Witness Statement Ref. No. 302/2

NAME OF CHILD: RAYCHEL FERGUSON (LUCY CRAWFORD)

Name: James McKaigue

Title: Doctor

Present position and institution:

Consultant Paediatric Anaesthetist, RBHSC

Previous position and institution: Consultant Paediatric Anaesthetist, Royal Belfast Hospital for Sick Children
[As at the time of the child's death]

Consultant Paediatric Anaesthetist, Royal Belfast Hospital for Sick Children (RBHSC)

Membership of Advisory Panels and Committees:
[Identify by date and title all of those between January 1995 - July 2012]

Association Paediatric Anaesthetists Executive Committee 2002 - 2006

Previous Statements, Depositions and Reports:
[Identify by date and title all those made in relation to the child's death]

WS-302/1 Date: 21/11/2012

OFFICIAL USE:
List of previous statements, depositions and reports:

Ref:	Date:	
WS-302/2	21-11-2012	Statement to the Inquiry

IMPORTANT INSTRUCTIONS FOR ANSWERING:

Please attach additional sheets if more space is required. Please identify clearly any document to which you refer or rely upon for your answer. If the document has an Inquiry reference number, e.g. Ref: 049-001-001 which is 'Chart No.1 Old Notes', then please provide that number.

If the document does not have an Inquiry reference number, then please provide a copy of the document attached to your statement.

(1) You have explained that Lucy's death was the subject of discussions with some of your colleagues (answer to question 11(i) WS-302/1). Please address the following additional matters:

(a) What was the purpose of the discussions which took place between you, Dr. Crean and Dr. Chisakuta in relation to the death of Lucy?

As a result of my discussion with Dr Chisakuta I was made aware of Lucy's death and also that Dr Hanrahan had referred her death to the Coroner.

I have no recollection of having discussions with Dr Crean shortly after Lucy's death, but subsequently (I am not precisely sure when) on a number of occasions, he mentioned concerns he had with Lucy's fluid management. Please see 1(f). I believe the purpose of these discussions was to share this information with me, in the context of ongoing wider discussions surrounding hyponatraemia. He also told me that in connection with her Inquest, the Coroner was also aware of his concerns.

In WS-302/1 11 (2) & (3) I make reference to the fact that Lucy's death may have been discussed with Dr Crean among others, as part of the wider discussion at a meeting of the Northern Ireland Paediatric Anaesthesia Group. The purpose of this meeting was to heighten awareness of risk factors for children developing post-operative hyponatraemia, to anaesthetists who had an interest or a lead role in paediatric anaesthesia.

(b) Was any action taken by you or your colleagues following such discussions?

Following my discussion with Dr Chisakuta I took no further action. I am unaware of what action if any Dr Chisakuta took following our discussion.

I took no specific action arising out of discussions I had with Dr Crean. I am unaware of what actions if any Dr Crean took following our discussions.

(c) Should Lucy's death have been reported as a critical incident by you or your colleagues?

I was unaware of a process around reporting critical incidents at the time of Lucy's death. I am not in a position to advise what my colleagues' knowledge may have been on this matter and their knowledge surrounding Lucy's death.

(d) Why was Lucy's death not reported as a critical incident?

Please see 1 (c)

(e) Lucy's death was considered at an audit meeting on the 10 August 2000 (Ref: 061-038-123). Did you participate in this process with regard to Lucy's death? If so, please explain the steps that you took as part of that process.

My signature is in the attendance register for the multidisciplinary audit meeting on 10th August 2000, however I have no memory of that meeting or what was discussed.

(f) At some point Dr. Crean made you aware that there were issues around Lucy's fluid management. What did he tell you about the nature of this fluid management issue? Did he speak to you about this before or after the post mortem was performed?

I cannot recall when Dr Crean made me aware, that there were issues around Lucy's fluid management. I believe that Dr Crean told me, that it was possible that Lucy's serum sodium result, while she was in the Erne Hospital, could have been lower than 127, because that blood sample (Na 127) appeared to have been taken after Lucy had been administered a large bolus of 0.9% Saline which would have had the effect of raising the serum sodium, during her resuscitation in the Erne Hospital. Dr Crean also told me that it was unclear from the fluid balance chart in the Erne Hospital, how much fluid Lucy had actually received.

(2) Please look at the statement of Dr. Caroline Stewart to the PSNI dated 9 April 2005 [Ref: 115- 022-001]. At Ref: 115-022-002 she said,

"I stated on the Autopsy form that the Clinical Diagnosis was Dehydration and Hyponatraemia, Cerebral Oedema, Acute Coning and Brain Death. This information was on the basis of the clinical information available, which was the working pathogenesis agreed by Dr. Hanrahan and the anaesthetists, in the absence of a definitive aetiological diagnosis."

Arising from that:

(a) Were you involved in agreeing any such "working pathogenesis" in respect of Lucy?

I was not involved in agreeing any such 'working pathogenesis' in respect of Lucy

(b) If you weren't involved in agreeing any such working pathogenesis, would you nevertheless have agreed at that time with what Dr. Stewart had recorded in the Autopsy form?

At that time I was not in a position to form a view as to the sequence of events leading to Lucy's clinical deterioration and ultimately her death. See also WS-302/1 (9)

(c) If you were involved with agreeing any such working pathogenesis, please state:

(i) Who else was involved?

(ii) How this working pathogenesis was arrived at?

(iii) **Whether consideration was given to the possible cause of the cerebral oedema, and, if so, the outcome of that consideration?**

(3) In answer to question 11(i) of WS-302/1 you have indicated that you were aware that Lucy had hyponatraemia, and that you were aware that her case had been discussed with the Coroner.

(a) Who advised you of the fact that her case was discussed with the Coroner?

Dr Chisakuta told me that her case was discussed with the Coroner

(b) What were you told about this discussion?

I cannot recall what Dr Chisakuta told me of the discussion with the Coroner, other than that Dr Hanrahan spoke with the Coroner

(4) You have indicated that at some point you no longer used No 18 solution as a maintenance fluid and that this became Trust policy (answer to question 13(b), WS-302/1). By what date did it become Trust policy not to use No 18 solution as a maintenance fluid, and how was this communicated to you?

Making reference to Trust policy 'Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.' Reference 1, the date that No 18 solution should no longer be used as a maintenance fluid is March 2008. I cannot recall how this was communicated to me at that time.

