The Regulation and Quality Improvement Authority

Review of Implementation of NICE Clinical Guideline 174

Intravenous (IV) Fluid Therapy in Adults in Hospitals in Northern Ireland

September 2020

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Assurance, Challenge and Improvement in Health and Social Care

Glossary

ABCDE	Airway, Breathing, Circulation, Disability, Exposure
ADEPT	Achieve Develop Explore Programme for Trainees/or Postgraduate Doctors in Northern Ireland
AKI	Acute Kidney Injury
Belfast Trust	Belfast Health and Social Care Trust
BMJ	British Medical Journal
BMI	Body Mass Index
CVA	Cerebrovascular Accident
CEC	Clinical Education Centre, Northern Ireland
CoE	Care of the Elderly
DoH	Department of Health
FMP	Fluid Management Plan
GI	Gastrointestinal
GMC	General Medical Council
HSC	Health and Social Care
HSCB	Health and Social Care Board
ICU	Intensive Care Unit
IV	Intravenous
MEWS	Modified Early Warning Score
NEWS	National Early Warning Score
NIAS	Northern Ireland Ambulance Service
NICE	National Institute for Health and Care Excellence
NIMDTA	Northern Ireland Medical and Dental Training Agency
Northern Trust	Northern Health and Social Care Trust
PHA	Public Health Agency
South Eastern Trust	South Eastern Health and Social Care Trust
Southern Trust	Southern Health and Social Care Trust
SQSD	Safety, Quality and Standards Department, DoH
U&E	Urea and Electrolytes
Western Trust	Western Health and Social Care Trust

The Regulation and Quality Improvement Authority

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Acknowledgements

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Executive Summary

This Review examines the effectiveness of the implementation of NICE CG174. This included assessment of implementation, governance and oversight of implementation, the knowledge and understanding of healthcare professionals and an audit of clinical practice.

The National Institute for Health and Care Excellence (NICE) Clinical Guideline CG174 - Intravenous (IV) fluid therapy in adults in hospital[(1)] was published in December 2013. This guideline detailed recommendations about general principles for managing intravenous (IV) fluid therapy in adults in hospital. This guideline is referred to as 'CG174' in this report.

In February 2014, the Department of Health, Social Services and Public Safety (renamed the Department of Health (DoH) in 2016) reviewed CG174 and developed a number of caveats (Appendix 1) to ensure its applicability before formally endorsing it for implementation in Northern Ireland.

In July 2014, the Department of Health issued Circular HSC (SQSD) (NICE CG174) 17/14, Subject: NICE Clinical Guideline CG174 – Intravenous fluid therapy in adults in hospital [(2)]. This Circular is referred to as 'the 2014 Circular' throughout this report.

The 2014 Circular required the Health and Social Care (HSC) Heath and Social Care Board (HSCB)/Public Health Agency (PHA) and Health and Social Care (HSC) Trusts to complete specific actions in accordance with the processes outlined previously in Circular HSC (SQSD) 3/13[(3)]. This previous Circular, issued in 2013, detailed the arrangements for the endorsement, implementation, monitoring and assurance of NICE Clinical Guidelines such as CG174 in Northern Ireland.

DoH subsequently requested RQIA to review implementation of CG174, to include a focus on the governance and oversight arrangements and ongoing assurance mechanisms in place across the Health and Social Care system.

This Review commenced in December 2017 and concluded in May 2018. The methodology for this Review included a comprehensive review of the literature and the design of a structured questionnaire informed by the key actions set out in the 2014 Circular. Additionally, a clinical audit was undertaken in each HSC Trust to audit the extent of implementation of the recommendations within CG174 which relate to clinical practice, namely:

- patients are appropriately assessed;
- IV fluid prescribing is reviewed in accordance with CG174;
- patients receive the appropriate IV fluids and electrolytes; and
- IV fluid therapy is appropriately monitored and documented clearly and legibly.

These audits were undertaken in collaboration with postgraduate medical doctors in each HSC Trust.

Focus Groups were facilitated by the Review Team and included a range of frontline staff were held in each HSC Trust during March and April 2018. During these meetings the Review Team met with more than 70 staff which included junior and senior medical staff, nursing and pharmacy staff. During the Review Week, held at the end of April 2018, the Review Team met with Executive Management Teams and Directors in HSC Trusts as well as staff in the HSCB and PHA who have responsibility for commissioning and public health which includes monitoring and assurance functions.

As service models change to be more responsive to increased demand and greater patient complexity, it is vital that HSC Trusts continue to deliver safe and effective care. Implementing NICE best practice guidance is essential to achieving this.

Key Findings

Good organisational and clinical governance is essential to assuring the delivery of high quality of services. As such, we examined not only the implementation of CG174 but also the governance, oversight arrangements and the ongoing assurance mechanisms applicable to it.

The Review Team concluded that CG174 was not fully implemented in each HSC Trust. There were deficits at key stages of implementation and in areas to support ongoing assurance of implementation of the guideline. These areas included HSCB oversight of implementation, HSC Trust dissemination and prioritisation of recommendations, staff training/education and incident management.

The Review Team make nine recommendations which, if actioned, we believe will strengthen the implementation of CG 174 and assurance of best practice in this regard.

Implementation and Assurance Model

Significant weaknesses were identified in the systems for governance and oversight of the implementation of CG174 and its continued use for patient care in Northern Ireland. Insufficient evidence was provided to demonstrate full implementation of CG174 across all applicable specialities and programmes of care in HSC Trusts.

HSC Trusts were directed by the DoH to proceed with targeted dissemination of CG174 to agree a clinical/management lead, to co-ordinate implementation of the guideline and to consider what actions were required to achieve implementation using a risk based assessment and a baseline review which would inform planning for full implementation.

The timescales advised by DoH were three months for completion of initial actions. Full implementation of CG174 was required within a further nine months except for elements of the guideline where significant issues and challenges were raised by Trusts to the HSCB/PHA, and which would require additional support. HSC Trusts were required to provide positive assurances at bi-monthly meetings with the HSCB in respect of initial actions required and subsequently on implementation of CG174.

In most HSC Trusts we found that there was no formal process to undertake a baseline review/risk based assessment of CG174. No prioritisation of individual recommendations was completed, either by individual Trusts or at a regional level, as part of the baseline review of individual recommendations when CG174 was received by Trusts.

HSC Trusts appeared to rely mainly on interested clinicians to support both the initial assessment and the wider work in respect of implementation. This approach has an inherent risk of promoting an inaccurate picture, and a single professional opinion/view rather than an evidence-based, multi-disciplinary assessment of the HSC Trust's actual position with respect to CG174.

We found that there was a general lack of awareness of the CG174 guideline itself and systems/processes relating to its implementation amongst frontline HSC staff including medical, nursing and pharmacist staff.

HSCB/PHA have responsibility for monitoring implementation of CG174 and providing assurances on implementation of this and other NICE guidelines at six monthly accountability meetings with the DoH.

Overall we found that the monitoring of implementation of CG174 by the HSCB in accordance with the actions set out in HSC (SQSD) 3/13 was not adhered to in any meaningful way. The oversight processes utilised by the HSCB were focused upon implementation of the guideline in its totality. This focus was procedural in nature and did not consider the assurance of implementation of each of the recommendations in the guideline. This is necessary to ultimately provide assurance of implementation of the complete guideline.

The detail and content of CG174 was not utilised to appropriately support regional prioritisation and provide meaningful assurance on improved outcomes for patients.

The timescales advised by the DoH for implementation of CG174 were not adhered to and there was no active follow-up in this regard. Review and corroboration of HSC Trust self-assessments were not undertaken even if a 'red' (not within deadline) implementation status was reported. Additionally, there appeared to be no avenue in the established process for HSC Trusts to address implementation challenges or to negotiate commissioning arrangements with the HSCB if same was required.

This NICE guideline is of particular importance for the provision safe care in view of the findings of the inquiry into Hyponatraemia-related Deaths[(4)] (ongoing at the time of this Review and published 18 June 2019). A system to ensure regular updates are provided to the DoH, in respect of the progress of implementation of CG174 is an essential component of assuring its implementation. There was no evidence that an effective system was in place and thus we determined that DoH could not have been appropriately assured in this regard.

Training and Education

One of the key factors to support full and appropriate implementation of CG174 within Northern Ireland was to be the training and education of all staff that are /would be involved in its implementation.

Frontline staff (including junior and senior medical, nursing and pharmacy staff) demonstrated some knowledge of the core principles of fluid management during this Review.

All five HSC Trusts provided evidence of induction and mandatory training for staff involved in prescribing and administering IV fluids for adults in hospital, but we found there was no system for the formal assessment of the effectiveness of the training delivered nor demonstration/evidence of competence of staff who had completed training, as required in CG174.

Whilst we considered that the current training did include the required elements in relation to recognition, assessment and prevention of the consequences of mismanaged IV fluid therapy; we were unable to evidence any system within which competency in these areas of CG174 were subsequently assessed or demonstrated following completion of training.

CG174 recommends was that hospitals should have lead person, responsible for training, clinical governance, audit and review of IV fluid prescribing and patient outcomes. At the time of this Review no HSC Trust had identified or confirmed such a person to act as the lead and hold these particular responsibilities.

Incident Management and Learning

CG174 includes a list of the specific triggers which may signal the presence of signs or symptoms relating to mismanagement if IV fluid therapy. These are hypovolaemia, pulmonary oedema, hyponatraemia, hypernatraemia, peripheral oedema, hyperkalaemia and hypokalaemia (see Appendix 3). These triggers can be used to identify incidents relating to IV fluid therapy. CG174 recommends that such incidents be recorded as adverse incidents through established Trust reporting and learning systems. We found that no HSC Trust was using these triggers to identify potential or actual adverse incidents relating to IV fluid therapy. Most Trust staff with whom the Review Team met highlighted that the existing Datix web incident management system does not include provision to capture these Triggers.

In general the Review Team found that HSC Trust staff were not aware of the requirement to identify and use these triggers in practice and there were no audits or examples of quality improvement (QI) work aligned to their occurrence.

The Review Team noted there was a lack of awareness in recognition, reporting and learning in relation to adverse events/incidents relating to IV fluid management.

Clinical Audit

The clinical audit was undertaken to complement the other methods employed during this Review and to provide further detailed information in respect of the implementation of a number of the recommendations within CG174.

The results from the regional clinical audit identified that CG174 was not fully implemented in any HSC Trust. Eleven[1] of the clinical recommendations (of which there were 27 in total) were audited and the results indicated that only 18% (2 out of 11) were fully achieved. Almost half of the recommendations (5 out of 11) were assessed as not fully achieved. For four recommendations it was considered not appropriate to make a determination following analysis of the data collected.

The audit findings support the evidence gathered during the course of this Review, indicating weaknesses within the Trusts internal assurance systems in relation to CG174 and subsequent assurances given to the HSCB by the Trusts. In view of this, RQIA would expect all HSC Trusts to reflect on the audit findings in their entirety and identify where improvement is required. Furthermore, all HSC Trusts should take steps to assure themselves and their respective Trust Boards of delivery of these improvements.

Whilst the Review Team welcomed audit/QI initiatives undertaken in the Northern and Western HSC Trusts we determined there was insufficient oversight and co-ordination of audit/QI work across all HSC Trusts. Such oversight would ensure that audit/and QI priorities are identified that are aligned to the gaps in implementation of recommendations or areas where incidents may be more common. Effective collaboration between HSC Trusts would enable meaningful learning relating to implementation of CG174, to be disseminated across all HSC Trusts in Northern Ireland.

[1] For Recommendation 1.2.2 all aspects of this recommendation were not included in the audit. The audit did examine the criteria specifically relating to clinical monitoring.

Section 1: Introduction

1.1 Context for the Review

Clinical Guideline CG174 - Intravenous (IV) fluid therapy in adults in hospital[1] was issued by NICE in December 2013. The guideline details recommendations about the general principles for managing IV fluid therapy in hospital inpatients aged 16 years and over with a range of conditions. The guideline aims to help prescribers understand the optimal amount and composition of IV fluids to be administered and the best rate at which to give them, to improve fluid prescribing and patient outcomes in hospital. The guideline does not cover patient groups with more specialised fluid prescribing requirements. These include pregnant women, and those with severe liver or renal disease, diabetes or burns.

CG174 highlighted the following:

- IV fluids are one of the most commonly prescribed drugs in the hospital setting and many adult hospital inpatients need IV fluid therapy to prevent or correct problems with their fluid and/or electrolyte status;
- Deciding on the optimal amount and composition of IV fluids required and the best rate at which to administer them can be a difficult and complex task and decisions must be based on careful assessment of each patient's individual needs;
- Inappropriate prescribing of IV fluids can lead to pulmonary oedema, heart failure or volume depletion;
- Errors in prescribing IV fluids and electrolytes are particularly likely in emergency departments, acute admission units, and general medical and surgical wards as it is frequently the most junior medical staff undertaking this prescribing activity and they may lack relevant experience.
- There is considerable debate about the best IV fluids to use (particularly for more seriously ill or trauma patients), resulting in wide variation in clinical practice. Many reasons underlie the ongoing debate, but most revolve around difficulties in interpretation of both trial evidence and clinical experience;
- Mismanagement of IV infusion was established as the cause of many deaths of hospitalised patients according to the National Confidential Enquiry into Perioperative Deaths (The Enquiry) in 1999[5]. The Enquiry recommended that fluid prescribing should be regarded as having equivalent status as that of other prescribed drugs.

In February 2014, the DoH reviewed CG174 and formally endorsed it for implementation in Northern Ireland. CG174 was subsequently reviewed at the DoH's request by a professional group led by the Centre Director of the School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast. This review resulted in a number of legislative/policy and specific fluid management caveats (summarised in Appendix 1) to the original NICE Guidance to ensure appropriate application in Northern Ireland. The Circular with the required Northern Ireland caveats, included as an appendix, was issued in July 2014. The caveats are explained in more detail in the following sub-section.

1.1.1 Caveats

In relation to patient-centred care CG174 recommended that healthcare professionals ensure that patients have the opportunity to make informed decisions about their care and treatment in partnership with them. It recommended that healthcare professionals follow the advice in the Department of Health document 'Reference Guide to Consent for Treatment or Examination' and that if a patient does not have capacity to make decisions that they follow the code of practice which accompanies the Mental Capacity Act 2005. The aforementioned policy document and legislation do not apply in Northern Ireland and the DoH 2014 Circular directed healthcare professionals to instead refer to the DHSSPS guidance 'Reference Guide to Consent for Examination, Treatment or Care (2003)' available from: http://www.dhsspsni.gov.uk/consent-referenceguide.pdf

Recommendation 1.4.4 of CG174 detailed that consideration be given to the use of sodium chloride 0.18% in 4% glucose with 27 mmol/l potassium for routine maintenance. HSC (SQS) 20/2007 and a further Addendum were issued in April 2007. This Circular endorsed implementation in Northern Ireland of the National Patient Safety Agency (NPSA) Patient Safety Alert 22: Reducing the risk of hyponatraemia when administering intravenous infusions to children. This alert recommended that IV fluids containing 0.18% sodium chloride be removed from stock and general use in areas that treat children. Consequently, IV fluids containing 0.18% sodium chloride have not been stocked in general wards in HSC hospitals in Northern Ireland since 2007. To facilitate implementation of CG174 the DoH asked that the professional review group develop a tool to assist clinicians with identification of suitable IV fluid alternatives where treatment using IV fluids containing 0.18% sodium chloride is recommended within the guideline. This locally developed guidance can be found in Appendix 2 of this report and of the 2014 Circular.

