DETAILED FINDINGS ABOUT THE IDENTIFICATION OF HYPONATRAEMIA AND HYPERNATRAEMIA

The blood sodium level for patients presenting to emergency care services, for example emergency departments (EDs), same day emergency care services or medical assessment units, should be available rapidly. Once an abnormal blood sodium level is identified this should then trigger the appropriate clinical assessment and further investigations to determine the cause. In addition, it is important that the clinicians involved in the care of the patient review results of previous blood sodium levels to determine the chronicity of the hyponatraemia or hypernatraemia and any changes from previous results. Chronic hyponatraemia is defined as hyponatraemia that has occurred over more than 48 hours; in addition, any patient who does not have a documented sodium assessment in last 48 hours should be assumed to have chronic hyponatraemia.

There were a small number of patients (7/392; 1.8%) who developed their emergency admission-related hyponatraemia after admission to hospital (i.e. they had a normal blood sodium result on presentation to the emergency department). The majority (258/392; 65.8%) of patients with emergency admission-related hyponatraemia had their lowest sodium level on presentation to hospital (120 (IQR: 116 to 124) mmol/L) (F3.1).

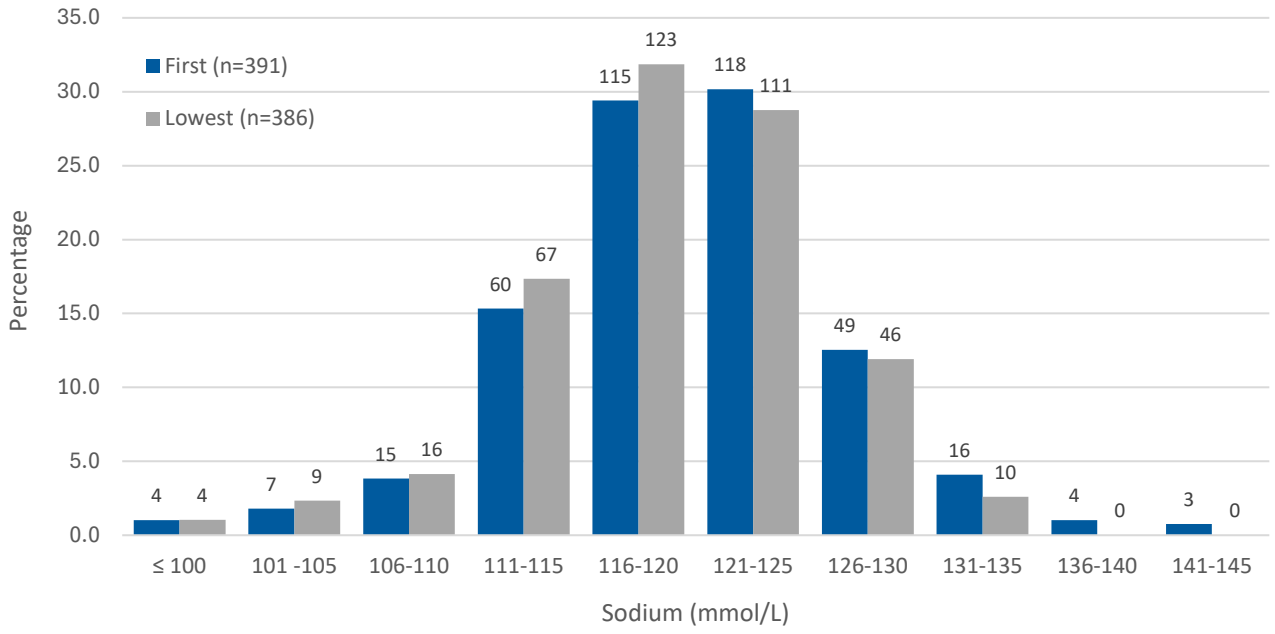

Figure 3.1 The first and lowest blood sodium levels for emergency admission hyponatraemia patients
Clinician questionnaire data

Patients who developed hyponatraemia postoperatively had less severe hyponatraemia based on their lowest blood sodium results; median lowest blood sodium was 120 (IQR: 116 to 123) mmol/L for emergency admission-related hyponatraemia and 125 (IQR: 122 to 128.25) mmol/L for postoperative hyponatraemia (F3.2 and F3.3). It was not possible to determine the impact of postoperative hyponatraemia on outcome due to small numbers.