(5) Do you recognise the document at Ref: 061-005-012? If so, please explain what it refers to.

I do not recognise the document Ref: 061-005-012

(6) Please clarify the arrangements which were in place at RBHSC in April 2000 for receiving patient notes by fax from another hospital and for delivering them to relevant clinicians in PICU? Were the notes sent directly to an office within PICU, and did a member of admin staff place the notes on the patient's chart?

The arrangements were 'ad hoc'. The PICU fax number was supplied to another party as and when required. The fax machine was located in the secretaries' office. Any one of a number of staff (including doctors, nurses and secretaries) would have had access to the fax machine, if they were expecting an incoming fax. I believe it was normal practice for secretarial staff to alert other members of staff when a fax arrived and this may have included placing the fax into the patient's chart. At many times of course secretarial staff would not be working.

Reference 1: *Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.*

THIS STATEMENT IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF

Signed: [signature] **Dated:** 23/1/13

Standards and Guidelines Committee

Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.

Summary	This policy outlines the BHSCT approach for administration of intravenous fluids to children aged from 1 month until the 16th birthday with particular reference to reducing the risk of hyponatraemia. It maps the advice issued in March 2007 from the National Patient Safety Agency (NPSA) and September 2007 from the Northern Ireland Regional Paediatric Fluid Therapy Working Group on how to reduce the risks associated with administering intravenous infusions to children. This is fundamentally a document aimed at prevention of hyponatraemia and not treatment.
Purpose	To improve the safe use of intravenous fluid in children and reduce the risk of hyponatraemia.
Operational date	March 2008
Review date	March 2010
Version Number	V4
Supersedes previous	V3
Director Responsible	Medical Director
Lead Author	Dr. Peter Crean
Lead Author, Position	Consultant Paediatric Anaesthetist, RBHSC.
Additional Author(s)	Dr H Steen, Associate Medical Director.
Department / Service Group	Social Services, Family and Child Care
Contact details	Dr Peter Crean Paediatric Intensive Care Unit Royal Belfast Hospital for Sick Children [redacted]

Reference Number	
Supercedes	N/A

Date	Version	Author	Comments
25 August 2009	V 3.1	JR Johnston	Draft version 3
14 September 2009	V 3.2	JR Johnston	Minor RMcL amendments
16 September 2009	V 3.3	JR Johnston	8.3.4; Appendix 6 changes Final Draft for RQIA
17 September 2009	V 3.4	JR Johnston	4.1; 8.4 - DKA Fluid chart change
17 September 2009	V 3.5	JR Johnston	Appendix 4 changes
February 2010	V 3.6	JR Johnston	Trigger list

Policy Record

		Date	Version
Author (s)	Approval	27/03/2008	1.2
Director Responsible - Dr A Stevens	Approval	27/03/2008	1.2

Approval Process – Trust Policies

Policy Committee	Approval		
Executive Team	Authorise		
Chief Executive	Sign Off		

Approval Process – Clinical Standards and Guidelines

Standards and Guidelines Committee	Approval		1.2
Policy Committee	Approval		
Executive Team	Authorise		
Appropriate Director	Sign Off		

Summary

Reference No: SG001/08

Title:
Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.

Purpose:
To improve the safe use of intravenous fluid in children and reduce the risk of hyponatraemia.

Objectives:
This Policy sets out recommended practice for everyone who looks after children receiving intravenous fluids. It is based on regional and national guidance, ongoing clinical audit, published literature and is also aimed at specifically reducing the risk of hyponatraemia.

It should be considered alongside the guidance from the National Patient Safety Agency Patient Safety Alert 22[1], and the Regional Paediatric Fluid Therapy Group wallchart[2].

Policy Statement(s):
1. The Paediatric Parenteral Fluid Therapy wallchart[2] forms the basis of BHSCT guidance on fluid prescription in paediatric patients aged from 1 month until the 16th birthday.
2. Sodium chloride 0.18% with glucose 4% will be withdrawn from general use in all BHSCT ward areas that treat children and the availability of these fluids will be restricted to critical care areas and other specialist wards such as renal, liver and cardiac units.
3. This policy and wallchart will be disseminated throughout the BHSCT.
4. Information about the availability of infusion fluids throughput the BHSCT will be attached to the Paediatric Fluid Guideline wall chart[2].
5. A new fluid prescription/ balance chart will be developed for the prescription of fluids for all children treated in the BHSCT.
6. All staff involved in prescribing, administering and monitoring IV fluids to such children will be made aware of this policy and the Paediatric Parenteral Fluid Therapy wallchart[2] through the BHSCT intranet and Service Group dissemination.
7. The BHSCT will implement the following governance measures – incident reporting using a set of reporting 'triggers' and formal auditing.

Chief Executive/ Director *(delete as appropriate)*	**Author**
Date:	**Date:**

Contents Page:

Full Description

Reference No: SG001/08

1. *Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.*

2. Introduction:

The development of fluid-induced hyponatraemia in the previously well child undergoing elective surgery or with mild illness may not be well recognised by clinicians.[1]

Since 2000, there have been four child deaths following neurological injury from hospital-acquired hyponatraemia reported in the UK.[1] International literature cites more than 50 cases of serious injury or child death from the same cause, and associated with the administration of hypotonic infusions.[1]

In March 2007 the National Patient Safety Agency (NPSA), with Alert 22, issued advice on how to reduce the risks associated with administering infusions to children[1].

In April 2007, with DHSSPSNI circulars[3,4], NHS organisations in Northern Ireland were tasked to produce and disseminate local clinical guidelines for the fluid management of paediatric patients based on the suggested NPSA guidelines template. The Northern Ireland Regional Paediatric Fluid Therapy Working Group produced an intravenous fluid clinical guideline in accordance with NPSA guidance[1]. This was disseminated to each HSC Trust for local implementation and monitoring.

In February 2009 the Regulation and Quality Improvement Authority (RQIA) published an independent review "*Reducing the risk of hyponatraemia when administering intravenous infusions to children"* which dealt with the implementation of recommended actions outlined within the NPSA Alert 22 and dissemination of the clinical guidelines / wall chart throughout HSC Trusts and independent hospitals. (see appendix 7.)