Recommendation 1.4.5 of CG174 detailed that consideration should be given to delivering IV fluids for routine maintenance during daytime hours. The DoH clarified in the 2014 Circular that this should be interpreted in Northern Ireland hospitals as being during normal waking hours i.e.: a period of not less than 16 hours.

CG174 includes a table detailing the consequences of fluid mismanagement and recommends that these be reported as critical incidents. Within Northern Ireland the DoH highlighted that such incidents should be treated as adverse incidents rather than as serious adverse incidents and should be reported in accordance with current incident reporting arrangements.

A key recommendation of CG174 was use of the '5Rs' terminology, namely Resuscitation, Routine Maintenance, Replacement, Redistribution and Reassessment, to underpin teaching and practice of fluid balance in adults. This terminology had not been routinely included in Northern Ireland guidance but the DoH indicated that it is now being included in the regional adult and paediatric fluid balance charts.

Additionally, the DoH updated that teaching practice at the undergraduate medical, nursing and pharmacy schools in Northern Ireland is being amended to ensure that the '5Rs' terminology becomes embedded in undergraduate and postgraduate programmes.

NICE produced an online training tool to support implementation of CG174. This tool included several illustrative cases which recommended the use of IV fluids containing 0.18% sodium chloride for routine maintenance. IV Fluids containing 0.18% sodium chloride have not been stocked in general wards in hospitals in Northern Ireland since 2007 in accordance with NPSA Patient Safety Alert 22. The online training tool also recommended that prescribers use abbreviations such as NaCl 0.9% instead of sodium chloride 0.9%. This contradicts HSC Trust Medicines Codes which recommend that abbreviations are avoided. Consequently, the DoH concluded that the online training tool was not appropriate for use in Northern Ireland.

Alignment of existing guidance for consistency with CG174 was considered and GAIN was asked by the DoH to review its' guidance on Hyponatraemia in Adults whilst also ensuring appropriate adjustment for the Northern Ireland caveats identified.

1.1.2 Implementation and Assurance Model

The 2014 Circular detailed the actions to be undertaken by the HSCB/PHA and HSC Trusts. These requirements are aligned with the processes described in the 2013 Circular HSC (SQSD) 3/13 which explained the arrangements for the endorsement, implementation, monitoring and assurance of all NICE Clinical Guidelines in Northern Ireland.

HSCB/PHA Responsibilities

The HSCB were responsible for monitoring implementation of CG174 through bi-monthly director level meetings with the HSC Trusts. HSC Trust assurances were to be recorded in the minutes of these meetings. The HSCB was also required to provide assurances on implementation of CG174 at six monthly accountability meetings with the DoH.

The 2014 Circular required the HSCB/PHA to identify a Professional Lead to consider the commissioning implications of CG174 , co-ordinate with any other relevant commissioning teams and identify any areas where regional planning/investment/commissioning are required or where there is a material risk to safety or quality. The HSCB/PHA was also required to disseminate CG174 if relevant to appropriate Family Practitioners.

HSCB/PHA was required to seek positive assurance from the HSC Trusts that the required initial actions had been undertaken within the three month period between August and October 2014. They were also required to seek positive assurance that CG174 had been fully implemented within a further nine months (by 22 July 2015), unless otherwise notified by the HSC Trusts.

If significant investment/commissioning needs could not be met the HSCB/PHA was required to agree appropriate arrangements with the HSC Trusts and report this to the DoH at 6 monthly accountability meetings.

HSC Trust Responsibilities

HSC Trusts were required to proceed with targeted dissemination of CG174, agree a clinical/management lead to co-ordinate implementation and to consider what had to be done to achieve implementation using a risk based assessment and baseline review as appropriate to support planning.

The timescales stipulated for the actions required were the three months, between August and October 2014, for completion of initial actions. Full implementation of CG174 was required within a further nine months (by 22 July 2015), apart from any elements where significant issues had been raised with the HSCB /PHA. HSC Trusts were required to provide positive assurance at the bi-monthly meetings with the HSCB in respect of initial required actions and subsequently on implementation of CG174.

The actions and timelines described above for the HSCB/PHA and HSC Trusts constituted the implementation and assurance model which was expected for the implementation of CG174.

In view of the context described above, and in particular the inquiry into Hyponatraemia-related Deaths [4] (ongoing at the time of this Review and published 18 June 2019), DoH directed RQIA to review implementation of CG174 in HSC Trusts across Northern Ireland. This Review focused on the governance and oversight arrangements for implementation of CG174 and continuing assurance of the implementation of best practice as outlined in the guideline and the associated caveats as advised by DoH.

1.2 Terms of Reference

The following terms of reference for this Review were agreed with members of the Reference Group/Review Team and with the DoH:

1. To describe and assess the implementation of NICE CG174 in hospitals in Northern Ireland, including education and training supporting implementation.

2. To assess the governance and oversight of implementation and continued use of NICE CG174 in hospitals in Northern Ireland.

3. To audit clinical practice relating to IV fluid therapy in adults, within the scope of NICE CG174, at ward level within five HSC Trusts.

4. To assess the knowledge and understanding of healthcare professionals involved in prescribing and delivering IV fluid therapy in adults within the scope of NICE CG174.

5. To report on findings, identify areas supporting improvement and, where appropriate, make recommendations for improvements in the implementation of NICE CG174 in hospitals in Northern Ireland.

Exclusions

CG174 does not apply to patient groups with more specialised fluid prescribing requirements or those receiving intensive monitoring and consequently this Review was focused upon the clinical areas/services and patient groups which were within the scope of the guideline.

The following clinical areas/services/patient populations were therefore excluded:

- Patients under 16 years old;
- Pregnant women;
- Patients with severe liver or renal disease, diabetes or burns;
- Patients needing inotropes and those on intensive monitoring;
- Patients with traumatic brain injury (including patients needing neurosurgery);
- Patients admitted to intensive care units (ICU).

Following discussions with the Deputy Medical Director in the Northern Ireland Ambulance Service (NIAS) the Review Team determined that this HSC Trust should be excluded. This decision was in view of the fact that CG174 is focused upon the general principles for managing IV fluid therapy in hospital inpatients whereas NIAS is responsible for the care of patients prior to hospital admission. Additionally, the organisation adheres to the National Guidelines from the Joint Royal Colleges Ambulance Liaison Committee (JRCALC)[6]. These clinical practice guidelines are based on current best evidence applicable to the pre-hospital environment.

This Review also excluded Independent (Private) Hospitals and Hospices within Northern Ireland. These establishments were not included within this Review as the request for a review of the implementation of CG174 from DoH specifically referenced the HSC Trusts and did not reference Independent (Private) Hospitals or Hospices. Independent (Private) hospitals and hospices are expected to have a Fluid Management Policy which is in line with current best practice, including NICE CG174: IV Fluid therapy in adults in hospital, and this is reviewed during RQIA inspections. The RQIA provider guidance for these establishments specifically details the following requirement:

'A fluid management policy in keeping with HSC (SQSD) (NICE CG174) 17/14 and NICE Clinical Guidance CG174 is in place and audited to provide assurance that the policy is being adhered to'.

1.3 Review Methodology

Fieldwork for this Review commenced in December 2017 with discussion on draft terms of reference for the work with DoH and formation of an independent Reference Group. Membership of the Reference Group is detailed in the Acknowledgements section of this report. The Group comprised members with considerable experience of the management of intravenous fluid therapy within their clinical specialities and across a range of conditions. An operational Review Team to support the work of the Reference Group was established and this comprised members of RQIAs core team and other members with significant experience in clinical and corporate governance including at Medical Director level.

The membership of the Review Team is also detailed in the Acknowledgements section of this report. Members of the Reference Group and Review Team designed the following methodology for this Review of implementation of CG174:

Literature Review

A review of relevant literature was completed to develop an understanding of the context for this Review and to identify key themes and the areas likely to require specific focus.

Engagement with Policy Leads and Commissioners

The 2014 Circular detailed the actions to be undertaken by the HSCB/PHA in relation to implementation and assurance of CG174. These requirements were aligned with the processes described in the 2013 Circular HSC (SQSD) 3/13 which explained the arrangements for the endorsement, implementation, monitoring and assurance of NICE Clinical Guidelines in Northern Ireland. The HSCB/PHA has responsibility for assurance of implementation of NICE guidance across the HSC.

The Review Team therefore engaged with the Policy Leads in DoH and with commissioners in HSCB/PHA. Through this engagement we understood the regional context relating to IV fluid therapy in adults in hospitals in Northern Ireland.

Structured Questionnaire

The Review Team designed a structured questionnaire informed by the key actions set out in the 2014 Circular. The questionnaire was issued to the five HSC Trusts, the HSCB and PHA. This provided an opportunity for each HSC Trust and the HSCB/PHA to describe their processes relating to governance and oversight arrangements in respect of CG174.

Regional Clinical Audit

The Review Team collaborated with Directors of Medical Education in each HSC Trust to obtain agreed nominations of postgraduate medical doctors to audit implementation of CG174 and assess clinical practice at ward level. It was agreed that the criteria for the audit would focus upon three of the '5Rs' of IV fluid therapy, namely Resuscitation, Routine maintenance and Reassessment. Replacement and redistribution were excluded.

Focus Groups with Staff

The Review Team held focus groups with frontline staff across all HSC Trusts and all adult programmes of care. The focus groups were held during March and April 2018 and involved more than 70 staff from medical, nursing and pharmacy teams. Focus groups were also held with junior and speciality doctors, these were arranged by the Northern Ireland Medical and Dental Training Agency (NIMDTA).

Meetings with Undergraduate and Postgraduate Training Providers

The Review Team met with education and training providers from Queen's University Belfast, Ulster University, the Open University and the HSC Leadership Centre in Northern Ireland to discuss education and training supporting implementation of CG174.

The Review Team had a particular interest in the '5Rs' (Resuscitation, Routine Maintenance, Replacement, Redistribution and Reassessment) terminology, and its' use in undergraduate and postgraduate education across the HSC in Northern Ireland.

Meetings with HSC Trusts

The Review Team undertook a week of meetings (the 'Review week') during April 2018 in which they met with each HSC Trust's Executive Management Team, Directors, Assistant Directors, Senior Clinicians, Service Managers and Governance leads. These meetings focused on discussion of findings, areas of concern and potential areas for improvement. The meetings were structured to follow key lines of enquiry arising from the detailed analysis of each HSC Trust's structured questionnaire, the main themes arising from staff focus groups and the learning emerging from the Review Team's engagement with education and training providers.

Fieldwork for this Review was completed in May 2018.

Section 2: Findings from the Review

This section presents the Review findings in six discrete sections. Each section describes elements of the implementation, governance systems and assurance arrangements in respect of implementation of CG174:

- HSC Trust Governance Systems;
- Assurance to the Health and Social Care Board (HSCB);
- Training and Education;
- Incident Management and Learning;
- Developments to Support Implementation and
- Regional Clinical Audit.

2.1 HSC Trust Governance Systems

The 2014 Circular issued by the DoH in July 2014 in relation to CG174[(2)] advised HSC Trusts to take the following actions:

Number	Action
1	Proceed with targeted dissemination, agree a clinical/management lead to co-ordinate implementation and consider what has to be done to achieve implementation using a risk-based assessment and baseline review as appropriate to support planning. These initial actions should be undertaken within a three month period.
2	Implement the Guideline within a further nine months (apart from any elements where significant issues have been raised with the HSCB/PHA).
3	Provide positive assurances to the HSCB that required initial actions have been taken within the three month planning period and that the guideline has been implemented within a further nine months, where appropriate.
4	Where significant investment/commissioning needs cannot be met within the usual timeframe, notify the HSCB at the earliest opportunity through the bi-monthly director level meetings and agree appropriate arrangements with them to achieve implementation.

Each HSC Trust provided information relating to the above actions through their structured questionnaire, meetings with senior management, focus groups with frontline staff and a clinical ward-based audit. The Review Team identified that all five HSC Trusts have a formal governance structure (not system) in place to manage DoH and other HSC correspondence requiring action. This correspondence includes NHS Improvement Patient Safety alerts, PHA learning letters and NICE clinical guidelines (which included CG174).

Each HSC Trust provided information to describe the process they followed upon receipt of the 2014 Circular from the DoH and its' subsequent dissemination through their organisation.

The Review Team found that each HSC Trust had one point of entry for all correspondence related to NICE Guidelines, which is the Chief Executive's Office. Such correspondence is then disseminated to relevant Directors and Assistant Directors for circulation within their directorate/division and to relevant groups and committees. This correspondence is logged and monitored centrally within the relevant HSC Trust's audit/governance department. Progress with respect to any required actions detailed in this correspondence are reviewed at an agreed frequency before an update is provided to the HSCB or other organisation as required.

Action 1 – Proceed with targeted dissemination, agree a clinical/management lead to co-ordinate implementation and consider what has to be done to achieve implementation using a risk-based assessment and baseline review as appropriate to support planning. These initial actions should be undertaken within a three month period.

Each HSC Trust confirmed that CG174 had been received and disseminated to relevant staff across their organisation.

Four HSC Trusts confirmed that they had appointed a clinical/management lead(s) to co-ordinate implementation or established a working group to co-ordinate implementation of CG174. However, within one HSC Trust (South Eastern HSC Trust) these actions were completed two months outside of the initial timescale of three months (in December 2014 instead of by October 2014). One HSC Trust (Belfast HSC Trust) did not provide evidence of their arrangements to support implementation.

HSC Trusts were found to be very reliant on interested clinicians to support the implementation of CG174 and there was limited support and dedicated protected time provided to assist these clinicians with undertaking the required tasks.

The Review Team considered that this approach has an inherent risk of promoting an inaccurate picture, and a single professional opinion/view rather than an evidence-based, multi-disciplinary assessment of the HSC Trust's actual position with respect to the guideline in question.

Recommendation 1	**Priority 1**
HSC Trusts should identify and define the required dedicated consultant programmed activities (PAs); ensuring time is allocated to enable clinical leadership of the implementation of NICE CG174.	

HSC Trust senior managers advised the Review Team that dissemination of CG174 across their organisations had been completed. The Review Team found in practice a general lack of awareness of the CG174 guideline itself and systems/processes relating to its' implementation amongst frontline staff (including medical, nursing and pharmacist staff).

