Retrospective observational study of neonatal attendances to a children's emergency department

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ABSTRACT

Aim

Attendances to Emergency Departments (EDs) in the UK are increasing, particularly for younger children. Community services are under increasing pressure and parents may preferentially bring their babies to the ED, even for non-urgent problems. This study aimed to characterise the presenting features, management, and disposition of neonatal attendances to a Children's ED (CED).

Methods

Retrospective observational review of neonatal attendances (≤28 days) to the CED at Bristol Royal Hospital for Children (BRHC) from 01/01/2016-31/12/2016. Further information was obtained from investigation results and discharge summaries. Data abstracted included sex, age, referral method, presenting complaint, diagnosis, investigations, and treatments.

Results

Neonatal attendances increased from 655 to 1205 from 2008-2016. The most common presenting complaints were breathing difficulty (18.1%) and vomiting (8.3%). The most common diagnoses were 'no significant medical problem' (41.9%) and bronchiolitis (10.5%). Half of neonatal attendances to the CED had no investigations performed and most (77.7%) needed advice or observation only.

Conclusion

Many neonates presenting to the CED were well and discharged with observation only. This suggests potential for improving community management and in supporting new parents. Drivers of health policy should consider developing enhanced models of out of hospital care which are acceptable to clinicians and families.

KEY WORDS

Child Health
Emergency Medicine
Infant, Newborn

KEY NOTES

- Neonatal attendances to the CED are increasing however the majority are discharged home as “well babies” or with low acuity problems, often without investigations that require a secondary facility.
- Most neonatal attendances to the Children’s Emergency Department require advice or observation rather than specific medical treatments or interventions.
- Increased community provision for assessing and managing common newborn problems is required.

INTRODUCTION

Emergency Departments (EDs) are under increasing pressure, with rising attendances and admission rates. In the UK there has been a 14% increase in childhood emergency admissions over the past decade, a rate which is doubled in infants under one year old. (1) One potentially modifiable pattern is short term admissions for minor conditions which may be managed away from hospital. (2) However community services are also under pressure. Even though women would like more contact with postnatal community practitioners, Health Visitor (HV) numbers have dropped by 20% (3). This, combined with earlier postnatal discharge, contributes to increased community case load (4), with consequent rises in ED attendances (5) for conditions traditionally managed by other health care professionals. (6)

ED attendances by neonates (≤28 days old) are rising disproportionately quicker than older infants. (5) However most studies to date are limited by small numbers, and their applicability to our setting is unknown. (7) In Europe (8–10) and North America (5,11), up to one-third of neonates attending EDs have no medical issue, and a high proportion have low acuity problems requiring no medical investigation or treatment. Studies have also shown that some parents can show a preference to bring their children to either general (12) or paediatric (13) EDs, even with non-urgent problems. Reasons described have included parental anxiety, perceived advantages of EDs (resources and expertise), and convenience.

Clinical assessment of neonates is challenging. They are a vulnerable and high-risk cohort, who exhibit non-specific symptoms even with serious illnesses.(14) Risk tolerance amongst non-hospital healthcare providers is therefore understandably low, given the risk of rapid deterioration and an inability to send and act on investigations. Although EDs have access to resources to exclude serious conditions, they are suboptimal environments for assessing well neonates due to increased

exposure to infections, and variable training for ED staff in normal newborn problems, leading to potential over-investigation and treatment.

OBJECTIVE

Our aim was to describe neonatal attendances to the ED in terms of demographics, reasons for attendance, referral source, investigations and treatments, and final disposition. If after reviewing our data, it mirrored findings in other reviews that low proportions of neonates required medical intervention, it would support the need to consider alternative clinical pathways for these patients.

METHODS

This retrospective chart review study evaluated attendances to a tertiary urban children's ED of all neonates (≤28 days of age) between 1st January and 31st December 2016 and is reported in accordance with the RECORD statement. There were no exclusion criteria. This ED provides local secondary level emergency care and is the regional tertiary centre for medical and surgical specialties, and paediatric major trauma. The hospital operates a "single front door" system, with the ED receiving all emergency attendances including referrals to inpatient specialty teams.

Participants were identified using electronic patient tracking systems. Data abstracted included sex, age, time/day of attendance, triage category, disposition, presenting complaint, diagnosis, investigations, and treatment. Triage category was based on the Manchester Triage System with range 1-5; 1 = immediate, to be seen in 0 minutes to 5 = non-urgent, to be seen within 240 minutes.. Admission was defined as a stay of any duration in any inpatient area including the short stay unit (SSU). The SSU is staffed by CED doctors and nurses and provides a place for observation or treatment of children for up to 24 hours. If a longer period of admission is anticipated, children are admitted to a traditional ward bed. Presenting complaints and diagnoses were categorised by one investigator (SB), with clarification sought from a second investigator (DM) where the category was unclear. Presenting complaints were verbatim information given by parents on ED arrival. We defined the diagnostic category "no significant medical problem" as "well babies with no identified pathology after assessment, with or without investigations or a period of observation/admission". "Suspected sepsis" was ascribed as a diagnosis when a clinician described this in their impression and instigated invasive tests to rule sepsis in/out and started intravenous antibiotic treatment.