This document, using both the NPSA guidance and the RQIA recommendations, outlines the BHSCT policy for administration of intravenous fluids to children aged from 1 month until the 16th birthday with particular reference to reducing the risk of hyponatraemia; it is fundamentally a document aimed at prevention of hyponatraemia and not treatment.

3. Purpose:

To improve the safe use of intravenous fluid in children and reduce the risk of hyponatraemia.

4. The scope:

4.1 Applicable to all children more than 1 month and until their 16th birthday throughout the Belfast Health and Social Services Trust (BHSCT).

It is relevant for all general inpatient areas that treat patients from this age range (even if it is only occasionally) and includes the post-operative scenario, emergency departments, day case departments and the ambulance service.

This policy (and attendant fluid prescription chart) is not intended to apply to paediatric

and neonatal intensive care units, specialist areas such as renal, liver and cardiac units where it is used to replace ongoing losses of hypotonic fluids, or those suffering from burns or diabetic keto-acidosis (DKA) where hypotonic solutions may have specialist indications.

Children receiving long term Total Parenteral Nutrition (TPN) are not covered by the conditions of this policy.

4.2 Young people

As a child progresses through the teenage years there is a transitional stage of physical development i.e. adolescence, as that child progresses through towards adulthood. They will be referred to as 'young people' and many are cared for in adult wards by staff who generally treat adults.

The DHSSPSNI indicates that this paediatric fluid therapy guidance relates to all children from 1 month until their 16th birthday, regardless of the ward setting, except in the ICU and specialist areas mentioned above.

5. Objectives:

This policy sets out recommended practice for everyone who looks after children receiving intravenous fluids. It is based on regional and national guidance, ongoing clinical audit, the published literature and is also aimed at specifically reducing the risk of hyponatraemia.

It should be considered alongside the guidance from the National Patient Safety Agency Patient Safety Alert 22[1], and the Regional Paediatric Fluid Therapy Group wallchart[2] and the RQIA recommendations[5].

6. Roles and Responsibilities:

All professionals caring for children must:-

- be familiar with the signs of hyponatraemia.
- be familiar with its emergency management.
- ensure that they have received adequate training in intravenous fluids appropriate to their role.
- if they exclusively care for young people in an adult ward, know where to obtain expert paediatric should it be needed. (Appendix 5).
- be familiar with the guidance on intravenous fluids for children outlined by the Regional Paediatric Fluid Therapy Group wallchart[2].

7. The definition and background of the policy:

A child, for the purposes of this policy, is defined as being aged from 1 month up to their 16th birthday.

Hyponatraemia is an abnormally low concentration of sodium (Na) in serum. The normal range is generally agreed to be 135 – 145 mmol/L.

Hyponatraemia is defined as a plasma Na of less than 135 mmol/L. It represents an excess of water in relation to sodium in extracellular fluid and is described as severe or significant if below 130 mmol/L.

Significant acute hyponatraemia is defined as a decrease in plasma sodium from normal to less than 130 mmol/L in less than 48 hours.

Symptoms are likely with serum Na <125 mmol/L or if the serum Na has fallen rapidly; greater than 5 mmol/L decline in 24 hours.

The main causes of hyponatraemia in children are:

- Administration of hypotonic fluids, intravenous or enteral (e.g. excessively dilute formula or sodium chloride 0.18% and glucose 4% (No 18 solution))
- Conditions with impaired free water excretion and high anti-diuretic hormone levels
    - Meningitis, encephalitis, pneumonia, bronchiolitis, sepsis
    - Surgery, pain, nausea and vomiting
- Gastrointestinal fluid losses

Less common but important causes are:

- Adrenal insufficiency (Congenital Adrenal Hyperplasia, Addison's Disease)
- Defect in renal tubular absorption, including obstructive uropathy
- Psychogenic polydipsia

The main symptoms of hyponatraemia relate to its central nervous system effects; cerebral oedema, seizures and death. Warning signs may be non-specific and include nausea, malaise and headache.

All children are potentially at risk, even those not considered to be obviously 'sick'. The complications of hyponatraemia often occur because of the inappropriate management of intravenous fluids but they can also occur with inappropriately managed oral fluid regimes. Vigilance is required for all children receiving fluids.

Children particularly at risk are those who are postoperative, have gastrointestinal fluid losses or who have bronchiolitis, CNS injuries or burns. These risk factors also apply to young people.

8. Policy / Guideline description:

The NPSA recommended in Alert 22 the following actions:-

1. **Remove 'No. 18 solution'** from general areas that treat children and restrict availability to specialist areas except in critical care and specialist wards such as renal, liver and cardiac units.
2. Produce and disseminate **clinical guidelines** for the fluid management of paediatric patients.
3. Provide adequate **training** and supervision for all staff involved in the prescribing, administering and monitoring of intravenous infusions for children.
4. Review and improve the design of existing intravenous fluid prescriptions and **fluid balance charts** for children.
5. Promote reporting of hospital acquired hyponatraemia **incidents** via local risk management reporting systems. Implement an **audit** programme to ensure adherence to the above.

The 16 RQIA recommendations (appendix 7) map to the above NPSA recommendations:-

NPSA	RQIA
1	1, 2
2	3, (4), 5, 7
3	6, 7, 8, 9, 10
4	11
5	12, 13, 14,
6	15, 16

The specific actions that the BHSCT will institute in order to limit the production of hospital acquired hyponatraemia are detailed below and are mapped to the RQIA recommendations.

8.1.1 *NPSA 1 RQIA 1* *Remove 'No. 18 Solution'*
Sodium chloride 0.18% with glucose 4% has been withdrawn from general use in all BHSCT ward areas that treat children and the availability of these fluids is restricted to critical care areas and other specialist wards such as renal, liver and cardiac units. A table showing areas permitted to stock or order 'No.18 solution' is given in Appendix 6.

8.1.2 *NPSA 1 RQIA 2* Any area that is still permitted to stock 'No. 18 solution will arrange for the provision of additional labelling or separate storage.

8.1.3 *NPSA 2 RQIA 5* Information about the availability of infusion fluids throughput the BHSCT (Appendix 4) will be attached to the Paediatric Fluid Guideline wall chart[2].

8.1.4 The BHSCT's list of sanctioned standard maintenance fluids is given in Appendix 4.

Where a senior clinician(s) considers that a "special" maintenance infusion fluid is required, then this alternative choice for fluid maintenance must be endorsed by the Chief Executive of the Trust with clear documentation of the reasons for that endorsement.