Recommendation 2	**Priority 2**
HSC Trusts should strengthen dissemination and communication mechanisms for implementation of NICE CG174 and provide evidence to give assurance of their effectiveness.	

The Review Team identified that in most HSC Trusts there was no formal process to undertake a baseline review/risk based assessment. Four of the five HSC Trusts submitted a completed baseline assessment for CG174 to the HSCB. One HSC Trust (Belfast Trust) did not submit a completed baseline assessment. Following examination of these baseline assessments the Review Team determined that there was insufficient evidence, or systems in place to gather the evidence, which would demonstrate that implementation was achievable and on target as planned.

The Review Team noted that baseline assessments were long and complex to complete fully and it was difficult to evidence that all standards had been met. They considered that this was an onerous task in the absence of dedicated time and processes. Completion of such broad and complex baseline assessments is challenging for HSC Trusts, particularly if a clinical guideline is itself broad in scope.

The 2014 Circular recognises it may not be appropriate for a HSC Trust to implement each individual recommendation of CG174. It advocates that a risk based assessment be used to assist with prioritisation at Trust service/area/directorate level. The Review Team noted that there was limited evidence provided by the HSC Trusts in relation to local methods which they employed to assist with prioritisation of the implementation of recommendations of CG174.

The Review Team determined that going forward it would be important for HSC Trusts to have robust processes which would support prioritisation or risk assessments of guidelines to ensure effective implementation of recommendations which have the greatest impact on quality of care. Additionally, the Review Team identified a requirement for a greater element of regional co-ordination and co-operation between HSC Trusts in relation to regional priorities.

Recommendation 3	**Priority 1**
The HSCB in partnership with all 5 HSC Trusts should assess each of the recommendations within NICE CG174 to establish those which have the greatest impact on patient care and prioritise those for immediate implementation. Prioritisation should be regionally co-ordinated with the involvement of the Northern Ireland NICE Facilitator and NICE Regional Forum to ensure alignment with other regional priorities.	

Action 2 – Implement the Guideline within a further nine months (apart from any elements where significant issues have been raised with the HSCB/ PHA).

Limited evidence was provided by each HSC Trust to demonstrate that CG174 had been fully implemented within nine months following endorsement for implementation; taking into account the caveats set out in the 2014 Circular.

All HSC Trusts advised the Review Team that at the time CG174 was implemented, they had a significant backlog of other NICE guidelines to implement. During focus groups clinical staff reported that they could be dealing with between four and ten different guidelines or alerts each week which may or may not be relevant to their particular speciality. Senior staff highlighted that there is an increasing volume of guidance to consider, of which NICE guidance is only one part.

The Review Team were assured that frontline medical and nursing staff were familiar with and demonstrated a good working knowledge of the core principles of fluid management such as the importance of prescribing fluids and electrolytes, appropriate management plans, assessment of patients and reporting of incidents/near misses.

HSC Trusts highlighted some challenges from their perspective in relation to why CG174 had been difficult to implement fully. These included the removal of fluids containing 0.18% sodium chloride in all general units in which children might be treated, a lack of a regional clinical guideline for the fluid management of adult patients (whereas one was developed for fluid management of children and young persons) and the absence of a regional training package to support education and training. The Review Team considered that not using fluids containing 0.18% sodium chloride constitutes a small part of the overall guideline and noted that guidance on alternatives to using 0.18% sodium chloride had been produced and circulated to all Trusts as Appendix 2 in the 2014 Circular. Therefore, this should not have been perceived as a barrier to full implementation of the guideline. Although a regional clinical guideline and training package would have been helpful, the Review Team again considered that it should not have prevented CG174 being fully implemented across HSC Trusts.

HSC Trusts were asked for evidence of any audits undertaken in relation to implementation of CG174. Evidence from discussions at focus groups and with senior managers highlighted that many specialities had conducted audits of their own practice focusing on accurate completion of fluid balance charts, rather than evidencing the overall use and implementation of CG174. Senior management teams within some of the HSC Trusts acknowledged, upon reflection, they had waited too long for a regional training package on CG174 before auditing current practice.

The Review Team concluded that full implementation of CG174 in HSC Trusts could not be sufficiently evidenced. The Review Team also determined that there are significant weaknesses in the systems for governance and oversight of CG174 and its' continued use.

2.2 Assurance to the Health and Social Care Board (HSCB)

Following endorsement of CG174 in July 2014, each HSC Trust was required to provide evidence of implementation and assurance of the guideline to the HSCB as described below:

Action 3 – provide positive assurances to the HSCB that required initial actions have been taken within the three month planning period and that the guideline has been implemented within a further nine months, where appropriate.

Action 4 – where significant investment/commissioning needs cannot be met within the usual timeframe, notify the HSCB at the earliest opportunity through the bi-monthly director level meetings and agree appropriate arrangements with them to achieve implementation.

Actions 3 and 4 required all HSC Trusts to provide positive assurances to the HSCB. This involved completion of a 'Positive Assurance Template' with respect to clinical guidelines issued by DoH. The template allows each HSC Trust to describe any major barriers, specific requirements or patient safety concerns. The Review Team noted that the template was not structured to provide evidence to demonstrate and assure what had been done positively to implement CG174. They determined that there was too much focus upon compliance and assurance of the implementation of each recommendation; as evidenced by a sub-section on the template which required details of the number of recommendations currently implemented to be specified.

The template has five sections, of which three sections relate to the assurance of Clinical Guidelines and must be submitted to the HSCB, these are

Section C – Assurance on the planning/dissemination of Clinical Guidelines;
Section D – Assurance on the implementation of Clinical Guidelines; and
Section E – Clinical Guidelines not implemented/not on track for implementation within 12 months of issue by DoH.

In respect of implementation of CG174, all five HSC Trusts provided evidence they had submitted sections C, D and E to the HSCB. Three HSC Trusts (Northern, Western and Southern HSC Trust) submitted the template within the required three month timescale. Belfast and South Eastern HSC Trusts did not submit within three months and the Review Team noted that this delay had not been followed up by HSCB.

All HSC Trusts indicated that, as a result of the number of caveats, the lack of a regional clinical guideline for the fluid management of adult patients and the required resources and time to implement CG174, they had reported to the HSCB that the implementation status was 'red' (not on target for completion within agreed timescales).

Section E of the template was then submitted to HSCB as required. The HSCB reported that no further action was taken following a review of the Section E submissions and the reasons given were that no safety or financial risks were identified.

The HSCB advised the Review Team that it did not request any supporting evidence to corroborate the assessment of the HSC Trust. The Review Team determined that there was no mechanism in the current process for HSC Trusts to address implementation challenges and negotiate commissioning arrangements with the HSCB.

The Review Team found that the mechanisms for monitoring of implementation of CG174 by the HSCB in accordance with the actions set out in HSC (SQSD) 3/13 and as described above in sub-section 1.1.2 of this report, were not effective.

The bi-monthly meetings between the HSCB and HSC Trusts were not happening with any regularity. An administrative approach in which HSC Trusts submitted a RAG status for each recommendation of CG174 was instead found. Following analysis of the RAG statuses submitted, the Review Team concluded that they did not accurately reflect findings regarding the practical assessment and implementation of the guidance.

The current processes were found not to support an improvement based model. Although the HSCB recognises the increasing need to prioritise guidance given the volume published and the limited resources available, the Review Team found no evidence that CG174 had been considered for commissioning and implementation in a regionally agreed priority order. The Review Team considered that the impact of this lack of regional prioritisation may be contributing to frontline staff feeling overwhelmed by the volume of best practice guidance to be assessed and implemented.

Recommendation 4	**Priority 2**
The HSCB should develop and implement an effective system, supported by submission of clear evidence, to provide assurance of the implementation of all recommendations within NICE CG174; reporting progress to the DoH at regular intervals.	

The HSCB has responsibility for monitoring implementation of CG174. The Review Team could not evidence that the six monthly accountability meetings with the DoH was a sufficiently robust mechanism to assure this implementation across all applicable specialities and programmes of care in hospitals in Northern Ireland.

The Review Team determined that in view of the significance of this particular NICE guideline to safety of care and in view of the findings of the IHRD inquiry (on-going at the time of this Review and published 18 June 2019) it is important that the DoH are regularly updated on the extent of the implementation of this guideline.

Recommendation 5	Priority 2
The DoH and the HSCB should agree and establish arrangements for updating the DoH at regular intervals on the progress of HSC Trusts in implementing NICE CG174.	

Due to the identification of concerns relating to implementation and oversight of CG174 which the Review Team considered could also apply to other NICE Guidance we wrote to the DoH on 01 June 2018 to highlight these issues.

2.3 Training and Education

One of the key factors supporting full implementation of CG174 is the training and education of all staff who are/will be involved in its' implementation. In this respect CG174 makes the following three recommendations:

- Hospitals should establish systems to ensure that all healthcare professionals involved in prescribing and delivering IV fluid therapy are trained on the principles covered in this guideline, and are then formally assessed and reassessed at regular intervals to demonstrate competence;
- Healthcare professionals should receive training and education about, and be competent in, recognising, assessing and preventing consequences of mismanaged IV fluid therapy;
- Hospitals should have an IV fluids lead, responsible for training, clinical governance, audit and review of IV fluid prescribing and patient outcomes.

All five HSC Trusts provided evidence to the Review Team of induction and mandatory training for staff involved in prescribing and delivering IV fluids for adults in hospital. A summary of evidence is provided below for undergraduate doctors; postgraduate doctors; nurses; hospital pharmacists and other staff who may be involved in management of IV fluids.

Queen's University Belfast (QUB) reported that undergraduate medical students receive teaching with respect to IV fluids during years three, four and five of their medical training. Teaching material shared demonstrated specific reference to the '5Rs' approach (Resuscitation, Routine Maintenance, Replacement, Redistribution and Reassessment). QUB confirmed that students complete case-scenarios using these principles to consolidate learning. CG174 was found to be referenced in lectures and in online material. This teaching material also highlighted that IV fluids containing 0.18% sodium chloride are not available for general prescribing within Northern Ireland.

Foundation Year 2, doctors receive mandatory generic skills teaching in acute kidney injury (AKI), acid base and fluids management. This annual training has been developed and delivered by Nephrologists in Northern Ireland; and is organised and hosted by Northern Ireland Medical and Dental Training Agency (NIMDTA).

Training material shared with the Review Team included reference to the regional variations from CG174. HSC Trusts reported that they deliver training on hyponatraemia twice yearly, although attendance at this training is voluntary. Doctors undertaking postgraduate medical training undertake the British Medical Journal (BMJ) adult hyponatraemia e-learning module on a three-yearly basis.

All HSC Trusts advised that they provide an induction programme for nurses, which includes management of IV fluids in adults and accurate completion of the regional fluid balance chart. HSC Trusts reported that they commission the Clinical Education Centre (CEC) to deliver a revision session on management of IV fluids in adults to all nursing staff. It is also compulsory for hospital pharmacists to undertake the BMJ adult hyponatraemia e-learning module on a three-yearly basis.

HSC Trusts advised they have a statutory and mandatory training policy which is designed to ensure all staff are competent to fulfil the full range of duties required of them. Trusts reported that all staff should have a Personal Development Plan and must attend relevant statutory and mandatory training. All HSC Trusts reported having mechanisms in place to monitor and review staff participation in this training through databases, supervision and appraisal systems. Trusts further advised that staff may also be directed to resources on the PHA website i.e. Central Repository for HSC resources relating to hyponatraemia but noted that these resources are in relation to children and young people and not adults.

During focus groups staff indicated their undergraduate and postgraduate education, induction and mandatory training, had equipped them with a general understanding of IV fluid therapy prescribing in line with the principles covered in CG174. They informed the Review Team that their training included the importance of safe prescribing of IV fluids and electrolytes, the need for appropriate management plans, assessment of patients and reporting of incidents/near misses.

The HSCB and HSC Trusts advised that although CG174 included an e-learning training tool; it was not suitable for use in Northern Ireland due to the caveats set out within the 2014 Circular in relation to fluids containing 0.18% sodium chloride. No regionally agreed accredited training package or alternative tool was available at the time of this Review.

Senior management highlighted the need for a regionally consistent approach to training, as healthcare staff especially junior medical staff; frequently move within and between HSC Trusts. At the time of this Review, HSCB advised that a business case to develop a regional learning and competency assessment package, which will include IV fluids prescription and administration in adults, had been completed and submitted to the e-Health and Care Strategy Project Board. A determination with respect to funding had not been made.

The Review Team concluded that although training was being provided in each HSC Trust for a range of multidisciplinary staff on the management of IV fluids in adults which covered the key principles of CG174; there were gaps in the assurance of completion of training across and within these groups. The Review Team highlighted in particular the gaps in assurance pertaining to consultant medical staff and nursing staff not in continuous employment.

The Review Team further determined that whilst the current training addressed the key principles pertaining to the management of IV fluids they were unable to identify any system for the formal assessment of this training or demonstration of competence. Additionally, whilst the current training was considered to address key elements in relation to recognition, assessment and prevention of the consequences of mismanaged IV fluid therapy; the Review Team was unable to identify any system within which competency in this key area of CG174 was subsequently assessed or demonstrated.

The third recommendation of CG174 in relation to training and education was that hospitals should have an IV fluids lead, responsible for training, clinical governance, audit and review of IV fluid prescribing and patient outcomes.

There was no evidence at the time of this Review that any HSC Trust had established an IV fluids lead who was undertaking the responsibilities detailed in the aforementioned recommendation. HSC Trusts had indicated during meetings with the Review Team, that from their perspective, this recommendation could not be implemented as it requires a dedicated resource with appropriate revenue. The Review Team considered that although this was a challenge and would have been helpful it was not a total barrier to implementation of CG174. The Review Team considered that HSC Trusts could collectively discuss the actions required to address this issue at the NICE Regional Forum and at accountability meetings with the HSCB.

The Review Team determined that although some training was provided to different professionals through various mechanisms it was not consistent and lacked competency assessment. The Review Team did not find an effective mechanism in place to ensure that all relevant staff had received training commensurate with their roles, and which is formally assessed as required by CG174.

Recommendation 6	**Priority 3**
A HSC Trust should be identified to lead, on behalf of all 5 HSC Trusts with involvement of the relevant commissioning lead in the HSCB and the NICE Regional Forum, to undertake the following: a) review existing training packages and agree a training programme for use across all HSC Trusts which includes the 5Rs approach, the NICE CG174 guideline and the NICE CG174 Trigger List and include a component of formal competency assessment; b) implement a mandatory requirement for completion of an appropriate level of training for all relevant grades; and c) ensure that there are effective arrangements in place to monitor and assure compliance with completion of required training/competency assessments across all staff groups.	