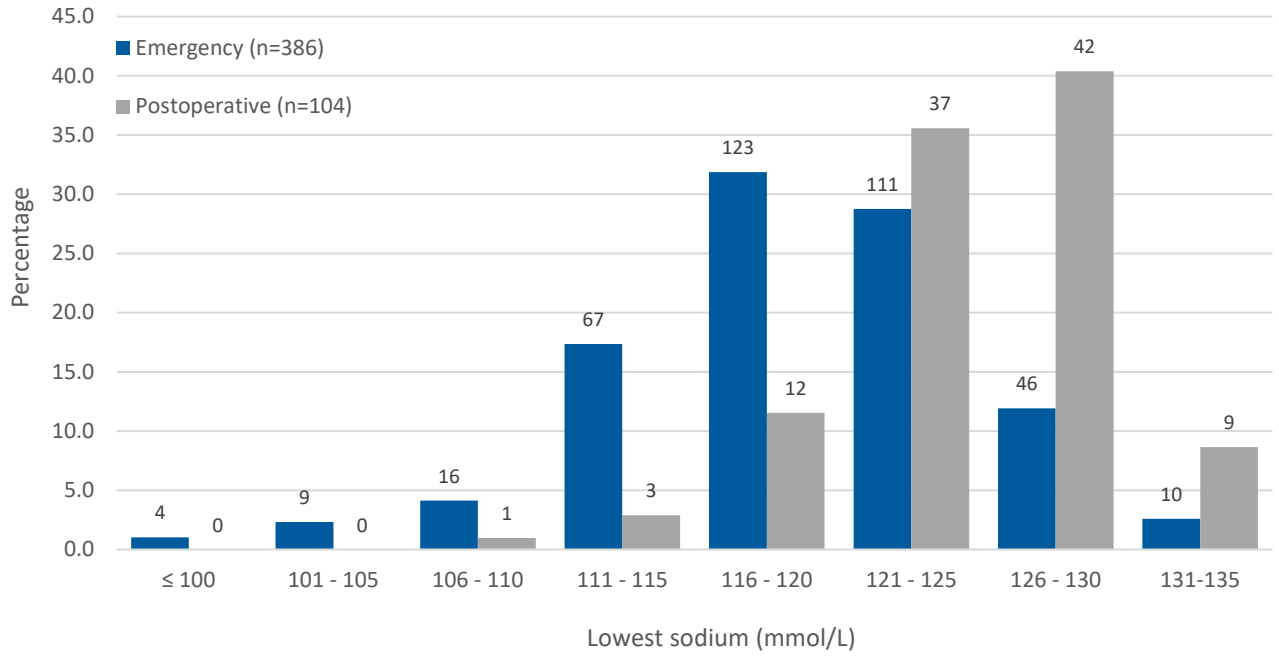

Figure 3.2 The lowest blood sodium levels for emergency admission and postoperative hyponatraemia patients by blood sodium concentration