8.2 *NPSA 2 RQIA 3,5,7* *Clinical Guideline*
The Paediatric Parenteral Fluid Therapy wallchart[2] forms the basis of BHSCT guidance on fluid prescription in paediatric patients within the previously defined age range. This policy and wall chart will be disseminated and displayed throughout the BHSCT; to all wards that accommodate children aged from one month until their 16th Birthday including Emergency Departments, Adult Wards, Theatre and Intensive Care Units.

This will replace any previous wallchart including the 2002 wallchart issued by CMO entitled "Any Child Receiving Prescribed Fluids is at Risk of Hyponatraemia". All previous versions of the chart should be removed.

8.2.1 *NPSA 2 RQIA 7* The BHSCT will develop policy and guidelines on the general principles of intravenous therapy for adults and children.

Until then, this policy will form the basis of guidance on fluid therapy in children within the BHSCT and, as for all BHSCT policies, it will be reviewed and implemented throughout the organisation.

8.2.3 *NPSA 2 RQIA 3* All medical and nursing staff should base their intravenous fluid practice for children, young people (and indeed adults) on the following best practice model of:-

- administer appropriate therapy for shock such as fluid boluses
- measure/estimate and correct any fluid deficit
- prescribe a fluid maintenance fluid regime.

Treatment of these elements of the overall fluid status is outlined in the Paediatric Parenteral Fluid Therapy wallchart[2].

The fundamental layout selected for this guideline complements a structured approach to patient clinical assessment. A sequence of questions is offered that prompts the clinician to

- assess for the presence of shock and guides treatment, if required;
- further assessment of whether there is also a deficit to be considered and then
- calculation and prescribing for maintenance requirements is also included.

8.2.4 This policy, centred on children, has many features that indicate good practice for young people and adults. An intravenous fluid therapy practice based on using

- an individual patient's weight in kilograms
- fluid administration based on a millilitres/hour prescription

is commended rather than blanket prescriptions based only on fluid volume.

8.2.5 Baseline Assessment

Good practice guidelines on monitoring body weight, electrolytes/urea and fluid balance should be followed. Again, these recommendations apply to adults as well as children.

An essential preliminary to these assessments is to accurately measure the body weight in kilograms or failing this, to make an estimate. This must be cross-referenced with the child's age to minimize the risk of error.

In the emergency situation an estimation of the child's weight should be made and an accurate weight obtained as soon as practically possible.

Baseline measurement of electrolytes and urea should be made unless the child is healthy and scheduled for elective surgery when it may be considered unnecessary.

8.2.6 Shock therapy

Shocked or collapsed children must immediately receive fluid boluses as outlined on the Regional Paediatric Fluid Therapy Group wallchart[2].

Good practice would indicate that the response to fluid therapy is closely observed and if there is no response by the time 40 mls/kg has been administered, senior medical advice and help is required.

Note that special treatment is needed for children with diabetic coma and trauma and the need to obtain senior advice and help is highlighted.

8.2.7 Fluid Deficit management

Calculation of the overall fluid deficit and the prescription of deficit replacement should only be undertaken by a doctor experienced in caring for dehydrated patients. The recommended fluid is sodium chloride 0.9% and it must be prescribed separately. The rate at which it is given is determined by the degree of dehydration and a relevant electrolyte sample.

For those caring for young people in a general adult ward, and who may not have such experience, they should ensure that they can avail themselves of advice from the sources as detailed in Appendix 5.

8.2.8 For advice regarding the estimation of the percentage of dehydration which is required for the fluid deficit calculation, the table in Appendix 2 should be consulted.

8.2.9 Maintenance fluid therapy

When prescribing maintenance fluids to children, young people and adults, the following scheme would be standard practice. For

- children use the calculations as indicated in the Regional Paediatric Fluid Therapy Group wallchart[2].
- young people and adults prescribe
    - 2 litres fluid for females over the weight of 40 kg.
    - 2.5 litres fluid for males over the weight of 60 kg.

8.2.10 The type of fluid selected must be tailored to the patient's needs as set out in the guideline. For example, following surgery, children who require intravenous fluids will be prescribed either sodium chloride 0.9% with or without pre-added glucose or Hartmann's solution in the post-operative period for maintenance fluid needs.

8.2.11 Children must not receive intravenous fluids unnecessarily. This guideline emphasises that assessment of each patient should include a decision on whether oral fluid therapy could be appropriately initiated instead of intravenous therapy and further prompts reconsideration of this question when IV therapy is reviewed.

8.2.12 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 or for consultation with a more senior clinician. 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 guidance as detailed in the wallchart[4] is fully appropriate in their case.

8.3 Training

NPSA 3 RQIA 3,6,8,10

The BHSCT will use various forms of training on paediatric fluid management; didactic lectures, staff induction training and computer based training:-

1. a training presentation in the policies and guidelines section of the Intranet. This multidisciplinary presentation is accessible from any computer terminal within the BHSCT.
2. BMJ e-learning module
3. 'Training Tracker' (Multimedia Design Studio Limited).

The BHSCT advocates the adoption of a regional computer based educational tool that allows:-

- creation of an unlimited number of educational and training courses; to include mandatory modules.
- 'training' of all grades of staff.
- content of the training to be tailored to our own needs.
- tracking
    - who has taken each module.
    - who has not taken each module.
    - who has passed and who has failed.
    - precisely which questions each trainee got right and wrong.
- competency assessment tools.
- training record to be obtained at any time.
- to award personalised certificates to those who reach a stated passmark.

8.3.1 *NPSA 3 RQIA 6,8,10* All staff involved in prescribing, administering and monitoring IV fluids to children will be made aware of this policy and the Paediatric Parenteral Fluid Therapy wallchart[2] through the BHSCT intranet and Service Group dissemination.

All staff working exclusively with children and especially those prescribing fluids to children will be encouraged to ensure they are conversant with the knowledge required to prescribe intravenous fluids to children and that it is within their scope of practice.

They will be encouraged to use the intranet training presentation and the BMJ learning module on hyponatraemia - http://learning.bmj.com/learning/search-result.html?moduleId=5003358

The production of the certificate on completion of the above module may be sought at staff assessments, RITAs, performance review, personal development plans and appraisals.