2.4 Incident Management and Learning

CG174 includes a table detailing the consequences of fluid mismanagement and recommends that these be reported as critical incidents. Within Northern Ireland the DoH highlighted in the 2014 Circular that such incidents should be treated as adverse incidents rather than as serious adverse incidents and should be reported in accordance with current incident reporting arrangements.

The Review Team found that all HSC Trusts use the incident management system known as Datix Web (Datix) and that any incidents pertaining to IV fluids are logged and coded on Datix using the field 'Medication Incident - IV Fluids'. All Trusts had developed their own policy and procedures for reporting and management of incidents. These policies were reviewed and confirmed to describe the processes for reporting, escalation, investigation, analysis and identification of learning.

CG174, with the aforementioned DoH caveat applied in Northern Ireland, highlights that explicit incidents relating to mismanagement of fluids (for example, unnecessarily prolonged dehydration or inadvertent fluid overload due to IV fluid therapy) should be reported in line with established incident reporting arrangements, as adverse incidents to support improvement in practice and training. The guideline also provides a list of specific triggers related to the consequences of fluid mismanagement (hypovolaemia, pulmonary oedema, hyponatraemia, hypernatraemia, peripheral oedema, hyperkalaemia and hypokalaemia) detailed in Appendix 3. These should also be reported as adverse incidents.

The Review Team found that no HSC Trust used the incident triggers as described in CG174. In general Trust staff were not aware of the requirement to identify and use these triggers in practice. The Review Team was concerned that overall there appeared to be a lack of recognition, reporting and learning in relation to adverse incidents involving IV fluid management.

All HSC Trusts suggested that incident triggers as defined in CG174 could be incorporated into the current Datix system. The Review Team were concerned that as the incident triggers were not part of established practice or training provided by/within HSC Trusts, the availability of the triggers within the Datix incident reporting system, by itself was unlikely to deliver the requirements for incident recognition and reporting as described by CG174.

There were a number of significant weaknesses in the current systems for identification, reporting and monitoring of adverse incidents involving IV fluid management. The appropriate use of the triggers advised in CG174 was highlighted as being a key mechanism to gather intelligence with respect to incidents and near misses involving use of IV fluids in adults. Though not all triggers may be useful in all clinical areas, each clinical area should review and implement systems to identify and report incidents relating to IV fluid management. These systems should include provision of adequate training, development of knowledge and skills to recognise adverse incidents appropriately and the use of the correct incident trigger codes on the Datix system.

Recommendation 7	Priority 2
HSC Trusts should: a) formally adopt NICE CG174 Trigger List codes, b) ensure that all incidents aligned to the NICE CG174 Trigger list codes are recorded on the Datix Web Incident Management System; and c) ensure all relevant staff receive training on the identification of incidents aligned to the NICE CG174 Trigger list codes.	

During focus groups, staff highlighted that managers of all departments/specialties have a core responsibility to review all incidents, discuss them at local multi-disciplinary meetings and escalate issues or concerns. All HSC Trusts provided examples of how their governance systems enabled the identification and sharing of learning following incidents. For example, a 'Learning Alert' can be issued to relevant areas so important learning can be shared. The Review Team found no examples of audits or examples of quality improvement work aligned to the occurrence of the incident triggers described in CG174 and the Review Team concluded that there were weaknesses in the current systems for the sharing of learning with respect to adverse events/incidents involving IV fluid management. We considered that dissemination of learning across all applicable staff groups could be enhanced and that this would assist with improving incident reporting.

All HSC Trusts advised they were reviewing their incident reporting systems to make them more user friendly and ensure they are used efficiently and effectively. All HSC Trusts reported that they planned to use the triggers described in CG174 moving forward as guidance to inform audit of management of IV fluids.

Recommendation 8	Priority 2
HSC Trusts should ensure learning arising from incidents involving IV fluids is actively disseminated on a local and regional basis as appropriate. HSC Trusts should seek regional collaboration in respect of identification of audit/quality improvement initiatives informed by the identification of incidents. This work should involve all available regional fora.	

2.5 Developments to Support Implementation

A NICE Regional Forum is established which provides an opportunity to share learning and support communication across the region in relation to NICE Guidance. The Review Team heard that it has been valuable in the dissemination of information about good practice relating to IV fluid management. The Forum has focused to date mostly on IV fluid management in children. The Review Team considered that there was an opportunity to utilise this Forum more effectively to support on-going review and learning regarding the status of recommendations from CG174 and other NICE Guidelines.

The NICE Regional Forum could also facilitate a more co-ordinated approach in relation to recommendations from CG174 and other NICE Guidelines which are considered to be outside of HSC Trust control and which may require additional resources or commissioner prioritisation.

During the course of this Review we identified significant weaknesses in existing HSC Trust governance systems and concluded that systems for receiving, implementing and assuring implementation of guidelines were not fully effective and that there is a requirement to implement robust assurance systems with appropriate supporting data and information.

The Review Team noted that all HSC Trusts advised they are in the process of reviewing or restructuring their governance arrangements to support development of an effective system for full implementation and dissemination of all guidelines, where appropriate. All HSC Trusts advised they were fully aware of the need to assure themselves that their systems and processes for dissemination and implementation of NICE guidance were sufficiently robust.

Recommendation 9	**Priority 2**
HSC Trusts should develop and implement an assurance system, underpinned by robust data and information, to provide assurances to their Trust Board and the HSCB, in respect of the implementation of NICE CG174 and each of the recommendations within this Review report.	

Some HSC Trusts (Northern and Western) provided examples of audit and QI initiatives relating to the management of IV fluids. The Western HSC Trust had developed a ward checklist which facilitates pre-ward round planning and enables frontline nursing and medical staff to identify any issues in relation to IV fluid management so that these can be discussed and resolved during the Consultant ward round. Additionally, key questions in relation to the type and volume of IV fluid, the rate of administration and review of the duration of treatment are prompted. The introduction of the checklist has improved the assessment of patients with respect to their IV fluid requirements and ensured that IV fluid prescriptions are reviewed during each ward round. It was also found that communication between nursing staff, junior medical and Consultant staff was enhanced.

The Review Team welcomed this initiative as it aligned with recommendation 1.1.1 of CG174 and the recommendation from the National Confidential Enquiry into Perioperative Deaths Report in 1999 that IV fluid prescribing should have the same status as any other drug prescribed.

The Northern HSC Trust had identified from an audit of IV fluid prescribing incidents a vulnerability in relation to junior doctor prescribing of IV fluids in the out of hours period. They identified that junior doctors were often undertaking this activity on their own without access to more senior support and that often the IV fluid requirements could have been assessed and prescribed earlier in the day.

The audit recommendations with respect to more time appropriate assessment and prescribing as well as access to senior support were implemented and resulted in improved patient management plans over the 24 hour period and a reduction in IV fluid prescribing by junior doctors in the out of hours period.

The Review Team assessed this audit example as aligning with recommendation 1.1.6 of CG174 and welcomed the use of the intelligence provided by the Datix incidents to support systemic changes.

The Review Team welcomed the initiatives implemented by the Northern and Western HSC Trusts as evidence of them recognising the need to obtain assurance regarding the management of IV fluids. The commitment to on-going audit/QI work was highlighted by the Review Team as a best practice approach for the HSC Trusts to take in order to strengthen this assurance and improve the quality and safety of their services.

Whilst the Review Team considered that the examples described above contain important learning to strengthen practice in relation to implementation of CG174, they were concerned that the audit/QI projects were examples of individual Trust initiatives and that no regional audits/QI projects were evidenced as having been undertaken. The Review Team could not evidence that the outcomes and learning from the individual Trust initiatives described had been shared with the other HSC Trusts in order to support improvements across the region.

Effective collaboration between HSC Trusts would enable meaningful learning relating to implementation of CG174, to be disseminated across all HSC Trusts in Northern Ireland.

2.6 Regional Clinical Audit

Introduction

During the Review, an audit of clinical practice at ward level was undertaken was undertaken, in all five HSC Trusts, in respect of IV fluid management in adults (adults within the scope of NICE CG174).

The audit assessed performance against recommendations within CG174 which relate to clinical practice. Specifically the audit assessed if:

- patients receiving IV fluids was appropriately assessed;
- prescribing of IV fluid was reviewed in accordance with CG174;
- patients received IV fluids and electrolytes appropriate to their particular needs; and
- IV fluid therapy, including the fluid and electrolyte prescription, appropriate monitoring and the assessment plan, was documented clearly and legibly.

The audit focused on three of the five ‘Rs’ as recommended within CG174; Resuscitation, Routine maintenance and Reassessment. Two of the five ‘Rs’, Replacement and Redistribution were not included.

This is because assessment of appropriate fluid prescription in these clinical cases can be complex, requiring a very detailed understanding of each individual patient's fluid losses and current physiology, which was beyond the scope of this audit.

This audit focused on clinical practice within wards and did not seek to assess those recommendations within CG174 specifically relating to training and education. The Review Team recognised that training and education is one of the key factors supporting full implementation of CG174 and consequently this was considered in detail during the Review. The findings with respect to training and education have been previously detailed in Section 2.3 of this report.

Methodology

Medical, Surgical, ED and Care of Elderly (CoE) wards, in the five HSC Trusts, were agreed as suitable target wards because the patients within these wards often receive IV fluid therapy as part of their treatment. HSC Trusts, in conjunction with the RQIA statistician, agreed that 20% of each ward type, in each Trust, should be audited to achieve a representative sample.

Clinical records of a minimum of two patients meeting one or more of the following criteria were audited in each ward:

- patients in receipt of IV fluids for at least 24 hours;
- one patient per ward who was fasting continuously for 24 hours;
- one patient per ward who had received maintenance fluids only for at least 48 hours;
- one patient per ward who had received resuscitation due to hypovolaemia.

Clinical records for patients with the following conditions/treatments were excluded from this audit:

- Pregnancy;
- Diabetes Mellitus;
- On inotropes;
- Severe Liver disease;
- Severe Renal disease;
- Receiving treatment for burns;
- Those with traumatic brain injury; and
- Children under the age of 16 years old.

The key findings arising from the audit are presented below, in line with recommendations made in CG174. A number of CG174 recommendations were not assessed. The rationale for non-assessment of those recommendations is documented in Appendix 4.

Directors of Medical Education in each HSC Trust identified and nominated postgraduate medical doctors to undertake the audit in their respective hospital(s) and HSC Trust.

A draft regional audit proforma was developed with expert input from the Review Reference Group and HSC Trust Affiliates. The proforma was piloted in two HSC Trusts (South Eastern and Northern HSC Trusts). Following those pilots, a number of suggested improvements were made to the regional audit proforma prior to commencing the audit exercise.

Training and guidance notes on the use of the final regional audit proforma were provided to the postgraduate medical doctors, nominated by the Directors of Medical Education to undertake the audit.

The audit was conducted over a four week period from 6 March to 3 April 2018. A total of 145 patient records were audited; one patient record was excluded at the point of data entry (as they were identified to have a condition excluding them from the sample). This resulted in a final audit sample of 144 patient records.

Data collected on paper audit proformas was transferred into an MS Excel spreadsheet to facilitate detailed analysis. Data analysis was undertaken by the RQIA Clinical Leadership Fellow with expert advice and guidance from an RQIA statistician.

A detailed summary of audit findings are described in Appendix 5.

CG174 Recommendation Audited

1.1.1 - Assess and manage patients' fluid and electrolyte needs as part of every ward review.

The audit did not assess this part of Recommendation 1.1.1 as the methodology employed enabled a review of only those patients in receipt of IV fluids.

Provide IV fluid therapy only for patients whose needs cannot be met by oral or enteral routes and stop as soon as possible.

For patients in receipt of IV Fluids, the records audited indicated that 85% (119 out of 140) contained evidence of a documented daily review. Only 45% (63 out of 140) of these patient records contained documented evidence that both the patients' fluid and electrolyte needs were reviewed on a daily basis.

CG174 highlights that all patients continuing to receive IV fluids need regular monitoring. The lack of daily assessment of the fluid and electrolyte needs in 55% (77 out of 140) of these patient records indicated that a determination of the appropriateness of continuing IV Fluids and/or consideration of oral/enteral routes was not completed.

In view of these results, this element of Recommendation 1.1.1 was assessed as not fully achieved.

1.1.5 - Include the following information in IV fluid prescriptions:

- ***The type of fluid to be administered.***
- ***The rate and volume of fluid to be administered.***

In respect of the IV fluid prescriptions audited, 97% (630 out of 650) included information on the type of fluid, 98% (634 out of 650) included information on the rate of administration of fluid and 96% (627 out of 650) included information on the volume of fluid to be administered.

In view of these results Recommendation 1.1.5 was assessed as fully achieved.

Although the General Medical Council (GMC) 'Good practice in prescribing and managing medicines and devices' (2013)[7] guidance was not specifically audited as part of Recommendation 1.1.5, it was recognised that the clear identification of the prescriber is an essential for determining whether the prescription has been generated by an authorised professional prescriber and is legally valid.

We found that the prescriber could only be clearly identified in 22% (142 out of 650) of the prescriptions audited and therefore determined that overall practice was not in keeping with GMC guidance.

1.1.6 - Patients should have an IV fluid management plan, which should include details of:

- ***The fluid and electrolyte prescription over the next 24 hours.***
- ***The assessment and monitoring plan.***

Approximately half of patient records audited, 52% (65 out of 125), contained evidence of a documented fluid management plan. However, these fluid management plans did not meet the requirements set out in CG174, with only 25% (75 out of 304) of the plans containing a reference to a fluid volume and 32% (97 out of 304) of plans containing reference to electrolyte prescription.

In view of these results Recommendation 1.1.6 was assessed as not fully achieved.

1.1.7 - When prescribing IV fluids and electrolytes, take into account all other sources of fluid and electrolyte intake, including any oral or enteral intake, and intake from drugs, IV nutrition, blood and blood products.

Fluid balance charts record the volume of fluids a patient has received (inputs) and lost (outputs) in a 24 hour period. This information is essential to inform the prescribing of IV fluids and electrolytes and for determining appropriate IV fluid plans. Accurate calculation and documentation of both daily input and output and daily totals, enable all sources of fluid and electrolyte intake to be considered when IV fluids are prescribed.

The audit sought evidence that recording of inputs and outputs was appropriately documented within fluid balance charts. A majority, 87% (436 out of 499) of fluid balance charts reviewed contained evidence of input and output recording. However, only in 54% (268 out of 499) of the fluid balance charts were the daily totals boxes completed.

Based on the information within fluid balance charts, we could not determine that all sources of fluid and electrolyte intake had been considered before the IV fluids were prescribed.

In view of these results Recommendation 1.1.7 was assessed as not fully achieved.

1.2.2 - Assess the patient's likely fluid and electrolyte needs from their history, clinical examination, current medications, clinical monitoring and laboratory investigations.

The audit did not aim to assess all aspects of this recommendation as detailed above; but specifically examined the criteria specifically relating to clinical monitoring as follows:

- ***Clinical monitoring should include current status and trends in:***
  - ***National Early Warning Score (NEWS)***
  - ***fluid balance charts***
  - ***weight***

CG174 describes the importance of all patients in receipt of IV fluids being monitored. This should initially include weight measurement twice weekly.

