FIM+FAM Extended activities	Alternative gain parameters if more appropriate to patient
Discharge planning on leaving the rehab unit	Discharge mode	Discharge destination
	Discharge destination	
	Anticipated discharge date	Discharge delays
	Actual discharge date	
	Reason for delay	
	Post code/CCG	Geographic differences in
Structure	Staffing levels	Compliance with national standards for staffing levels in relation to complexity of case load

1   Copies of these tools were provided in the data collection pack

16.3   Information from ONS mortality data and HES

Data	Fields	Purpose
ONS mortality data	Date of death	To identify those who have died
HES	Dates of admission and discharge and HRG codes for inpatient treatments in the six month period after discharge from the MTC	To identify hospital treatments other than rehabilitation in a Level 1 or 2 rehabilitation service HRG data will indicate the principal purpose of admission

After linkage of **recruited and rehabilitation** datasets with the above HES and ONS-Mortality datasets, descriptive data analysis will be carried out on data collected to identify:

- For **recruited** patients who were not admitted to Level 1 or Level 2 services discharged from the MTCs:
    - The proportion of patients admitted to other in-patient services after discharge from the MTCs.
    - The primary and secondary purposes of those admissions from HRG data – ICD/OPCS codes.
    - The availability (and results) of any outcome measures recorded in HES.
- For **rehabilitation** patients who were not identified in the MTCs as having complex needs, but were subsequently admitted to Level 1 or Level 2 services:
    - Where they received their acute major trauma care.
    - Why they were not identified as having Category A or B needs, which may be:
        - Administrative – due to lack of staff to complete RPs and SpRPs in MTCs.
        - Clinical – genuine change in circumstances/needs.

16.3.1.1   ONS data

Linkage with ONS data will support the identification of those patients who subsequently died and are therefore not expected to appear in the rehabilitation dataset.

17 APPENDIX 2: THE NCASRI MINIMUM DATASET

In the course of this first round it became clear that, useful as some clinicians find them, it is not feasible to collect all five SpRP tools going forward, even for the few patients with highly complex needs. After working closely with the MTCs a **minimum core dataset** was proposed, consisting of:

1. **The Complex Needs Checklist.**

2. **The Rehabilitation Complexity Scale (RCS-ET).**

3. **The Clinical Category of Rehabilitation Needs.**

These should be recorded for patients who are considered to have complex (Category A/B) needs for further specialist in-patient rehabilitation, at the 'Transfer ready' point when the patient is ready to leave the MTC. They should be recorded by an experienced clinician who does not necessarily need to be a consultant in RM, according to the scheme in Figure A2.1 below.

All **data should be collated on TARN**. Locally-used databases and electronic patient records should provide data in a form that can be uploaded into TARN for future linkage with UKROC.

Figure A2.1: Proposed new scheme for MTC data collection for future audit

Required data collection within the MTC

Rehabilitation Prescription
Started within 48 hours

↓

At Transfer-Ready (TR) point*
For patients requiring further in-patient rehabilitation:
• Complex needs checklist (CNC)
• Rehabilitation Complexity Scale (RCS-ET)
• Clinical category of need (A-D)

↓

At discharge
For patients requiring further in-patient rehabilitation:
• TARN minimum dataset (the 5 new questions)

Optional data collection

• PCAT tool
Particularly for patients with category A needs

If recording impairment or dependency
• NIS-Trauma
• NPDS/NPCNA

*The **TR point** is when the patient no longer needs to be in the acute MTC or TU setting and the primary need for further in-patient treatment is now rehabilitation

Level 1 specialised rehabilitation services

The **PCAT** remains the gold standard for identifying patients with Category A/B needs and provides further information to describe those needs. Confirmation of Category A needs using the PCAT is a requirement for acceptance of patients for rehabilitation by a Level 1 specialised rehabilitation service. Its continued use is encouraged for detailing complex needs – and also to improve our understanding of complex non-neurological needs. It is therefore recommended that the PCAT and other SpRP tools (the NIS and NPDS) should remain available on the TARN database for clinicians to use if they find them helpful for clinical decision-making.

The Minimum dataset is detailed in Figure A2.2 below.

Figure A2.2: The Complex Needs Checklist (CNC) and Rehabilitation Complexity Scale (RCS-ET)

NHS Number	NHS Number	DOB:	ISS:

TARN Minimum dataset	**On-going Trauma Care requirements:**
Rehabilitation Prescription ☐ Required ☐ Not required **Presence factors affecting activities/participation** ☐ Physical ☐ Cognitive / mood ☐ Psycho-social	☐ Orthopaedic / trauma ☐ Plastics ☐ Neurology / neurosurgery ☐ Burns ☐ Vascular ☐ ENT ☐ Abdominal ☐ Max-fax ☐ Cardiothoracic ☐ Other............................. ☐ Urology