The future BHSCT policy and guideline on the general principles of intravenous therapy (8.2.1) will also be available in the various training modules.

8.3.2 *NPSA 3 RQIA 6,8* All professionals caring for children must be familiar with the signs of hyponatraemia and its emergency management.

8.3.3 *NPSA 3 RQIA 6,8* For those caring for young people, they should either have received adequate training in intravenous fluids or if they exclusively care for young people in an adult ward, they should know where to obtain such expertise on children should it be needed. (Appendix 5).

Furthermore, they should be familiar with the guidance on intravenous fluids for children outlined in this policy and Regional Paediatric Fluid Therapy Group wallchart[2].

8.3.4 *NPSA 3 RQIA 9* The BHSCT has identified that young people aged 14 - 16 years old can be cared for (even if only occasionally) on most wards that are generally regarded as adult wards with the obvious exceptions of wards like Care of the Elderly. Staff in those locations will be made aware of the training opportunities mentioned in 8.3 and 8.3.1.

BHSCT Service groups will consider cohorting young people in dedicated wards - where this can be done safely and will not lead to any diminution in the level of care.

8.3.5 The BHSCT will work with the NIMDTA to ensure that the principles of paediatric fluid therapy and its potential risks, as highlighted in the National Patient Safety Agency Alert, are highlighted in postgraduate training programmes.

8.3.6 All professionals caring for children must be able to diagnose and manage acute hypoglycaemia.

8.4 *NPSA 4 RQIA 11* <u>Fluid prescription/ balance chart</u>
A new fluid prescription/ balance chart has been developed within the Royal Belfast Hospital for Sick Children (RBHSC) with guidance from all other areas in the BHSCT that treat children. It will be used for the prescription of fluids for all children and young people treated in the BHSCT with the exception of treatment of diabetic ketoacidosis (DKA) when a specialised fluid prescription chart may be used.

If needed, they should avail themselves of advice from the sources as detailed in Appendix 5.

8.4.1 All children, other than emergencies, must have a blood sample taken for electrolyte and blood glucose estimation before intravenous maintenance fluids are started. This must be repeated at least 24 hourly, more often in the circumstances described. Clinical and other methods of monitoring are outlined in the guidance.

8.4.2 Monitoring

Monitoring of the child receiving parenteral fluid will include considerations of:-

- Body weight to be measured or assessed as a baseline and at least daily thereafter.
- Clinical state to be closely monitored and recorded on a regular basis.
- All fluid intake of any kind (intravenous, oral and medicines) must be measured and recorded on the fluid balance chart.
- All fluid output must be assessed and, if clinically indicated, measured and recorded on the fluid balance chart.
- An assessment of input/output and need for plasma glucose estimation should be made and documented every 12 hours.
- A formal reassessment of the fluid prescription and the need for intravenous fluids must be made and documented every 12 hours.
- Measurement of E&U and blood glucose/BM should be made at least daily.
- If hyponatraemia exists, these measurements should be 4 – 6 hourly.
- Urinary osmolarity and electrolytes measurements should be considered when dealing with hyponatraemia.
- The ill child will require more frequent and detailed investigations.

For more detailed information about the monitoring requirements the wallchart[2] should be consulted.

8.5 **Audit**

NPSA 5 RQIA 12 The BHSCT will implement the following governance measures.

8.5.1 *NPSA 5 RQIA 13* The BHSCT clinical biochemistry department will collate, analyse and report quarterly on paediatric hyponatraemia incidents to designated clinicians for children and young people. They will regularly audit these incidents, collate them with the Trust Adverse Incident Reporting System and instigate actions linked to the NPSA Alert 22. Appendix 3 outlines this audit process.

8.5.2 Incident reporting

NPSA 5 RQIA 14 The BHSCT will report these potential adverse incidents related to intravenous infusion through the Trust Adverse Incident Reporting System.

A system of 'triggers' (adapted from those developed by the NHSCT) will be used to

- generate a list of hospital acquired hyponatraemia episodes
- highlight variance from best practice guidance as highlighted in this document
- generate a Trust Adverse Incident Form whenever such incidents occur.

These triggers (Appendix 3) will cover the choice of fluid prescribed at ward level, charting relevant findings in the medical notes, the frequency of electrolyte analysis and the detection of biochemical abnormalities.

8.5.3 Audit

NPSA 5 RQIA 15,16 The BHSCT will implement an audit programme for intravenous infusion therapy in children throughout the trust.

The audits will be based on the

- NPSA audit checklist
  http://www.npsa.nhs.uk/EasySiteWeb/GatewayLink.aspx?alId=5308
- the BHSCT trigger list (Appendix 3).
- Regional GAIN hyponatraemia audit

8.5.4 Where young people are cared for in general adult wards, special audit arrangements will be put in place to ensure they receive appropriate and safe fluid management.

9. Additional policy statements:

9.1 Senior medical advice must be sought when treating the child with hyponatraemia.

9.2 Where additional electrolytes are required, they should only be administered as supplied by the manufacturer and in line with guidance.

Children at or below the age of 13 years must not have electrolytes added to bags of intravenous fluids.

Ordinarily children from 13 to 16 should also not have electrolytes added to bags of intravenous fluids; in certain, predominantly adult areas, children of this age group may have magnesium sulphate or phosphates added.

9.3 Apart from boluses for shocked patients, fluids may only be administered by way of an infusion device. Details of the pump must be recorded on the fluid prescription and balance chart.

9.4 When referring to this policy, staff should consult the BHSCT policy on the management of strong intravenous potassium solutions and/or injections.

10. Implementation / Resource requirements:

The implementation requirements for this policy include:-

- Wallchart production and distribution
- Fluid prescription/ balance chart production and distribution
- Staff training costs – induction, postgraduate courses.

Raising staff awareness of the issues surrounding hyponatraemia and the subsequent staff training will be encouraged, as suggested by DHSSPSNI circular[4], by using the BMJ e-learning module.

11. Source(s) / Evidence Base:

The following sources were used:-

a) NPSA Alert 22
b) NPSA background information
   http://www.npsa.nhs.uk/EasySiteWeb/GatewayLink.aspx?alId=5310
c) HSC (SQSD) 20-07 - reducing risk of Hyponatraemia in children (27/04/2007)
d) HSC (SQSD) 20-07 - addendum (16/10/2007)
e) Paediatric Parenteral Fluid Therapy wallchart.