To assess this recommendation, for each patient record audited we examined whether Modified Early Warning Score (MEWS) charts balance charts were in use and whether weight was documented on admission to the ward.

MEWS was in use for 98% (141 out of 144) of patients receiving IV fluids. The results relating to completion of fluid balance charts are detailed above under Recommendation 1.1.7.

Patient records (medical and nursing), the fluid balance charts and the kardex (prescription record) contain a section for a patient's weight to be documented. Weight was documented, in one of these locations, in 63% (89 out of 142) of patient records audited. However, weight was documented in only 9% (8 out of 89) the fluid balance chart.

In view of these results the clinical monitoring aspect of Recommendation 1.2.2 was assessed as not fully achieved.

1.2.3 - If patients are receiving IV fluids for resuscitation, reassess the patient using the ABCDE approach (Airway, Breathing, Circulation, Disability, Exposure), monitor their respiratory rate, pulse, blood pressure and perfusion continuously, and measure their venous lactate levels and/or arterial pH and base excess according to guidance on advanced life support (Resuscitation Council [UK], 2011).

For those patients who were in receipt of IV fluids for resuscitation (n=16), a review of their patient records was undertaken to identify whether there was documentation of an ABCDE approach being used during reassessment. Only 38% (6 out of 16) of these patient records containing documentation of reassessment.

Of the patient records containing documentation of reassessment (n=6), we found that only half (3 out of 6) had documented evidence of the reassessment using an ABCDE approach.

In view of the patient numbers being small the audit result should be interpreted with caution. As such, it was considered not appropriate to make a determination with respect to Recommendation 1.2.3.

1.2.4 All patients continuing to receive IV fluids need regular monitoring. This should initially include at least daily reassessments of clinical fluid status, laboratory values (urea, creatinine and electrolytes) and fluid balance charts, along with weight measurement twice weekly.

Fluid balance charts record the fluids a patient has received (inputs) and lost (outputs) in a 24 hour period. This Recommendation highlights the importance of the fluid balance chart being reviewed on a daily basis to ensure appropriate monitoring.

During the audit, reviews of 499 fluid balance charts were completed. The majority of fluid balance charts 87% (436 out of 499) contained evidence of daily input/output recording.

Urea and electrolyte (U&E) measurement is an essential part of IV fluid prescribing as it allows for the detection of abnormalities that may affect the appropriate choice of IV fluid to be prescribed.

During the audit, we reviewed how many days the patient had a U&E measurement taken and reviewed whilst receiving IV fluids. We assessed daily U&E measurements for each day that patients were receiving IV fluids and found that 72% (104 out of 144) of patients had evidence of a daily U&E measurement and review.

We recognised that it may not be necessary for a U&E measurement to be undertaken on the day that IV fluids are stopped. The audit therefore reviewed the results in this context. The results indicated that if one missed daily U&E was permitted, for the day IV fluids were discontinued, then 90% (130 out of 144) of patients had a daily measurement and review.

The audit did not assess compliance with twice weekly weight measurements as part of this Recommendation however it did consider evidence of a documented weight when assessing Recommendation 1.2.2 above.

In view of these results Recommendation 1.2.4 was assessed as not fully achieved.

1.3.1 - If patients need IV fluid resuscitation, use crystalloids that contain sodium in the range 130–154 mmol/l, with a bolus of 500 ml over less than 15 minutes. (For more information, see the Composition of commonly used crystalloids table.)

The audit initially identified that 40% (58 out of 144) patients required resuscitation due to suspected hypovolaemia. However, it was found that not all of these patients truly required resuscitation but rather some actually required fluid replacement due to fluid losses. Of the patient records audited 11% (16 out of 144) were assessed as requiring true resuscitation and as having started treatment with a bolus IV fluid. There was documented evidence within 16 patient records that patients had received a bolus of fluid of either compound sodium lactate (Hartmann's) solution or sodium chloride 0.9% which is accordance with CG174.

In accordance with CG174, the use of glucose 5% was not documented in any of the records audited: not in the original cohort of 58 identified as potentially having received resuscitation, nor in the subgroup of 16 confirmed as truly requiring resuscitation.

In view of the limited numbers identified as receiving resuscitation, we could not make a final determination with respect to achievement of Recommendation 1.3.1.

1.3.2 - Do not use tetrastarch for fluid resuscitation.

Of the total 144 patient records audited across 11 CoE, 19 surgical and 28 medical wards in all five HSC Trusts and 2 Emergency Departments in two HSC Trusts, the data did not identify any patients in which tetrastarch fluid was used for resuscitation**.**

In view of these results Recommendation 1.3.2 was assessed as fully achieved.

1.3.3 - Consider human albumin solution 4–5% for fluid resuscitation only in patients with severe sepsis.

No cases were identified of this solution being used for resuscitation. CG174 recommends that it only be considered in the specific case of severe sepsis. This audit did not review any patients with severe sepsis and consequently we did not examine consideration of the use of human albumin solution 4–5%.

In view of no patients with severe sepsis being identified, we could not make a determination with respect to Recommendation 1.3.3.

1.4.1 - If patients need IV fluids for routine maintenance alone, restrict the initial prescription to:

- ***25–30 ml/kg/day of water;***
- ***approximately 1 mmol/kg/day of potassium, sodium and chloride; and***
- ***approximately 50–100 g/day of glucose to limit starvation ketosis. (This quantity will not address patients' nutritional needs; see Nutrition support in adults [NICE clinical guideline 32].)***

This recommendation relates specifically to routine maintenance. In practice, it is difficult to isolate IV fluids used for routine maintenance from other additional requirements for replacement/resuscitation as both will often take place at the same time. The inclusion criteria for this section of the audit were thus restricted to enable valid analysis.

The patient records, for 13 out of a possible 144 patients, met the inclusion criteria for this section of the audit, i.e. those which were receiving fluids for maintenance only.

Considering the requirement for 25–30 ml/kg/day of water; 77% (10 out of 13) of patient records contained were prescriptions for this this volume or less and 23% (3 out of 13) more than this volume.

With respect to the requirement for approximately 1 mmol/kg/day of potassium, sodium and chloride 62%(8 out of 13) of patient records indicated patients were receiving an excess amount of sodium and chloride and 54% (7 out of 13) were receiving a suboptimal amount of potassium with 57% (4 out of 7) of patients receiving no potassium at all.

Further analysis of the 8 patient records which had identified that patients were receiving an excess amount of sodium highlighted that 63% (5 out of 8) of patient records indicated receipt of more than 3 times the recommended dose.

Lastly, in relation to the requirement for approximately 50–100 g/day of glucose to limit starvation ketosis; 85% (11 out of 13) of patients failed to receive the recommended minimum prescription of glucose.

Considering these results, the complexities of fluid balance management and the small numbers of records included, it was considered not appropriate to make a final determination with respect to achievement of this Recommendation 1.4.1.

Regional Clinical Audit - Discussion

Principles of IV Fluid Therapy

The results from this audit identified that CG174 was not fully implemented in any HSC Trust.

Eleven[2] recommendations were audited and the results indicated that only 18% (2 out of 11) were fully achieved. Almost half of the recommendations (5 out of 11) were assessed as being not fully achieved. For four recommendations it was considered not appropriate to make a determination. This was due to factors such as small number of patient records and additional restrictions on inclusion criteria relating to specific recommendations. These limitations were accounted for during the data analysis and when making final determinations.

In the previous section of this Review we indicated that the five HSC Trusts provided positive assurance returns to the HSCB in relation in respect of the implementation of CG174. The findings from this audit do not support these positive assurances and identify significant gaps in respect of the extent of implementation.

[2] For Recommendation 1.2.2 all aspects of this recommendation were not included in the audit. The audit did examine the criteria specifically relating to clinical monitoring.

The Review Team were concerned that identification of prescribers either by legible name or GMC number was only possible in 22% (142 out of 650) of prescriptions audited. The ability to identify the prescriber and thus ensure the validity of prescriptions is also an essential component of patient safety and provision of effective care.

Initial Assessment

Though the daily assessment of patients receiving IV fluids was evident in 85% (119 out of 140) of patient records audited, the content of these assessments require further work as they were not fully comprehensive in terms of detailing both fluid and electrolyte requirements.

Fluid management plans did not meet with CG174 recommendations in terms of volume of fluid prescribed and electrolyte requirements. Improvement is required to ensure that they are appropriately developed and implemented on a daily basis.

Reassessment

MEWS charts were used to actively monitor patient clinical status in 98% (141 out of 144) of cases. There was evidence of input/output recording in 87% (436 out of 499) of fluid balance charts reviewed but the daily totals box, which is an essential tool for calculating fluid needs for the next 24 hours, was completed in only 54% (268 out of 499) of the reviewed fluid balance charts.

Although patient weight was only documented in 9% (8 out of 89) of fluid balance charts assessed, it was noted that recording of weight was documented elsewhere in 63% (89 out of 142) of patient records. The Review Team considered that there is a need to improve recording of weight measurement to ensure this information is easily available to those prescribing in line with CG174.

Resuscitation

The complexities of clinical presentation impacted on the assessment of fluids given for resuscitation, given the frequent overlap with fluid replacement and redistribution.

The number of patients identified in the audit as requiring true fluid resuscitation were small (n=16) as the majority of those initially identified were found to actually require fluid replacement due to fluid losses. All 16 patients requiring true fluid resuscitation received bolus of fluids which were in line with CG174.

Recording the use of the ABCDE approach to reassessment was poor; only 38% (6 out of 16) of patient records contained required documentation. However, The Review Team determined that as the patient numbers involved were small the results should be interpreted with caution.

Routine Maintenance

It was difficult to isolate the records for IV fluids used for routine maintenance from other additional replacement/resuscitation requirements. In clinical practice these will frequently occur at the same time as a component of maintenance fluids. The criteria for inclusion in this section of the audit were restricted to enable valid analysis. Consequently, the number of patient records audited was small 9% (13 out of 144).

Results from this audit indicated that while the majority of patients were prescribed an appropriate volume of fluid they were receiving excess amounts of sodium and chloride and a suboptimal amount of potassium.

The fact that 57% (4 out of 7) of patient records indicated that patients were not receiving any potassium is concerning.

Although the number of patient records which met the inclusion criteria for receiving fluids for maintenance only was small at 9% (13 out of a possible 144 patients) it was apparent that within this sample the majority (62%) of patients (8 out of 13) were receiving an excess amount of sodium. This finding coupled with an identification of a preference to prescribe sodium containing IV fluids in preference to glucose containing fluids is concerning. CG174 highlights the importance of monitoring patients in receipt of IV fluids containing chloride concentrations greater than 120mmol/L, such as sodium chloride 0.9%, to avoid the development of hyperchloraemia or acidaemia.

Additionally, the preference to prescribe sodium containing IV fluids in preference to glucose containing fluids exacerbates the risk of patients developing starvation ketosis. Although the sample size analysed was small it was again concerning to find that 85% (11 out of 13) of patients failed to receive the recommended minimum prescription of glucose.

Both of these findings suggest that further training and awareness is required for staff involved in the prescription of IV fluids.

Results from this audit support the findings emerging through other parts of this Review where returns from the five HSC Trusts would suggest that robust ongoing assurance systems in relation to CG174 are not in place.

CG174 contains multiple recommendations aligned to the 5Rs, these were not all assessed as part of this audit. Moving forward there is an opportunity for the five HSC Trusts to collaborate and develop a standardised Northern Ireland Checklist to enable regular audit of a sample of IV Fluid Prescriptions to be undertaken in each Trust in order to improve practice and share learning. The approach and learning from the development of the Paediatric IV Fluid Audit Improvement (PIVFAIT) tool following the GAIN Paediatric Fluid Audit 2014 could be similarly applied.

HSC Trusts could also consider dividing the recommendations, contained in CG174, between them for more in-depth targeted audits. This would facilitate sharing of outcomes and learning regionally and enable QI initiatives aligned to CG174 to be more effectively identified and implemented into operational practice.

Section 3: Conclusions and Recommendations

3.1 Conclusions

Implementation of CG174 is crucial for the delivery of safe and effective care. This Review examines the effectiveness of the implementation of CG174 which included assessment of the extent of implementation, effectiveness of oversight and assurance of implementation, the knowledge and understanding of healthcare professionals and an audit of clinical practice.

Mismanagement of IV fluid therapy is associated with significant complications or morbidity an issue which has been further highlighted by the IHRD inquiry which was on-going at the time of this Review.

This Report has made nine recommendations. Three recommendations relate to strengthening the HSC Trust internal assurance systems; two relate to strengthening systems of oversight and assurance within the HSC Board, one relates to actions required to ensure effective regional prioritisation; one relates to required improvements in development and delivery of training and education and two relate to strengthening systems of incident identification and subsequent implementation of learning and quality improvement.

A clinical audit was undertaken to complement the other methods employed. The findings of the audit support the evidence gathered during the course of this Review, indicating weaknesses within the Trusts internal assurance systems in relation to CG174 and subsequent assurances given to the HSCB by the Trusts. In view of this, RQIA would expect all HSC Trusts to reflect on the audit findings in their entirety and identify where improvement is required. Furthermore all HSC Trusts should take steps to assure themselves and their respective Trust Boards of delivery of these improvements.

We believe that these recommendations would support significant improvement in systems and processes required to ensure effective implementation and assurance of implementation of CG174 and ultimately contribute to improved outcomes for patients.

It is particularly important to note this Review has identified a need for stronger regional co-ordination and collaboration in respect of both prioritisation of recommendations and systems of assurance. Regional co-ordination and co-operation is critical, not only to maximising opportunities for quality improvement associated with CG174, but also for ensuring the effective implementation, oversight and assurance of future clinical and NICE guidelines.

3.2 Summary of Recommendations

The recommendations have been prioritised in relation to the timescales in which they should be implemented, following the publication of the report.