Clinician questionnaire data

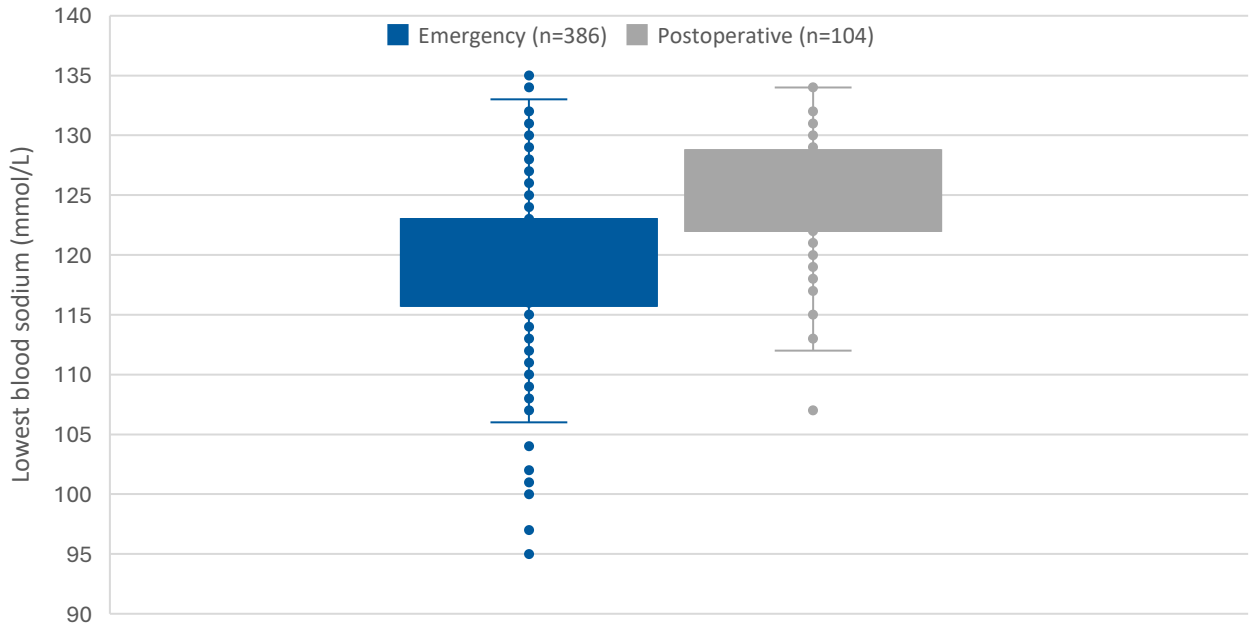

Figure 3.3 Comparison of lowest blood sodium levels between emergency admission and postoperative hyponatraemia

Clinician questionnaire data

The blood sodium level on admission (first) and highest blood sodium level in patients with hypernatraemia are shown in Figure 3.4. The median (IQR) blood sodium concentration on admission (first) was 150 (142 to 159) mmol/L and the median (IQR) highest blood sodium concentration during the admission was 156 (153 to 164) mmol/L (F3.5). Patients who had hypernatraemia were more likely to develop worsening of their hypernatraemia during their admission, as only 38/142 (26.7%) had their highest blood sodium level at the time of admission.

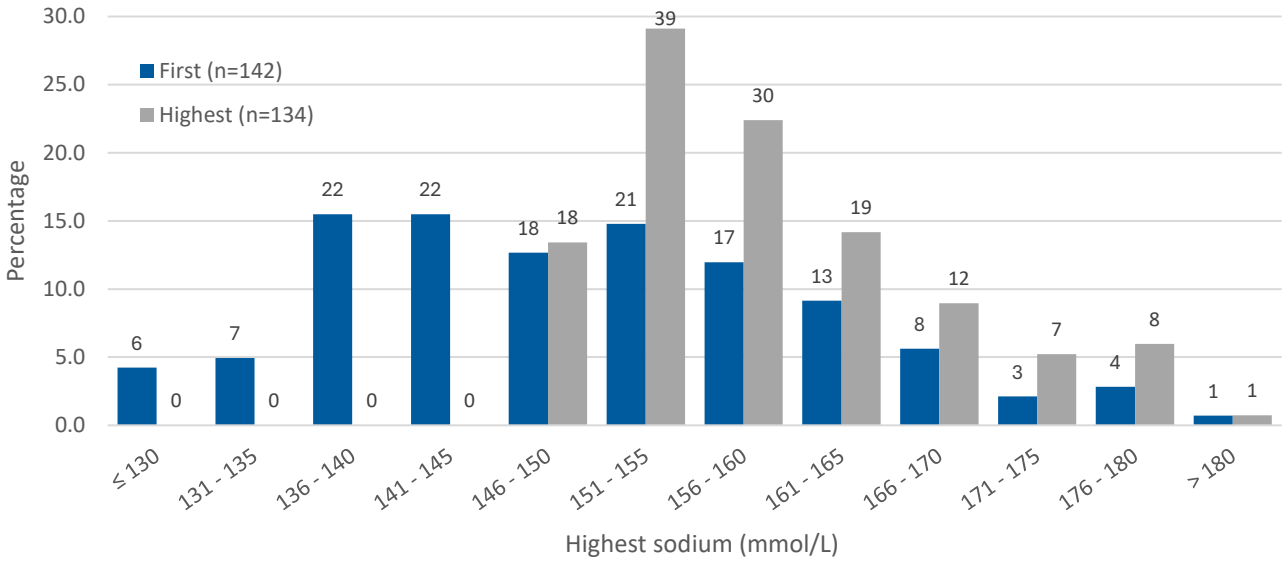

Figure 3.4 First and highest blood sodium levels in patients with hypernatraemia
Clinician questionnaire data