12. References, including relevant external guidelines:

1. Reducing the risk of hyponatraemia when administering intravenous infusions to children. National Patient Safety Agency, Patient Safety Alert 22, March 2007.
2. Paediatric Parenteral Fluid Therapy initial management guideline, DHSSPSNI 2007. http://www.dhsspsni.gov.uk/hsc__sqsd__20-07_wallchart.pdf.
3. HSC (SQSD) 20-07 reducing risk of Hyponatraemia in children
4. http://www.dhsspsni.gov.uk/hsc__sqsd__20-07_-_addendum.pdf

5. Regulation and Quality Improvement Authority (RQIA). Reducing the risk of hyponatraemia when administering intravenous infusions to children - September 2008. http://www.rqia.org.uk/cms_resources/NI%20%20report%20Hyponatraemia%20FINAL%20v%203%200.pdf

13. Consultation Process:

This policy is adapted from the

- NPSA Alert 22,
- Northern Ireland Regional Paediatric Fluid Therapy Working Group
- HSC (SQS) 20/2007 and its addendum documentation from the DHSSPSNI.

It has been assured through the Standards and Guidelines committee.

14. Equality and Human Rights screening carried out:

In line with duties under the equality legislation (Section 75 of the Northern Ireland Act 1998), Targeting Social Need Initiative, Disability discrimination and the Human Rights Act 1998, the Belfast Trust has carried out an initial screening exercise to ascertain if this policy should be subject to a full impact assessment.

√ Screening completed ☐ Full impact assessment to be carried out.
No action required.

15. Procedures:

Appendix 1 - Paediatric Parenteral Fluid Therapy wallchart
Appendix 2 - Estimating the percentage dehydration based upon physical examination findings.
Appendix 3 - Paediatric Hospital Acquired Hyponatraemia Audit
- Triggers for potential adverse events
Appendix 4 - Availability of intravenous fluids throughout the BHSCT (500ml bags)
Appendix 5 - Sources of advice regarding Paediatric fluid therapy
Appendix 6 - Areas where it is permitted to stock/order No. 18 Solution* - as of August 2009
Appendix 7 - RQIA independent review - September 2008 - Recommendations

Director **Author**

Date: **Date:**

PAEDIATRIC PARENTERAL FLUID THERAPY (1 month – 16 yrs)

Initial management guideline

Sept 2007

Monitoring & observations essential

ALL CHILDREN

Admission Weight. U&E *(unless child is well & for elective surgery)*

12 Hourly –
Assess In / Output, plasma glucose

Daily – Clinical reassessment. U&E (more often if abnormal; 4-6 hourly if Na^+ < 130 mmol/L).

ILL CHILDREN
May need:
Hourly - HR, RR, BP, GCS. Fluid In/ Output (urine osmolarity if volume cannot be assessed)
2-4 hourly – glucose, U&E, +/- blood gas.

Daily – weight if possible

Each shift
Handover and review of fluid management plan.

If plasma Na^+ < 130 mmol/L or > 160 mmol/L or plasma Na^+ changes > 5 mmol/L in 24 hours ask for senior advice

Is shock present? YES

ADMINISTER RAPID FLUID BOLUS
Give 20 ml/kg sodium chloride 0.9% IV or Intraosseous
[10 ml/kg if history of haemorrhage or in diabetic ketoacidosis]
Reassess. Repeat bolus if needed. Call for senior help.
(Up to 60 ml/kg may be needed. Use blood after 40 ml/kg if patient has haemorrhaged)

NO

Can child be managed with oral fluids? YES

PRESCRIBE ORAL REHYDRATION SOLUTION

DKA / burns: initiate departmental protocol. Renal / cardiac / hepatic - get senior advice.

Is there a fluid deficit? YES

ESTIMATE DEFICIT
FLUID DEFICIT = (% dehydration x kg x 10) as mls of:
sodium chloride 0.9%

The volume of fluid to be prescribed is: fluid deficit MINUS volume of any fluid bolus received

Prescribe this residual volume of deficit separately from the maintenance prescription.
Give over 24 hours (but over 48 hours if Na^+ < 135 or > 145 mmol/L)

ONGOING LOSSES: calculate at least 4 hourly. Replace with an equal volume of:
sodium chloride 0.9% (with or without pre-added potassium)

Be prepared to change fluid type and volume according to clinical reassessment, electrolyte losses and test results

NO

Prescribe Maintenance fluids

PRESCRIBE INITIAL IV MAINTENANCE FLUID AND TIME FOR REASSESSMENT

Patients particularly at risk of hyponatraemic complications:
peri-operative patients; patients with head injuries; gastric losses; CNS infection; severe sepsis; hypotension; intravascular volume depletion; bronchiolitis; gastroenteritis with dehydration; abnormal plasma sodium, particularly if less than 138 mmol/L but also when greater than 160 mmol/L; salt wasting syndromes.

Fluid choices: glucose containing fluid normally required if under 1 year old and may also be required by older children

sodium chloride 0.9% (with/ without pre-added glucose 5%)
or
Hartmann's Solution
or
Solution Corporately Approved at Trust Level

Other Patients:
sodium chloride 0.45% with pre-added glucose 2.5% or 5%

All Patients:
Alter fluid rate according to clinical assessment. Change electrolyte and glucose content of infusion fluid according to test results.
COMMENCE ORAL FLUIDS & DISCONTINUE IV FLUIDS AS SOON AS POSSIBLE

CALCULATION OF 100% MAINTENANCE RATE

(a) for first 10 kg:	100 ml/kg/ day	≡	4ml/kg/hr
(b) for second 10 kg:	50 ml/kg/ day	≡	2ml/kg/hr
(c) for each kg over 20 kg:	20 ml/kg/ day	≡	1ml/kg/hr

[for 100% daily maintenance add together (a) + (b) + (c)]

MAXIMUM: in females 80 mls per hour; in males 100 mls per hour
If risk of hyponatraemia is high consider initially reducing maintenance volume to two thirds of maintenance

Hypokalaemia (< 3.5 mmol/L): Check for initial deficit. Maintenance up to 40 mmol/L IV potassium usually needed after 24 hrs using pre-prepared potassium infusions as far as possible. Consult Trust Policy on IV strong potassium.
Oral intake and Medications: volumes of intake, medications & drug infusions must be considered in the fluid prescription.
Hypoglycaemia (< 3 mmol/L). **Medical Emergency: give 5 ml/kg bolus of glucose 10%.** Review maintenance fluid, consult with senior and recheck level after 15-30 mins. **INTRA-OPERATIVE PATIENTS:** consider monitoring plasma glucose.
Symptomatic Hyponatraemia: check U&E if patient developes nausea, vomiting, headache, irritability, altered level of consciousness, seizures or apnoea. **This is a Medical Emergency and must be corrected.**
Commence infusion of sodium chloride 2.7% at 2 ml/kg/hour initially and get senior advice immediately.