Priority 1 - completed within 6 months of publication of report
Priority 2 - completed within 12 months of publication of report
Priority 3 - completed within 18 months of publication of report

Number	Recommendation	Priority
1	HSC Trusts should identify and define the required dedicated consultant programmed activities (PAs); ensuring time is allocated to enable clinical leadership of the implementation of NICE CG174.	1
2	HSC Trusts should strengthen dissemination and communication mechanisms for implementation of NICE CG174 and provide evidence to give assurance of their effectiveness.	2
3	The HSCB in partnership with all 5 HSC Trusts should assess each of the recommendations within NICE CG174 to establish those which have the greatest impact on patient care and prioritise those for immediate implementation. Prioritisation should be regionally co-ordinated with the involvement of the Northern Ireland NICE Facilitator and NICE Regional Forum to ensure alignment with other regional priorities.	1
4	The HSCB should develop and implement an effective system, supported by submission of clear evidence, to provide assurance of the implementation of all recommendations within NICE CG174; reporting progress to the DoH at regular intervals.	2
5	The DoH and the HSCB should agree and establish arrangements for updating the DoH at regular intervals on the progress of HSC Trusts in implementing NICE CG174.	2
6	A HSC Trust should be identified to lead, on behalf of all 5 HSC Trusts with involvement of the relevant commissioning lead in the HSCB and the NICE Regional Forum, to undertake the following: a) review existing training packages and agree a training programme for use across all HSC Trusts which includes the 5Rs approach, the NICE CG174 guideline and the NICE CG174 Trigger List and include a component of formal competency assessment;	3

Number	Recommendation	Priority
	b) implement a mandatory requirement for completion of an appropriate level of training for all relevant grades; and c) ensure that there are effective arrangements in place to monitor and assure compliance with completion of required training/competency assessments across all staff groups.	
7	HSC Trusts should: a) formally adopt NICE CG174 Trigger List codes, b) ensure that all incidents aligned to the NICE CG174 Trigger list codes are recorded on the Datix Web Incident Management System, and c) ensure all relevant staff receive training on the identification of incidents aligned to the NICE CG174 Trigger list codes.	2
8	HSC Trusts should ensure learning arising from incidents involving IV fluids is actively disseminated on a local and regional basis as appropriate. HSC Trusts should seek regional collaboration in respect of identification of audit/quality improvement initiatives informed by the identification of incidents. This work should involve all available regional fora.	2
9	HSC Trusts should develop and implement an assurance system, underpinned by robust data and information, to provide assurances to their Trust Board and the HSCB, in respect of the implementation of NICE CG174 and each of the recommendations within this Review report.	2

Appendix 1: Endorsed NICE Clinical Guideline CG174

Developed following a Departmental review undertaken by an Expert Group led by Professor Ian Young (Centre Director of School of Medicine, Dentistry and Biomedical Sciences, Queen's University, Belfast) and issued by DoH in Appendix 1 of Circular HSC (SQSD) (NICE CG174) dated 22 July 2014.

Reference Number	NICE Clinical Guideline - CG174
Title	**Intravenous fluid therapy in adults in hospital**
Summary of guidance	This clinical guideline offers evidence-based advice on intravenous (IV) fluid therapy for adults in hospital. It contains recommendations about general principles for managing IV fluids, and applies to a range of conditions and different settings. It does not include recommendations relating to specific conditions.
Number of people expected to take up or benefit from the service / therapy	Unable to calculate for NI.
Costs / savings associated with implementation	Due to lack of local data we are unable to calculate the cost of implementing this guidance in NI. Potential areas for additional costs include the possible need for additional specialist hours. In addition, hospitals will need to review their local training systems however; it is thought any increase in training costs is not likely to be significant. As a result of implementing this guidance in England, it is expected that the number of prescribing errors will be reduced, as well as the subsequent adverse effects on morbidity and mortality which will generate savings locally.
Related strategically relevant DHSSPS policies	None
Inter-Departmental interest	None

Legislative / policy caveats	This advice does not override or replace the individual responsibility of health professionals to make appropriate decisions in the circumstances of their individual patients, in consultation with the patient and/or guardian or carer. This would, for example, include situations where individual patients have other conditions or complications that need to be taken into account in determining whether the NICE guidance is fully appropriate in their case. The Mental Capacity Act 2005 and the Department of Health document 'Reference Guide to Consent for Treatment or Examination' do not apply in NI, but work is under way to bring forward similar legislation for NI, incorporating mental capacity and mental health provisions. The DHSSPS guidance 'Reference Guide to Consent for Examination, Treatment or Care (2003)', which is available on the DHSSPS website, gives advice on determining whether a person has capacity and on what action may be taken where the person lacks capacity. Available from: http://www.dhsspsni.gov.uk/consent-referenceguide.pdf
Fluid Management – specific Caveats	Recommendation 1.4.4 recommends that consideration be given to the use of 25–30 ml/kg/day sodium chloride 0.18% in 4% glucose with 27 mmol/l potassium for routine maintenance. Fluids containing 0.18% sodium chloride must be removed from stock and general use in all general units in which children might be treated. Suitable alternatives must be available. Recommendation 1.4.5 recommends that consideration should be given to delivering intravenous fluids for routine maintenance during daytime hours. This should be interpreted as during normal waking hours i.e. a period of not less than 16 hours. NICE Clinical Guideline CG174 includes a table which sets out the consequences of fluid mismanagement to be reported as critical incidents. In Northern Ireland, these should be treated as adverse incidents and reported in line with your arrangements for reporting of adverse incidents. One of the key recommendations of CG174 is the use of terminology involving the '5Rs' (Resuscitation,

	Routine Maintenance, Replacement, Redistribution and Reassessment) to underpin teaching and practice of fluid balance in adults. This terminology has not been routinely used until now in NI guidance, but is now being adopted and integrated with Northern Ireland guidance on the topic. The '5Rs' terminology is now being reflected in the regional adult and paediatric fluid balance charts. A letter is also being issued to the directors of undergraduate medical, nursing and pharmacy education to ensure that teaching practice at the respective schools is amended to ensure that the '5Rs' terminology becomes embedded in undergraduate and postgraduate programmes. NICE have produced an online training tool to support implementation of Clinical Guideline CG174. This tool uses a number of illustrative cases which recommend the use of fluids containing 0.18% sodium chloride for routine maintenance. Fluids containing 0.18% sodium chloride must be removed from stock and general use in all general units in which children might be treated. Suitable alternatives must be available. The online training tool recommends that prescribers abbreviate e.g. 'sodium chloride 0.9%' to 'NaCl 0.9%'. Trust Medicines Codes recommend that abbreviations are avoided. For the reasons outlined above the NICE online training tool is not appropriate for use in Northern Ireland and must not be utilised. GAIN has been asked to conduct a review of its guidance on Hyponatraemia in Adults to ensure that it is consistent with NICE Clinical Guideline CG174 on Intravenous fluid therapy in adults in hospital adjusted for the above NI caveats. In the interim, the GAIN guidance should be used in conjunction with NICE CG174 and above NI caveats.

Appendix 2: Alternative to Solution 18

Tool developed by an Expert Group led by Professor Ian Young (Centre Director of School of Medicine, Dentistry and Biomedical Sciences, Queen's University, Belfast) to assist clinicians where treatment with fluid containing sodium chloride is required. Issued by DoH in Appendix 2 of Circular HSC (SQSD) (NICE CG174) dated 22 July 2014.

Suggested IV fluid prescription (by body weight) for routine maintenance **over a 24-hour period**, to deliver 25 ml/kg/day, 1 mmol/kg of Na, K and Cl. Maximum routine maintenance volume 2500 mls/day for individuals over 100kg. Consider seeking expert advice in the case of very obese patients.

Body Weight (Kg)	**Total IV fluid volume (mls) and rate (mls/hr) (based on 25 ml/kg/day)**	**0.9% sodium chloride with 20 mmols potassium (500 ml bag) (mls)**		**5% glucose with 20 mmols potassium (500 ml bag) (mls)**	
		Volume	**Duration**	**Volume**	**Duration**
40	1000 = 42 mls/hr	250	6 hours	750	18 hours
50	1250 = 52 mls/hr	315	6 hours	935	18 hours
60	1500 = 62 mls/hr	375	6 hours	1125	18 hours
70	1750 = 73 mls/hr	440	6 hours	1310	18 hours
80	2000 = 83 mls/hr	500	6 hours	1500	18 hours
90	2250 = 94 mls/hr	565	6 hours	1685	18 hours
100	2500 = 104 mls/hr	630	6 hours	1870	18 hours
>100	2500 = 104 mls/hr	630	6 hours	1870	18 hours

Routine maintenance provision should nearly always be a short term measure.
These are initial prescriptions and further prescriptions should be guided by appropriate assessment and monitoring.

Suggested IV fluid prescription (by body weight) for routine maintenance **over a 16-hour period,** to deliver 25 ml/kg/day, 1 mmol/kg of Na, K and Cl. Maximum routine maintenance volume 2500 mls/day for individuals over 100kg. Consider seeking expert advice in the case of very obese patients.

Body Weight (Kg)	**Total IV fluid volume (mls) and rate (mls/hr) (based on 25 ml/kg/day)**	**0.9% sodium chloride with 20 mmols potassium (500 ml bag) (mls)**		**5% glucose with 20 mmols potassium (500 ml bag) (mls)**	
		Volume	**Duration**	**Volume**	**Duration**
40	1000 = 62 mls/hr	250	4 hours	750	12 hours
50	1250 = 79 mls/hr	315	4 hours	935	12 hours
60	1500 = 94 mls/hr	375	4 hours	1125	12 hours
70	1750 = 109 mls/hr	440	4 hours	1310	12 hours
80	2000 = 125 mls/hr	500	4 hours	1500	12 hours
90	2250 = 140 mls/hr	565	4 hours	1685	12 hours
100	2500 = 156 mls/hr	630	4 hours	1870	12 hours
>100	2500 = 156 mls/hr	630	4 hours	1870	12 hours

Routine maintenance provision should nearly always be a short term measure.
These are initial prescriptions and further prescriptions should be guided by appropriate assessment and monitoring.

Appendix 3: NICE CG174 Trigger List

Consequence of Fluid Mismanagement	Identifying Features	Timeframe of Identification
Hypovolaemia	• Patient's fluid needs not met by oral, enteral or IV intake **and** • Features of dehydration on clinical examination • Low urine output or concentrated urine • Biochemical indicators, such as more than 50% increase in urea or creatinine with no other identifiable cause	Before and during IV fluid therapy
Pulmonary oedema (breathlessness during infusion)	• No other obvious cause identified (for example, pneumonia, pulmonary embolus or asthma) • Features of pulmonary oedema on clinical examination • Features of pulmonary oedema on X-ray	During IV fluid therapy or within 6 hours of stopping IV fluids
Hyponatraemia	• Serum sodium less than 130 mmol/l • No other likely cause of hyponatraemia identified	During IV fluid therapy or within 24 hours of stopping IV fluids
Hypernatraemia	• Serum sodium 155 mmol/l or more • Baseline sodium normal or low • IV fluid regimen included 0.9% sodium chloride • No other likely cause of hypernatraemia identified	During IV fluid therapy or within 24 hours of stopping IV fluids
Peripheral oedema During IV fluid therapy or within 24 hours of stopping IV fluids	• Pitting oedema in extremities and/or lumbar sacral area • No other obvious cause identified (for example, nephrotic syndrome or known cardiac failure)	During IV fluid therapy or within 24 hours of stopping IV fluids

Consequence of Fluid Mismanagement	Identifying Features	Timeframe of Identification
Hyperkalaemia	• Serum potassium more than 5.5 mmol/l • No other obvious cause identified	During IV fluid therapy or within 24 hours of stopping IV fluids
Hypokalaemia	• Serum potassium less than 3.0 mmol/l likely to be due to infusion of fluids without adequate potassium provision • No other obvious cause (for example, potassium-wasting diuretics, refeeding syndrome)	During IV fluid therapy or within 24 hours of stopping IV fluids

Appendix 4: NICE CG174 Recommendations not Assessed

The following recommendations were not assessed. The rationale has been outlined in blue text:

Recommendation Number	Recommendation and Rationale for not being Assessed
1.1.2	Skilled and competent healthcare professionals should prescribe and administer IV fluids, and assess and monitor patients receiving IV fluids. This was unable to be included in the scope of the audit as it would require an assessment of the competency of those staff involved in the care of each of the patients.
1.1.3	When prescribing IV fluids, remember the 5 Rs: Resuscitation, Routine Maintenance, Replacement, Redistribution and Reassessment. It was agreed that there would be no practical method of assessing what prescribers remembered as they made prescriptions. Therefore, this was not included in the audit.
1.1.4	Offer IV fluid therapy as part of a protocol. Assessment of this recommendation was included in other Review methodology. The HSC Trusts provided information as to how they integrated CG174 into their own protocols.
1.1.8	Patients have a valuable contribution to make to their fluid balance. If a patient needs IV fluids, explain the decision, and discuss the signs and symptoms they need to look out for if their fluid balance needs adjusting. If possible or when asked, provide written information (for example, NICE's Information for the public), and involve the patient's family members or carers (as appropriate). Assessment of this recommendation would have required a more in-depth audit, with a patient engagement element. It was agreed that this was not viable given the time required for data collectors to complete the already complex and lengthy audit tool.
1.2.1	Assess whether the patient is hypovolaemic. Retrospectively assessing whether or not this had happened, and had happened correctly, with an accurate assessment being performed, taking into account the varied baselines of different individuals, made this recommendation difficult to assess and therefore was not included in the audit tool.

Recommendation Number	Recommendation and Rationale for not being Assessed
1.2.5	If patients have received IV fluids containing chloride concentrations greater than 120 mmol/l (for example, sodium chloride 0.9%), monitor their serum chloride concentration daily. If patients develop hyperchloraemia or academia, reassess their IV fluid prescription and assess their acid–base status. Consider less frequent monitoring for patients who are stable. Assessment of this recommendation would have required a more in-depth audit. It was agreed that this was not viable given the time required for data collectors to complete the already complex and lengthy audit tool.
1.2.6	Clear incidents of fluid mismanagement (for example, unnecessarily prolonged dehydration or inadvertent fluid overload due to IV fluid therapy) should be reported through standard critical incident reporting to encourage improved training and practice. Assessment of this recommendation was included in other Review methodology.
1.2.7	If patients are transferred to a different location, reassess their fluid status and IV fluid management plan on arrival in the new setting. The movement of patients within the hospital can be challenging to identify within the clinical record. It was therefore agreed to not assess this recommendation as it would have increased the size and complexity of the audit tool further and reduced the practicality of the audit.
1.4.2	For patients who are obese, adjust the IV fluid prescription to their ideal body weight. Use lower range volumes per kg (patients rarely need more than a total of 3 litres of fluid per day) and seek expert help if their BMI is more than 40 kg/m2. This recommendation was not assessed within the audit tool as to do so would have required the data collectors to make a clinical judgement, which RQIA could not have quality assured, or the audit tool would have had to be significantly expanded to capture more data and thus the audit tool would have become impractical to use.
1.4.3	Consider prescribing less fluid (for example, 20–25 ml/kg/day fluid) for patients who: • are older or frail • have renal impairment or cardiac failure • are malnourished and at risk of refeeding syndrome

Recommendation Number	Recommendation and Rationale for not being Assessed
	This recommendation was not assessed within the audit tool as to do so would have required the data collectors to make a clinical judgement, which RQIA could not have quality assured. Also, the audit tool would have had to be significantly expanded to capture more data and thus the audit tool would have become impractical to use.
1.4.4	When prescribing for routine maintenance alone, consider using 25–30 ml/kg/ day sodium chloride 0.18% in 4% glucose with 27 mmol/l potassium on day 1 (there are other regimens to achieve this). Prescribing more than 2.5 litres per day increases the risk of hyponatraemia. These are initial prescriptions and further prescriptions should be guided by monitoring. This recommendation is not applicable within Northern Ireland as this fluid solution is not routinely available.
1.4.5	Consider delivering IV fluids for routine maintenance during daytime hours to promote sleep and wellbeing. Not assessed as this recommendation requires that clinicians 'consider' it only and it may have been considered at a Trust level and a decision taken about practice which it would not be possible for the audit tool to pick up.