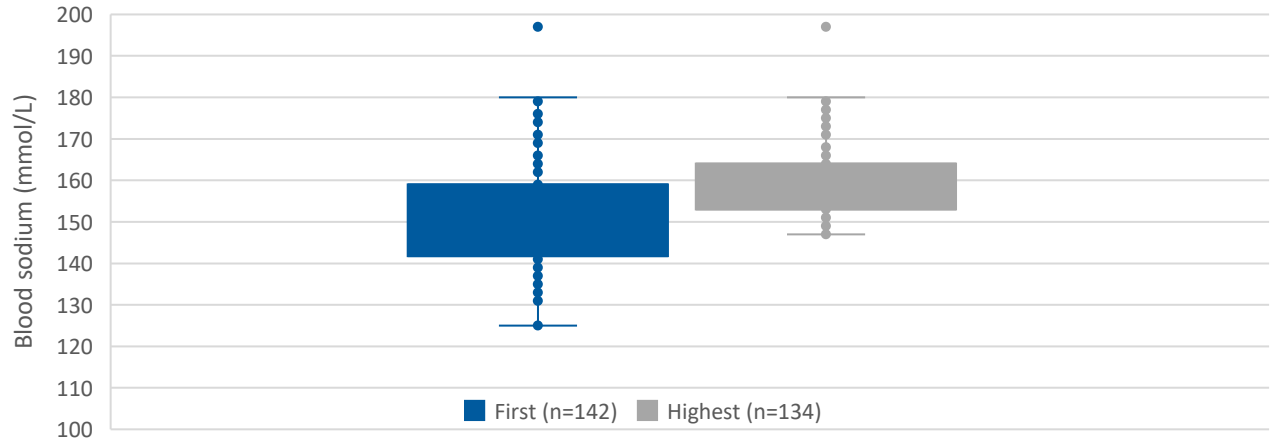

Figure 3.5 Comparison of admission (first) and highest blood sodium concentration in patients with hypernatraemia
Clinician questionnaire data

Royal College of Pathologists guidance in 2013 provided a key performance indicator on the turnaround times for specific blood testing from emergency department presentations, stating that *"90% of renal function and urea and electrolytes (U&Es) (both of which would include measurement of sodium) tests from A&E should be completed within one hour of sample collection,"* although it did note that the laboratory often may not be aware of the time of collection.[7]

This key performance indicator forms the basis of the subsequent 2019 Royal College of Pathologists *'Key Assurance Indicators for Pathology Services'* guidance and the 2nd Edition of the NHS England and NHS Improvement *'Pathology Quality Assurance Dashboard'*, which while not specifying turnaround times for laboratory tests, both stated that there needs to be local agreements between laboratory services and requesters on the anticipated times for all relevant laboratory investigations around collection of the sample, receipt of the sample in the laboratory and the reporting of the result to the requester.[8,9]

Delays to the processing and analysis of the blood sample within the laboratory can impact on agreed times from collection to reporting of results, delays can also occur at various other points in the pathway. These include: i) time from presentation to blood collection; ii) time from blood collection to arrival in the laboratory; and iii) time for clinicians to act on the abnormal results.

There were 90/183 (49.1%) first sodium results available for patients with hyponatraemia within an hour of time of arrival at hospital. This increased to 137/183 (74.9%) within 2.5 hours (F3.6).

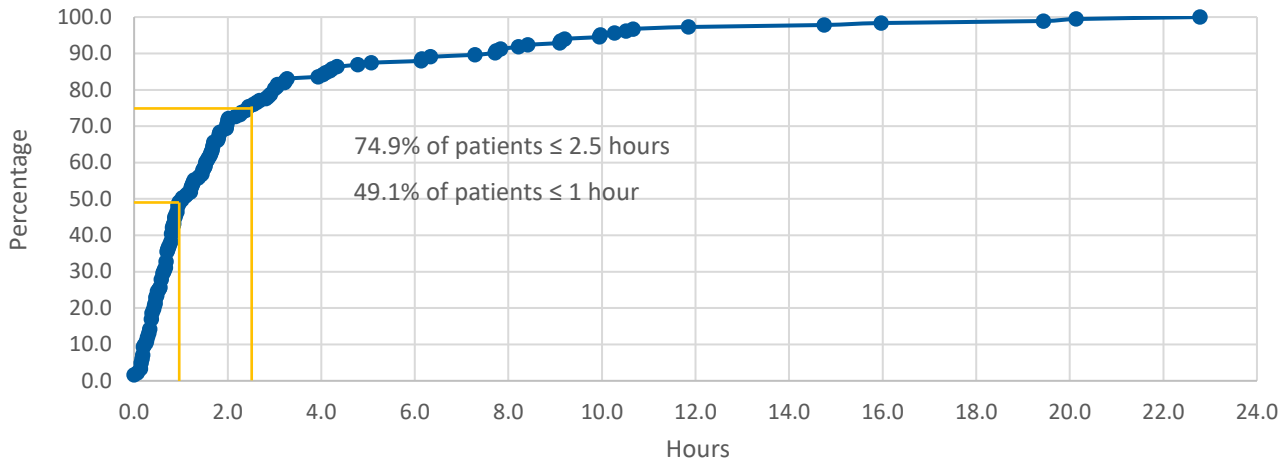

Figure 3.6 Time to first sodium measurement from arrival
Reviewer assessment form data (n=183)