Standards & Guidelines Committee – Hyponatraemia + IV fluids for children – V3.6 – 17/09/2009

Appendix 2

Estimating the percentage dehydration based upon physical examination findings.

Estimated Percentage Dehydration	Physical Examination Findings
<3	History of fluid loss but no findings on physical examination
5	Dry oral mucous membranes but no panting or pathological tachycardia
7	Mild to moderate decreased skin turgor, dry oral mucous membranes, slight tachycardia, and normal pulse pressure.
10	Moderate to marked degree of decreased skin turgor, dry oral mucous membranes, tachycardia, and decreased pulse pressure.
12	Marked loss of skin turgor, dry oral mucous membranes, and significant signs of shock, pallor, cool peripheries, prolonged capillary refill time, hypotension, confusion.

Appendix 3

PAEDIATRIC HOSPITAL ACQUIRED HYPONATRAEMIA AUDIT

Laboratory Report Details (to be completed by audit dept)

Patient No. Patient Date of Birth:

Date of specimen: Time of specimen: Result :

Admission Details

Date of admission: Time of admission:

Diagnosis: 1.

2.

Hospital acquired hyponatramia (defn)

- Na ≥130mmol/l at time of admission, & a subsequent Na of < 130mmol/l whilst on IV fluids.
- Na< 130mmol/l on their initial U&E's, where the U&E's are done >48hrs after admission and they are on IV fluids.
- Admitted from another hospital with Na < 130mmol/l at time of admission whilst on IV fluids.

1. Is this hospital acquired hyponatraemia? Yes / No

   If no, reason: _____

   If yes, was it acquired whilst in this trust? Yes / No

   If no, patient transferred from: _____

Treatment and monitoring of hyponatraemia

2. Was the fluid prescribed appropriate? Yes / No

   If no, details: _____

3. Was IV fluid prescription reviewed 12hrly whilst on IV fluids? Yes / No

4. Were U&E done 24hrly whilst on IV fluids? Yes / No

Following the Na of <130mmol/l,

5. Was appropriate advice sought? Yes / No

   Grade: _____ Speciality: _____

6. Was the frequency of repeat U&Es appropriate? Yes / No

   If No, details: _____

Recording and communication of incidents (to be completed by Audit dept)

7. If yes to Q1, was adverse incident form completed? Yes / No

8. Was copy of form sent to other trust if acquired outside BHSCT? Yes / No

Triggers for potential adverse events related to the administration of intravenous fluids to children (1 month – 16 years old)

(adapted from Northern H&SCT policy)

CHOICE OF IV FLUID

1. Bolus fluid: use of a solution with sodium concentration of <131mmol/L for treatment of shock.
2. Deficit fluid: use of a solution with sodium concentration of <131mmol/L for correction.
3. Maintenance fluid: use of a solution with sodium concentration of <131mmol/L in a peri-operative patient (intraoperative period and first 24 hours following surgery).

BIOCHEMICAL ABNORMALITIES

4. Any episode of symptomatic hyponatraemia while in receipt of IV fluids.
5. Any episode of hypoglycaemia (blood glucose less than 3mmol/L) while in receipt of IV fluids.
6. Any episode of severe acute hyponatraemia (i.e. sodium level dropping from 135mmol/L or above to < 130mmol/L within 24hrs of starting IV treatment).

ASSESSMENT

7. Electrolytes not checked at least once per 24 hours in any patient receiving IV fluids exclusively.
8. Failure to record the calculations for fluid requirements on the prescription sheet.
9. Failure to note in the case notes/ prescription sheet a serum sodium of less than 130mmol/L.
10. Failure to document in the case notes the steps taken to correct a serum sodium of less than 130mmol/L.

If any of the above occurs an IR1 Form must be completed.

October 2010

Appendix 4

AVAILABILITY OF INTRAVENOUS FLUIDS THROUGHOUT THE BHSCT (500ML BAGS)

SITE	RGH	BCH	MPH	MATER
Sodium chloride				
Sodium chloride 0.45%	√	√		√
Sodium chloride 0.9%	√	√	√	√
Sodium chloride 1.8%	√	√	√	√
Sodium chloride 2.7%	√		√	√
Combined solutions				
Sodium chloride 0.45% Glucose 2.5%	√	√	√	
Sodium chloride 0.45% Glucose 5%	√		√	
Sodium chloride 0.9% Glucose 5%	√			
Glucose solutions				
Glucose 5%	√	√	√	√
Glucose 10%	√	√	√	√
Glucose 15%	√			
Glucose 20%	√	√		
Potassium containing solutions				
Glucose 5% 10mmol Potassium chloride	√			
Glucose 5% 20mmol Potassium chloride	√	√	√	
Glucose 5% 40mmol Potassium chloride	√	√	√	
Glucose 10% 10mmol Potassium chloride	√			√
Glucose 10% Sodium chloride 0.18% 10mmol Potassium chloride*	√			
Sodium chloride 0.45% Glucose 2.5% 10mmol Potassium chloride	√	√		
Sodium chloride 0.45% Glucose 2.5% 20mmol Potassium chloride	√			
Sodium chloride 0.45% Glucose 5% 10mmol Potassium chloride	√			
Sodium chloride 0.45% Glucose 5% 20mmol Potassium chloride	√			
Sodium chloride 0.9% 10mmol Potassium chloride	√			
Sodium chloride 0.9% 20mmol potassium chloride	√	√	√	√
Sodium chloride 0.9% 40mmol potassium chloride	√	√		

* commonly known as Basic solution

Sites: RGH = Royal Hospitals
BCH = Belfast City Hospital
MPH = Musgrave Park Hospital
MATER = Mater Hospital

Appendix 5

Sources of advice regarding Paediatric fluid therapy

For help and advice regarding

- management of fluid therapy
- especially to prevent and/or treat hyponatraemia

in all children, but especially for those children aged 13 – 16 years old being managed in adult wards,

please use the following sources of help and advice. Ordinarily, advice should be for complex cases and should be Consultant to Consultant discussions even though contact will often have to be made through trainee on-call rotas.