Does the patient have COMPLEX clinical needs?	**Date of assessment**

Complex Physical eg	**Complex Cognitive / Mood** eg	**Complex Psychosocial** eg
☐ Complex musculoskeletal management ☐ Complex neuro-rehabilitation ☐ Complex amputee rehabilitation needs ☐ Re-conditioning / cardiopulmonary rehab ☐ Complex pain rehabilitation ☐ Profound disability / neuropalliative rehabilitation	☐ Complex communication support ☐ Cognitive assessment/management ☐ Complex mood evaluation / support ☐ Challenging Behaviour management ☐ Evaluation of Low Awareness state	☐ Complex discharge planning eg o Housing / placement issues o Major financial issues o Uncertain immigration status ☐ Major family distress / support ☐ Emotional load on staff

Checklist of needs that are likely to require specialist rehabilitation (tick any that apply) **(Examples)**		**Specialist needs?**
Specialist rehab medical (RM) or neuropsychiatric needs	☐ On-going specialist investigation/ intervention ☐ Complex / unstable medical/surgical condition ☐ Complex psychiatric needs ☐ Risk management or Treatment under section of the MHA	☐ Yes ☐ No
Specialist rehabilitation environment	☐ Co-ordinated inter-disciplinary input ☐ Structured 24 hour rehabilitation environment ☐ Highly specialist therapy /rehab nursing skills	☐ Yes ☐ No
High intensity	☐ 1:1 supervision ☐ ≥4 therapy disciplines required ☐ High intensive programme (>20 hours per week) ☐ Length of of rehabilitation ≥ 3 months	☐ Yes ☐ No
Specialist Vocational Rehab	☐ Specialist vocational assessment ☐ Multi-agency vocational support (for return to work /re-training /work withdrawal) ☐ Complex support for other roles (eg single parenting)	☐ Yes ☐ No
Medico-legal issues	☐ Complex mental capacity / consent issues ☐ Complex Best interests decisions ☐ DoLs / PoVA applications ☐ Litigation issues	☐ Yes ☐ No
Specialist facilities / equipment needs	☐ Customised / bespoke personal equipment needs (eg Electronic assistance technology, communication aid, customised seating, bespoke prosthetics/orthotics) ☐ Specialist rehabilitation facilities (eg treadmill training, computers, FES, Hydrotherapy etc)	☐ Yes ☐ No

Provisional Categorisation of Rehabilitation Needs	
☐ **Category A** (requiring Level 1 or 2a Rehabilitation)	**If probable category A or B needs,** refer for specialist rehabilitation review:
☐ **Category B** (requiring Level 2 Rehabilitation)	**Referred** Yes / No Date......./......./........
☐ **Category C or D** (requiring RR&R pathway)	**Reviewed** Yes / No Date......./......./........

Rehabilitation Complexity Score (RCS-ET-adapted) (Only count highest score for care / risk – not both)

Medical	Care/ Risk	Nursing	Therapy-Disciplines	Therapy-Intensity	Equipment	Total Score (0-25)
0 1 2 3 4 5 6	0 1 2 3 4 / 0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3	........./25

Completed by (please circle): Band 8 / Band 7 / Band 6 / other..............

This core dataset will reduce the burden on MTC teams, but still provides substantially more rehabilitation-related information than was available prior to NCASRI when the only mandatory data fields collected in TARN were the four boxes **circled** as the TARN Minimum Dataset.

18 APPENDIX 3: DATA LINKAGE FOR NCASRI

Provisional Data flows – National Clinical Audit of Specialist Rehabilitation for Patients with Complex Needs Following Major Injury

| Existing Datasets | Trusts/Independent Providers | Data Linkage
Linked data:
  Controller: HQIP
  Processor: Multiple | UKROC/TARN NCA team
Data Controller: HQIP
Data Processor: NCA team
Pseudonymised | Outputs
  Anonymised and Aggregated |
|---|---|---|---|---|
| **TARN Data**
Controller: TARN
Identifiable; Sensitive | Trauma units submit data to TARN | TARN link with UKROC to find matches | Pseudonymised data from TARN and UKROC linked using TARN and UKROC IDs | HQIP Annual Reports
Anonymised and Aggregated |
| **UKROC Data**
Controller: NHS England?
Identifiable; Sensitive | Rehabilitation units submit data to UKROC | UKROC link with TARN to find matches | | Other Publications & Presentations
Anonymised and Aggregated |
| | | Linked TARN & UKROC data | Analysis of pseudonymised data | data.gov.uk
Anonymised and Aggregated
Throughout the year |
| | | *HSCIC (DARS) link with ONS Data (identify cases where patient has died)* | | |
| **ONS Mortality Data**
Controller: ONS
Identifiable; Sensitive | | Patient Identifiable Data removed from linked data
Only TARN & UKROC IDs remain | Feedback to trusts:
Seek clarification if missing/suspect data found during analysis of linked data | |
| | | *Feedback reidentified before being passed back to provider?* | | |

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