Most of the initial sodium results in patients with hyponatraemia recorded in the clinician questionnaires (357/386; 92.5%) (unknown for 6) and reviewer assessment forms (169/263; 64.3%) (unknown for 7) were from laboratory testing rather than point-of-care testing (e.g. blood gas analyses).

More initial sodium results from point-of-care testing may have been available to the treating clinicians than indicated in the questionnaire responses. This discrepancy could arise because such results are not always fully integrated into laboratory electronic reporting systems, or clinicians using blood gas analysers might not have entered the patient identifiers needed to enable linkage. In these circumstances, the blood gas or other point-of-care results are typically printed and then once reviewed may not be filed in the patient's medical records.

During any single admission, it is important that clinicians follow the trend in results from one type of analysis (point-of-care or laboratory) as there is the potential for differences between different analytical methods.

Clinicians may act with caution on blood gas or other point-of-care results, concerned that electrolyte measurements on blood gas machines may be inaccurate. Where point-of-care testing machines are maintained, then the sodium results on these machines are reliable and can be used to guide treatment without the need to wait for confirmation from a laboratory processed sample.[10-12] Even where treatment is started prior to laboratory confirmation, the initial point-of-care test result should be subsequently confirmed by a laboratory-processed sample.
Royal College of Pathologists guidelines state that *"sodium values below 120 mmol/L in adults and 130 mmol/L in children should be escalated to clinical teams, ideally by telephone, within two*

hours."[13] When the laboratory staff are unable to contact someone, staff should follow a local escalation procedure for managing the abnormal blood result. This guideline is being revised and does not have any changes to the sodium values that require alerting clinical teams, but there is greater emphasis on the use of non-telephone-based alerting systems. As most of the alerting is through telephone, this can lead to laboratory staff spending long times waiting to speak to clinical staff, meaning they cannot undertake other essential activities.

The majority of hospitals (123/156; 78.8%) had guidelines for laboratory staff to escalate abnormal results and set values to trigger an alert (T3.1).

Table 3.1 Hyponatraemia values for escalation to clinical teams	Number of hospitals	%
Sodium ≤120 mmol/L	98	79.7
Sodium ≤125 mmol/L	18	14.6
Sodium ≤130 mmol/L	7	5.7
Total	**123**	

Organisational questionnaire data; n=156

All hospitals reported that a sodium level of 120 mmol/L or less would be escalated to clinicians; interestingly, 25/123 (20.3%) of hospitals reported that they alerted clinicians to sodium values higher (121 to 130 mmol/L) than the Royal College of Pathologist recommendations. This study did not provide the data to determine if, or how soon the treating clinical teams were alerted to a blood sodium level of less than 120 mmol/L by laboratory staff.

Currently there are no national guidelines or recommendations on how quickly clinicians should act on abnormal blood sodium levels once reported. And there are no recommendations on the criteria for reporting rapidly dropping sodium results, which may be a more important risk factor for the development of hyponatraemic encephalopathy than the absolute value.

Only 60/156 (38.5%) organisations had local guidelines to assist clinicians in the management of hypernatraemia. Despite this, 119/156 (76.3%) had criteria for laboratory staff for escalation of elevated blood sodium levels.

All of the local guidelines available met the Royal College of Pathologists guidance for rapid (within two hours) escalation to clinical staff of blood sodium levels above 160 mmol/L criteria, and 77/119 (64.7%) recommended escalation for blood sodium levels between 150 to 159 mmol/L (T3.2).

Table 3.2 Blood sodium level for escalation by laboratory staff to clinical teams	Number of hospitals	%
Sodium ≥ 160 mmol/L	40	33.6
Sodium ≥155 mmol/L	32	26.9
Sodium ≥150 mmol/L	45	37.8
Other	2	1.7
Total	**119**	

Organisational questionnaire data; n=156, unknown for 37