Appendix 5: Full Results of the Regional Clinical Audit

Results

Of the 145 patient records audited, one patient record was excluded at the point of data entry due to a condition excluding them from the audit resulting in an audit sample of 144.

The audit was divided into four parts:

1. Demographics and general good practice in terms of documentation of prescriptions, plans, assessments and monitoring;
2. Patient Assessment, Fluid Management Plans, and Prescriptions;
3. Patients deemed to have received resuscitation, and
4. Patients receiving maintenance fluids.

Part 1: Demographic information

The analysis in this part included all 144 audit records.

Table 1a, 1b, and 1c show the breakdown of the audit population by HSC Trust, further categorised by ward type, by gender and by age.

Table 1a: Number of patient records included: breakdown per HSC Trust (n=144)

HSC Trust	Number of patient records
Belfast	36
Northern	23
Southern	36
South Eastern	24
Western	25
Total	**144**

Table 1b: Number of patient records audited: breakdown by gender and HSC Trust (n=142)

HSC Trust	Number of patient records	Male	Female
Belfast	36	20	16
Northern	23	7	16
Southern	36	24	12
South Eastern	23	12	11
Western	24	12	12
Total	**142**	**75 (53%)**	**67 (47%)**

(The data collector did not record gender in 2 cases)

Table 1c: Number of patient records: breakdown by patient age range (n=143)

Age	Number of patient records (%)
16-30	3 (2%)
31-64	38 (27%)
65-84	60 (42%)
85+	42 (29%)
Total	**143**

(The data collector did not record age in 1 case)

Table 2a shows the number of patient records sampled across each of the ward types and across all 5 HSC Trusts.

Table 2a: Number of patient records audited: breakdown by ward type and HSC Trust (n=144)

HSC Trust	CoE	Surgical	Medical	ED
Belfast	3	18	15	0
Northern	9	3	11	0
Southern	6	13	17	0
South Eastern	3	9	8	4
Western	9	3	8	5
Total Number (%)	**30 (21%)**	**46 (32%)**	**59 (41%)**	**9 (6%)**

Although the minimum target was not met in ED the target minimum number of patient records for each ward was achieved across all other wards and all five HSC Trusts. For ED 90% of the target sample was achieved.

Table 2b: Minimum number of patient records targeted: breakdown by ward type and HSC Trust (n=144)

(Number in brackets is the difference between target sample and sample achieved)

HSC Trust	CoE	Surgical	Medical	ED
Belfast	4 (-1)	10 (+8)	14 (+1)	2 (-2)
Northern	2 (+7)	4 (-1)	8 (+3)	2 (-2)
Southern	2 (+4)	4 (+9)	8 (+9)	2 (-2)
South Eastern	2 (+1)	4 (+5)	10 (-2)	2 (+2)
Western	2 (+7)	4 (-1)	8 (0)	2 (+3)
Total	**12 (+18)**	**26 (+20)**	**48 (+11)**	**10 (-1)**

The RQIA statistician advised that 20% of each ward type should be audited; indicating that one ED per HSC Trust should be reviewed.

Table 3a: Planned number of each ward type to be audited and difference between planned and achieved (number in brackets is the difference between planned and achieved): breakdown by ward type and HSC Trust (n=60)

HSC Trust	CoE	Surgical	Medical	ED
Belfast	2 (0)	5 (+3)	7 (0)	1 (-1)
Northern	1 (+1)	2 (-1)	4 (-1)	1 (-1)
Southern	1 (0)	2 (+2)	4 (+4)	1 (-1)
South Eastern	1 (+1)	2 (+2)	5 (0)	1 (0)
Western	1 (+3)	2 (0)	4 (+1)	1 (0)
Total	**6 (+5)**	**13 (+6)**	**24 (+4)**	**5 (-3)**

The planned number of patient records audited was not achieved for three of the five HSC Trusts (Belfast, Northern and Southern). In respect of EDs, the audit did not achieve the 20% target at a regional level as only two HSC Trust (South Eastern and Western) EDs were audited. Table 3b shows the number of actual wards audited

Table 3b: The number of wards audited: breakdown by ward type and HSC Trust (n=60)

HSC Trust	CoE	Surgical	Medical	ED
Belfast	2	8	7	0
Northern	2	1	3	0
Southern	1	4	8	0
South Eastern	2	4	5	1
Western	4	2	5	1
Total (%)	**11 (18%)**	**19(32%)**	**28 (47%)**	**2 (3%)**

Patient profile

A range of diagnoses were identified across the 144 patient records included in the audit. For example, 47% (68 out of 144) of patients had been admitted with some form of infection, 46% (31 out of 68) of these cases involved respiratory tract infection. Other reasons for admission included bowel obstruction, falls, cerebrovascular accident (CVA), fractured neck of femur and upper gastrointestinal (GI) haemorrhage. Of particular relevance to the audit, 13% (18 out of 144) cases were specifically diagnosed with electrolyte disturbances.

The numbers of patients receiving IV Fluids

The regional audit was not carried out at a single point in time. Individual data collectors carried out audits of records on the same ward on different dates. Consequently, the number of patients identified as receiving IV fluids on a given ward was differed depending upon the time/date an individual auditor completed their audit.

It was therefore, not possible to calculate the exact figure for the total number of patients receiving IV fluids during the audit period from 6 March 2018 – 3 April 2018, and some patients may have been counted more than once.

In order to estimate the population of patients on these wards, during the audit period, and thus the number in receipt of IV fluids, and therefore eligible for inclusion, the following process was agreed:

- The data was sorted by ward and time of audit. Each ward contributed information to the number of patients only once; we refer to this as a unique audit point, e.g. if there was three audit records from a single ward and they contained the same numbers of patients, this was used once;
- If data was incomplete or appeared inaccurate, the record was excluded, for example, a 33 bed CoE ward reported as only having 6 patients one day after it had 33 patients, or a vascular ward where every patient was on IV fluids; and
- If a ward was contributing data on more than one day with differing numbers of patients present on the ward on each day, an average was calculated to estimate the number of patients on the ward during the unique audit point.

Using this method we estimated there were approximately 1,136 patients on the wards during the audit period, and estimated 218 patients were in receipt of IV fluids and eligible for inclusion. Of this population, 144 patients in receipt of IV fluids were actually included in the audit as shown in Table 4.

Table 4: Estimated population on wards during audit, numbers in receipt of IV fluids, proportion receiving IV Fluids, and actual number of patient records audited: breakdown by HSC Trust

HSC Trust	Estimated number of patients on the wards	Estimated number of patients in receipt IV Fluids on the wards	Estimated percentage of patients receiving IV fluids	Actual number of patients included in the audit
Belfast	288	49	17%	36
Northern	84	35	42%	23
Southern	325	51	16%	36
South Eastern	225	36	16%	24
Western	214	47	22%	25
Overall	**1,136**	**218**	**19%**	**144**

Table 5 shows that on average, the patients included in the audit received IV fluids for 3.33 days across the five HSC Trusts. Patients from the South Eastern Trust received IV fluids for the shortest time period, averaging 2.45 days.

Table 5: Number of patient records audited and mean number of days patients were in receipt of IV fluids: breakdown by HSC Trust
(n=144)

HSC Trust	Number of patient records audited	Mean number of days receiving IV fluids during the previous 7 days
Belfast	36	3.61
Northern	23	3.74
Southern	36	3.67
South Eastern	24	2.45
Western	25	2.83
Overall	**144**	**3.33**

Table 6 shows that, type of admission for 94% of patients (136 out of 144) was documented as emergency (either direct emergency admission or transfer from another hospital). In cases were the admission type was documented as 'other' the patients' diagnosis was used to determine if it was most likely to have been an elective or emergency admission. For example, if a patient transferred between hospitals following emergency surgical repair of a traumatic fracture this was classified as emergency admission type.

Table 6: Number of patient records audited: breakdown by admission type and HSC Trust
(n=144)

HSC Trust	Emergency	Elective
Belfast	32 (22%)	4 (3%)
Northern	22 (15%)	1 (1%)
Southern	35 (24%)	1 (1%)
South Eastern	22 (15%)	2 (1%)
Western	25 (17%)	0 (0%)
Overall	**136 (94%)**	**8 (6%)**

Part 2 – Patient Assessment, Fluid Management Plans and Prescriptions

Daily reviews and assessment of fluid and electrolyte needs

CG174 recommends (Recommendation 1.1.1) that patients are assessed daily to ascertain their fluid and electrolyte requirements. The audit tool collected data on whether or not there was documented evidence that patients received a daily review.

Table 7 shows that 85% (119 out of 140) of patient records, indicated patients were reviewed daily when including all five HSC Trusts. This calculation was based on 140 patients as data was not entered for 4 patients.

Table 7: Number/proportion of patient records containing evidence of a daily review: breakdown by HSC Trust
(n=140)

HSC Trust	Daily review	%
Belfast	29/36	81%
Northern	21/23	91%
Southern	31/36	86%
South Eastern	17/20*	85%
Western	21/25	84%
Overall	**119 / 140***	**85%**

Table 8 shows the number and percentage of patient records in each of the five HSC Trusts were there was evidence that patients had received: only a daily fluid needs assessment; only a daily electrolytes needs assessment; or both of these assessments. The audit also sought evidence that daily assessments were documented within in the patient record.

We included 140 patient records as no data was collected for 4 patient records. When considering all five HSC Trusts, 52% (73 out of 140) of patient records contained documented evidence of a daily assessment of fluid needs being completed, 69% (97 out of 140) contained evidence of electrolyte needs being assessed daily, and 45% (63 out of 140) contained evidence of both of these assessments being completed on a daily basis.

Table 8: Proportion of patient records audited containing evidence of daily assessment of patient fluid and electrolyte requirements
(n=140)

HSC Trust	Fluid needs assessment	%	U&E needs assessment	%	Both Assessed	%
Belfast	17/36	47%	23/36	64%	15/36	42%
Northern	10/23	43%	15/23	65%	9/23	39%
Southern	18/36	50%	23/36	64%	14/36	39%
South Eastern	11/20*	55%	18/20	90%	11/20	55%
Western	17/25	68%	18/25	72%	14/25	56%
Overall	**73 / 140***	**52%**	**97 / 140**	**69%**	**63 / 140**	**45%**

Modified Early Warning Score (MEWS) Charts

The use of Modified Early Warning Score (MEWS) charts was evident in 98% (141 out of 144) of patients receiving IV fluids; 2% (3 out of 144) patient records did not contain evidence of MEWS observations being documented while on IV fluids (2 out of the 36 Belfast Trust patient records, and 1 out of the 36 Southern Trust patient records).

Fluid Balance Charts

Each fluid balance chart records the amount and type of fluids a patient has received (input) and lost (output) during a 24 hour period. The audit considered whether there was evidence of recording of inputs and outputs in each fluid balance chart and whether the daily total boxes were completed. Overall 87% (436 out of 499) of the fluid balance charts contained evidence of input/output recording while only 54% (268 out of 499) had daily total boxes completed.

Table 9: Proportion of fluid balance charts containing documented input/outputs and completed daily totals box (n=499 charts)

HSC Trust	Fluid Balance Charts		
	Input / output recording	Daily totals	Average number of charts per patient
Belfast	128/136 (94%)	76/136 (56%)	3.56 (128/36)
Northern	86/92 (93%)	45/92 (49%)	4.00 (92/23)
Southern	108/124 (87%)	68/124 (55%)	3.44 (124/36)
South Eastern	57/68 (84%)	48/68 (71%)	2.83 (68/24)
Western	57/79 (72%)	31/79 (39%)	3.16 (79/25)
Overall	**436/499 (87%)**	**268/499 (54%)**	**3.41 (491/144)**

Urea and Electrolytes (U&E)

Urea and electrolyte (U&E) measurement is an essential part of IV fluid prescribing as it allows for the detection of abnormalities that may affect the appropriate choice of IV fluid to be prescribed (CG174 Recommendation 1.24). The audit criteria included a review of how many days the patient had a U&E measurement taken and reviewed whilst receiving IV fluids. We calculated how many patients had not had a U&E measurement taken every day they were receiving IV fluids. We also calculated how many patients had missed more than one U&E as this may be legitimate, for example, on the day that IV fluids are stopped.

Table 10 shows that 28% of patient records (40 out of 144) did not contain evidence of a daily U&E measurement whilst they were receiving IV fluids across the five HSC Trusts. No U&E was required on the day that IV Fluids stopped. When one omitted daily U&E measurement was permitted then 10% (14 out of 144) of records did not containing evidence of a daily U&E.

Table 10: Proportion of patient records not containing evidence of daily measurement of urea and electrolytes
(n=144)

HSC Trust	Urea and Electrolytes (U&Es)			
	Number of patient records that did not contain daily U&Es	Percentage	Number of patient records were more than one daily U&E was omitted	Percentage
Belfast	10 / 36	28%	4 / 36	11%
Northern	6 / 23	26%	1 / 23	4%
Southern	15 / 36	42%	7 / 36	19%
South Eastern	5 / 24	21%	0 / 24	0%
Western	4 / 25	16%	2 / 25	8%
Overall	**40 / 144**	**28%**	**14 / 144**	**10%**

Patient Weight

CG174 recommends (Recommendation 1.24) that a patient's weight should be fully considered when prescribing IV fluids. A section exists on each IV fluid prescription and balance chart for the patient's weight to be documented. The audit examined whether or not weight was documented on admission for each patient and where this record of weight was located. Other locations considered for documenting a patient's weight included the carded (prescription record), the nursing record and the medical record. There was no data documented for two patient records*.

Table 11 shows 30% of patient records (43 out of 142) did not have their weight documented despite being prescribed IV fluids; 6% of patients (9 out of 142) were noted as being unable to be weighed.

Table 11: Proportion of patient records in which weight was documented/ not documented
(n=142)

HSC Trust	Patient Weight					
	Weight documented	Percentage	Unable to be weighed	Percentage	Weight not documented	Percentage
Belfast	20 / 34*	59%	6 / 34	18%	8 / 34	23%
Northern	19 / 23	83%	0 / 23	0%	4 / 23	17%
Southern	23 / 36	64%	2 / 36	6%	10 / 36	28%
South Eastern	18 / 24	75%	0 / 24	0%	6 / 24	25%
Western	9 / 25	36%	1 / 25	4%	15 / 25	60%
Overall	**89 / 142**	**63%**	**9 / 142**	**6%**	**43 / 142**	**30%**

**(In 2 of the audit proforma there was no data* documented *against these criteria)*

Table 12 shows the location where patient's weight was documented and that weight may have been documented in more than one location within the record. It also shows that only 9% of patients, across the five HSC Trusts, had their weight documented on the fluid balance chart.