Team		Address	Extension
RBHSC Paediatricians	Paediatric On Call Rota	Allen Ward Musgrave Ward	Bleep 2277
RBHSC Paediatric ICU	Paediatric ICU		2449
Musgrave Park	Orthopaedic theatre – Anaesthesia team during working hours.		
BCH Dufferin theatres	ENT theatre – Anaesthesia team during working hours.		
General Biochemistry	**Clinical Biochemistry**		
	Inside working hours	**Outside working hours**	
RVH Tie line:7222 Ext.3798	Ext.4714	Contact Medical doctor on call either via the laboratory or via switchboard.	
BCH Tie line:7111 Ext. 3096/2926/3628	Ext.3497/3136/3160	Ext.3216 or Contact Medical doctor on call either via the laboratory or via switchboard	
MIH Tie line: 7231 Ext. 2223/2229	Ext.2326/2228	Contact Medical doctor on call either via the laboratory or via switchboard	

Other sources of help are:

1 APA consensus guideline on perioperative fluid management in Children
http://www.apagbi.org.uk/docs/Perioperative_Fluid_Management_2007.pdf

2 Royal Children's hospital Melbourne Clinical Practice Guidelines
Intravenous fluids
http://www.rch.org.au/clinicalguide/cpg.cfm?doc_id=5203#Other%20Resources

3 Royal Children's hospital Melbourne Clinical Practice Guidelines
Hyponatraemia
http://www.rch.org.au/clinicalguide/cpg.cfm?doc_id=8348

Appendix 6

Areas where it is permitted to stock/order No. 18 Solution* - as of August 2009

SERVICE GROUP	SITE	SPECIALITY	Stock on Ward	Named patient supply – consultant request only.
Clinical Services	RGH, BCH	High Dependency Unit	X	
Clinical Services	RGH, BCH, MATER	Intensive Care	X	
Clinical Services	Mater, BCH, RGH	Recovery Wards		X
Clinical Services	Mater, RGH	Theatres		X
Clinical Services	BCH	Tower Theatres		X
Clinical Services / OPMS	Mater, RGH, BCH	Day Procedure Units		X
Specialist Serv	RGH	Wards 4E and 4F (Neurosciences)		X
OPMS T&O	MPH	Recovery Ward - Orthopaedics		X
OPMS T&O	MPH	High Dependency Unit		X
OPMS T&O	MPH	Theatres - Orthopaedics		X
SS, Women, family and childcare	RBHSC	Barbour Renal	X	
SS, Women, family and childcare	RBHSC	PICU	X	

* "No. 18 Solution" = sodium chloride 0.18% and glucose 4%

Appendix 7

RQIA INDEPENDENT REVIEW - SEPTEMBER 2008 - RECOMMENDATIONS

Recommendation 1	All hospitals should monitor the ongoing use of No. 18 solution to enable assurance that infusions are removed from stock and general use in areas that treat children.
Recommendation 2	Where appropriate, hospitals must be able to demonstrate that an active strategy is in place for minimising risk of use in clinical areas that continue to stock No 18 solution and where children are accommodated. For example, provision of additional labelling or separate storage for those No.18 solution bags still stocked in such clinical areas.
Recommendation 3	All hospitals should continue with the ongoing work of disseminating clinical guidelines. This should be undertaken in conjunction with multidisciplinary awareness-raising and education on the use of the guidance and wall chart in all settings where children may be treated. This is particularly important in adult wards where older children are treated.
Recommendation 4	Independent hospitals must be assured that all visiting doctors who may manage patients up to 16 years old use the clinical guidelines when managing children being treated with intravenous infusions.
Recommendation 5	All hospitals should ensure that only the DHSSPS Paediatric Parenteral Fluid Therapy wall-chart *issued by DHSSPS in October 2007* is displayed in clinical areas where children may be treated, with a list of available local fluids available alongside it. All previous versions of the wall chart should be removed from clinical areas.
Recommendation 6	Hospitals should assure themselves that staff have the appropriate skill and knowledge in this clinical area. Competency assessment tools in administration of intravenous infusion to children should be developed, formalised and implemented for all relevant, multi-professional staff.
Recommendation 7	Hospitals should continue to review, collaborate and implement organisation wide policy and guidelines, in relation to intravenous infusion for children.
Recommendation 8	All hospitals should ensure that the development and provision of multidisciplinary education opportunities in administration of intravenous infusion to children and that all relevant clinical staff uptake this education.
Recommendation 9	Hospitals should develop mechanisms to identify the location of patients aged 14-16 years who are in adult wards and ensure staff who care for those children are provided with competency based, assessed education in administration of intravenous infusion to children.
Recommendation 10	All hospitals should make wider use of training sources available such as BMJ E-Learning Module on Hyponatraemia to address different learning styles and devise a mechanism to ensure 100% multi-professional uptake of such learning.
Recommendation 11	Priority must be given to the completion of a Trust-wide review, and implementation of revised paediatric intravenous fluid prescription and

fluid balance charts in all settings where children may be treated including adult wards where children are treated.

Recommendation 12 All hospitals should develop a culture of incident reporting, analysis and learning generally and specifically in respect of intravenous fluids and hyponatraemia.

Recommendation 13 Plans for development of systems for reporting, analysing and monitoring incidents to assure organisations of safe practice and that actions linked to NPSA Alert 22 should be implemented and regularly audited by all hospitals to ensure adherence to the process.

Recommendation 14 The development of 'trigger lists' that have been adopted by a the Antrim Area Hospital to aid understanding of the types of incidents to be reported should be shared and taken up more widely .

Recommendation 15 The development of an audit tool which may include wider aspects but should address as a minimum aspects of NPSA Alert 22 should continue to be progressed and used at least annually.

Recommendation 16 Trusts should continue to seek approval and funding for a regional audit (GAIN proposal) on the uptake of the Paediatric Parenteral Fluid Therapy guideline and potential unexpected clinical consequences of the guideline.