Table 12: Proportion of records where patients weight was documented: breakdown by location and HSC Trust
(n=89)

HSC Trust	Location weight documented on/in:							
	Fluid balance chart	%	Kardex	%	Nursing record	%	Medical record	%
Belfast	3/20	15%	7/20	35%	11/20	55%	2/20	10%
Northern	0/19	0%	10/19	53%	11/19	58%	0/19	0%
Southern	5/23	22%	22/23	96%	16/23	70%	4/23	17%
South Eastern	0/18	0%	2/18	11%	17/18	94%	3/18	17%
Western	0/9	0%	1/9	11%	8/9	89%	0/9	0%
Overall	**8/89**	**9%**	**42/89**	**47%**	**63/89**	**71%**	**9/89**	**10%**

CG174 advises that for patients who are obese the IV fluid prescription should be adjusted to their ideal body weight. It is recommended that lower range volumes per kg are prescribed and that expert help is sought if the patient's BMI is more than 40 kg/m^2. The audit also assessed whether there was evidence of a BMI being documented. Table 13 shows a summary of the results.

Table 13: Proportion of records with Body Mass Index (BMI) documented: breakdown by HSC Trust
(n=144)

HSC Trust	Number of patient records containing record of BMI	Completed %
Belfast	10 / 36	28%
Northern	7 / 23	30%
Southern	8 / 36	22%
South Eastern	18 / 24	75%
Western	6 / 25	24%
Overall	**49 / 144**	**34%**

Fluid Management Plans (FMPs)

The data collectors were asked to review the number of days in which it was documented that the patient was receiving IV fluids and review the clinical record to examine if a documented Fluid Management Plan (FMP) was present (as per CG174 Recommendation 1.16). The fluid balance chart was not accepted as an FMP on the basis that it is not possible to retrospectively confirm that all prescriptions were written at a single time point, and therefore it was not possible to determine the intention for the management of that patient for the subsequent 24 hour period at the point of the daily review.

Table 14 shows that 52% (65 out of 125) of patients had an FMP present in their clinical record on a daily bases. Of the patient records audited, 72% (90 out of 125) contained evidence FMP for all expect 1 day (the reason for omitting recording on one day may be that a plan was not documented for the day that the IV fluids was stopped).

Table 14: Proportion of patient records containing a documented Fluid Management Plan (FMP)
(n=125)

HSC Trust	FMP in the clinical record daily	Percentage of records containing daily FMP	FMP documented on all except one day	Percentage of records with FMP on all except one day	Data not entered by data collector
Belfast	14/33	42%	20/33	61%	3
Northern	7/21	33%	12/21	57%	2
Southern	18/31	58%	22/31	71%	5
South Eastern	10/19	53%	16/19	84%	5
Western	16/21	76%	20/21	95%	4
Overall	**65/125**	**52%**	**90/125**	**72%**	**19**

CG174 recommends that FMPs consider both the volume of IV fluids and the electrolyte requirements. The audit examined how many FMPs contained reference to IV fluid volumes and electrolyte requirements.

Table 15 shows that 25% (75 out of 304) of FMPs detailed IV fluid volume and 32% (97 out of 304) detailed a reference to electrolytes.

Table 15: Proportion of Fluid Management Plans (FMP) detailing fluid volume/ electrolytes

HSC Trust	Plans detailing a volume of fluid	Plans detailing reference to electrolytes
Belfast	16/71 (23%)	28/71 (39%)
Northern	9/51 (18%)	20/51 (39%)
Southern	28/87 (32%)	11/87 (13%)
South Eastern	14/39 (36%)	10/39 (26%)
Western	8/56 (14%)	28/56 (50%)
Overall	**75/304 (25%)**	**97/304 (32%)**

Table 16 shows that, when considering the number of days patients received IV fluids, only 65% (265 out of 405) of records contained an FMP, after excluding those not were a daily FMP was not required (i.e. day that IV fluid was stopped).

Table 16: Percentage of days on IV fluids on which a Fluid Management Plan (FMP) was documented (n=265)

HSC Trust	Percentage of days on fluids covered by FMP (excluding those not requiring daily FMP)
Belfast	62 FMP / 117 Days (53%)
Northern	45 FMP / 75 Days (60%)
Southern	78 FMP / 116 Days (67%)
South Eastern	35 FMP / 47 Days (74%)
Western	45 FMP / 50 Days (90%)
Overall	**265 FMP / 405 Days (65%)**

Prescriptions

The audit examined 650 individual IV fluid prescriptions. The audit assessment whether or not the type, rate and volume of IV fluids were documented and were legible (as per CG174 Recommendation 1.1.5) and also whether or not the prescriber's name and General Medical Council (GMC) number were documented and legible.

Table 17 shows that the type, rate and volume of fluids were documented in, 97% (630 out of 650), 99% (642 out of 650) and 96% (627 out of 650) of cases respectively. The documentation of type, rate and volume were considered legible in 97% (633 out of 650), 98% (634 out of 650) and 93% (607 out of 650) of cases respectively.

Table 17: Proportion of prescriptions containing documented IV fluid type, rate and volume (n=650)

HSC Trust	Prescriptions						
	Total	Type		Rate		Volume	
		Documented	Legible	Documented	Legible	Documented	Legible
Belfast	181	180/181 (99%)	180/181 (99%)	179/181 (99%)	179/181 (99%)	175/181 (97%)	165/181 (91%)
Northern	118	113/118 (96%)	118/118 (100%)	116/118 (98%)	117/118 (99%)	115/118 (97%)	115/118 (97%)
Southern	164	155/164 (95%)	159/164 (97%)	163/164 (99%)	160/164 (98%)	164/164 (100%)	159/164 (97%)
South Eastern	82	80/82 (98%)	76/82 (93%)	81/82 (99%)	77/82 (94%)	70/82 (85%)	67/82 (82%)
Western	105	102/105 (97%)	100/105 (95%)	103/105 (98%)	101/105 (96%)	103/105 (98%)	101/105 (96%)
Overall	**650**	**630/650 (97%)**	**633/650 (97%)**	**642/650 (99%)**	**634/650 (98%)**	**627/650 (96%)**	**607/650 (93%)**

Table 18 shows that identification of the prescriber was poor overall with only 55% (358 out of 650) of prescriptions containing documented evidence of the prescribers name, with only 22% of all prescriptions containing a legible name (142 out of 650). We found that 40% of all the names documented were legible (142 out of 358).

We sought evidence of the presence and legibility of a GMC number as an alternative identifier for the prescriber. Table 18 shows that a GMC number was found in 1.5% (10 out of 650) of the prescriptions audited, of which only 1.2% (8 out of 650) were legible.

Table 18: Proportion of prescriptions in which name and General Medical Council (GMC) number were documented and legible (n=650)

HSC Trust	IV Fluid Prescriptions			
	Name		GMC Number	
	Documented	Legible	Document	Legible
Belfast	85/181 (47%)	45/181 (25%)	4/181 (2%)	3/181 (2%)
Northern	74/118 (63%)	2/118 (2%)	0/118 (0%)	0/118 (0%)
Southern	86/164 (52%)	30/164 (18%)	2/164 (1%)	1/164 (1%)
South Eastern	44/82 (54%)	21/82 (26%)	4/82 (5%)	4/82 (5%)
Western	69/105 (66%)	44/105 (42%)	0/105 (0%)	0/105 (0%)
Overall	**358/650 (55%)**	**142/650 (22%)**	**10/650 (1.5%)**	**8/650 (1.2%)**

Part 3 – Resuscitation

CG174 contains recommendations relating to resuscitation (Recommendations 1.31, 1.3.2, and 1.3.3). Accordingly, the audit captured information relating to resuscitation for those patient records with suspected hypovolaemia.

Of the 144 patient records included in the audit, 40% (57 out of 144) related to patients requiring fluid resuscitation due to suspected hypovolaemia. The patient records examined by the data collectors relating to these patients management did not indicate that all actually required true resuscitation but rather that some required fluid replacement due to fluid losses. For example, sepsis was listed as a common reason for resuscitation but in one case the patient was given 1000ml of IV Fluids over 2 hours: which either represents a patient who did not truly require resuscitation or management not in keeping with CG174 (Recommendation 1.3.1). The audit data could not enable a determination of which scenario applied and consequently only those records where a patient originally received a bolus of IV fluids were examined to determine whether or not they continued to be managed in line with CG174.

With this exclusion criteria applied, 11% of patients (16 out of 144) received a 500ml bolus of IV fluid over 15 minutes. All 16 patients received a bolus of fluid type of either compound sodium lactate (Hartmann's) solution or sodium chloride 0.9% in line with CG174. Considering all original 58 patients i.e. 16 included and 42 excluded 'glucose 5%' was not referenced at all, which is in line with CG174.

CG174 Recommendation 1.2.3 advises that when patients are receiving IV fluids for resuscitation they are reassessed using the ABCDE approach. Table 20 shows that documenting of reassessment was poor with only 38% (6 out of 16) of patient records containing documentation of reassessment. Table 19 shows that of those records containing evidence of reassessment, 50% (3 out of 6) containing evidence that an ABCDE approach was used.

Table 19: Proportion of patient records containing documented evidence of resuscitation reassessment and evidence of an ABCDE approach being used (n=144)

HSC Trust	Number	Evidence of reassessment	Evidence of ABCDE approach to reassessment
Belfast	3/36 (8%)	1/16 (6%)	0/6 (0%)
Northern	2/23 (9%)	1/16 (6%)	1/6 (17%)
Southern	4/36 (11%)	2/16 (13%)	0/6 (0%)
South Eastern	4/24 (17%)	2/16 (13%)	2/6 (33%)
Western	3/25 (12%)	0/16 (0%)	0/6 (0%)
Overall	**16/144(11%)**	**6/16 (38%)**	**3/6 (50%)**

Table 20 shows that further resuscitation was required for 38% (6 out of 16) of patients, including 3 patients who did not have evidence of a reassessment in their patient record.

Table 20: Proportion of patient records containing documented evidence for the requirement for additional fluid resuscitation (n=16)

HSC Trust	Number of patients requiring additional fluid resuscitation	Evidence of reassessment and detailing of requirement for additional resuscitation	Was this as per CG174
Belfast	1/16 (6%)	1/16 (6%)	1
Northern	0/16 (0%)	0/16 (0%)	0
Southern	1/16 (6%)	1/16 (6%)	1
South Eastern	2/16 (13%)	1/16 (6%)	2
Western	2/16 (13%)	0/16 (0%)	1
Overall	**6/16 (38%)**	**3/16 (19%)**	**5/6 (83%)**

In total, only 19% (3 out of 16) patients were documented as receiving more than 2 litres of IV fluid for resuscitation. In 67% (2 out of 3 cases), expert advice was sought. In the other case the patient was admitted with an upper GI bleed on the same day as the audit, which may not have facilitated time for an expert review to take place.

Part 4 – Maintenance

Determining the correct fluid prescription for any given patient requires a complex assessment of the interaction of inputs, outputs, electrolyte status and co-morbidities. The audit criteria included a series of questions to exclude records of patients who were likely to have been receiving fluids for reasons other than maintenance.

Firstly, the audit required that the patient must have a 48 hour period of requiring only routine maintenance fluids; this enabled those patients who had a complete 24 hour period with nothing but maintenance fluid prescribed and a fluid balance chart to be identified. Further confirmation was obtained by seeking documented evidence of patients having ongoing losses during this time. Any records relating to patients identified as having ongoing fluid losses were then excluded.

The audit identified 13 patient records for inclusion in the assessment of routine maintenance. Of the 13 included patient records, a response was documented in 12 cases in relation to the amount of water prescribed. However, based on the answers to subsequent questions it was possible to extrapolate the answer for the 13th patient. 77% (10 of the 13) of patients were prescribed no more than 30ml/kg/day of water (as per CG174 Recommendation 1.4.1) and 23% (3 out of 13) of patients were prescribed more than this.

The subsequent questions concerned electrolyte prescriptions. Records of patient who were fasting were excluded as this may affect their electrolyte levels and consequent prescription requirements. CG174 Recommendation 1.4.1 details a dose of approximately 1mmol/kg/day of potassium, sodium and chloride.

Table 21 shows that 38% (5 out of 13) of patient records indicated receipt of the recommended dose of sodium and chloride and 46% (6 out of 13) of patient records indicated receipt of the recommended dose of potassium.

Further analysis revealed that no patient records indicated receipt of less sodium or chloride than recommended by CG174, but 63% (5 out of 8) of patient records indicated receipt of more than 3 times the recommended dose.

Of records indicating prescribed doses of potassium outside of the recommendation all seven patient records indicated patient maybe receiving sub-optimal doses, with 4 patients receiving no potassium at all.

Table 21: Number of patient records indicating patients received recommended dose or did not receive recommended doses (n=13)

	Sodium	Chloride	Potassium
Received recommended dose	5	5	6
Did not receive recommended dose	8	8	7

CG174 Recommendation 1.4.1 also indicates a dose of approximately 50-100g/day of glucose be prescribed to limit starvation ketosis. 15% (2 out of 13) of patients received a prescription of glucose in keeping with CG174 Recommendation 1.4.1.

Although analysis revealed that no patient records indicated receipt of less sodium or chloride than recommended by CG174; further analysis of the 8 patient records which had identified that patients were receiving an excess amount of sodium highlighted that 63% (5 out of 8) of patient records indicated receipt of more than 3 times the recommended dose.

Appendix 6: References

Number	Reference
1	Intravenous fluid therapy in adults in hospital, NICE, December 2013. Cited: June 2020. Available from: https://www.nice.org.uk/guidance/cg174
2	Circular HSC (SQSD) (NICE CG174) 17/14, Subject: NICE Clinical Guideline CG174 – Intravenous fluid therapy in adults in hospital, Department of Health, October 2014. Cited: June 2020. Available from: http://www.hscboard.hscni.net/download/PUBLICATIONS/NICE/clincal_guidelines/CG174.pdf
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4	The Inquiry into Hyponatraemia-related Deaths, Department of Health, January 2018. Cited: June 2020. Available from: http://www.ihrdni.org/Full-Report.pdf
5	The National Confidential Enquiry into Perioperative Deaths, April 1999 to March 2000. Cited: June 2020. Available from: https://www.ncepod.org.uk/2001report/01sup.pdf
6	Joint Royal Colleges Ambulance Liaison Committee (JRCALC). Cited: June 2020. Available from: https://www.jrcalc.org.uk/
7	Good practice in prescribing and managing medicines and devices (2013). Cited: June 2020. Available from: https://www.gmc-uk.org/-/media/documents/Prescribing_guidance.pdf_59055247.pdf

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