We used a convenience sample of attendances over a one-year period to account for any seasonal variation. Data were classed as missing if they were unavailable on medical chart review. Data were analysed using STATA V. 12.0 (15) and results are presented using descriptive statistics, utilising

proportions for discrete variables, and means with standard deviations where appropriate. No tests for association of statistical significance were deemed appropriate given the study design. Attendance and admission data from 2008-2016 were reviewed to determine whether overall attendance rates in our institution were increasing in line with previous studies. Activity data up to 2020 was subsequently reviewed, to examine the potential impact of any mitigating actions, and of the COVID-19 pandemic.

This study was approved as a service evaluation using routinely collected, existing, anonymised data by University Hospitals Bristol NHS Foundation Trust following assessment against the Health Research Authority Framework. (16) Raw data is available on request from study authors.

RESULTS

Overall, attendances to the CED rose by 41% from 29,164 in 2008 to 41,067 in 2016, with a disproportionate rise in neonatal attendances from 655 to 1205 (84% increase). Neonatal admissions increased from 262 to 489 over this period, though the proportion of patients admitted remained constant (40% in 2008; 41% in 2016) (Figure 1). Including data up to 2019, total CED attendances rose to 46875 (13% increase), with a smaller increase in neonatal attendances to 1318 (9% increase), and a drop in admissions to 457 (35%). Through 2020, representing the COVID-19 era, CED attendances dropped to 31924 (32% decrease), with an 11% drop in neonatal attendances to 1173, 30% of which were admitted (Figure 1).

The 1205 attendances in 2016, by 1104 neonates, accounted for 3% of all CED attendances, and represented approximately 8% of babies born in the catchment area (Figure 1). Data were missing for referral source in two cases, presenting complaint in one case and disposition in 6 cases; data were otherwise complete. Mean age was 14 days (SD +/- 8 days), and 679 (56%) were male; nearly half were brought directly by parents and one-third were referred by community colleagues (Table 1). Nearly two-thirds of attendances were discharged home from the CED (754, 63%). (Table 2)

“Breathing difficulty” was the most common presenting complaint (218/1205; 18%); vomiting and poor feeding were the next most common (8% each). The most common diagnosis was “no significant medical problem” (504/1205; 42%). This diagnosis was made with investigations in 257/504 (51%) and without investigations in 247/504 (49%). Common acute pathologies included bronchiolitis (126/1205; 11%), and suspected sepsis (121/1205; 10%). Common diagnoses for each referral source are shown in Table 2.

For neonates discharged directly from the CED, over half (411, 54.5%) had “no significant medical problem” (Table 3). For those admitted to inpatient wards, suspected sepsis was the most common diagnosis. Of the 106 (88%) septic screens available for review, five neonates had invasive bacterial

infection (IBI; four positive blood cultures, three positive cerebrospinal fluid (CSF) culture). Nineteen patients had a positive urine culture (17 E. Coli), and Enterovirus was detected in the CSF of 21 (20%) patients.

Half (601/1205) had no laboratory investigations performed. The most common investigations were blood tests (305; 25%), blood gases (261; 22%), urine samples (218; 18%) and lumbar punctures (LP) (97; 8%). Investigations were less frequently performed in those discharged directly from the CED (37%) than those admitted to the SSU (68%) and inpatient wards (74%) (Table 3). Proportions requiring investigations categorised by referral source are shown in Table 2.

Most families (936, 78%) required advice or reassurance only, and no pharmacological treatment. Patients discharged directly or admitted to SSU had treatment commenced in 10% of cases; of those admitted to inpatient wards, treatment was commenced in 59% (Table 3).

Greater proportions of attendees with no significant medical problem were <14 days, and had a triage category of 3 or 4, compared to those with another diagnosis. (Table 4) Proportions with no investigations were similar, but those with another diagnosis were more likely to have had multiple investigations (14.9 vs 27.3%).

Ninety-five (9%) patients had at least one re-attendance before the age of 28 days, of which 34 (36%) had unrelated presenting complaints; the most common diagnosis when re-attending for the same problem was bronchiolitis (n=12). Thirteen were planned re-attendances for repeat investigations or medical review. Sixteen of those with an initial diagnosis of “no significant medical problem” returned with a similar presenting problem and were discharged with no change in diagnosis; five had a change in diagnosis (two with bronchiolitis, one with constipation, one with gastroenteritis, and one with gastro-oesophageal reflux disease).

DISCUSSION

In this chart review study, many neonates attending the CED were well babies, with the most common diagnosis being “no significant medical problem”. Half were brought directly to the ED by parents, two-thirds were discharged directly home, half had no investigations, and most did not need pharmacologic treatment. Common pathologies requiring admission included bronchiolitis and suspected sepsis, but rates of proven IBI were low.

In keeping with other sources, (5) the rise in neonatal presentations over an eight year period was disproportionate to the rise in all-cause attendances, though the proportion requiring admission remained constant. Half were self-referrals (of which only one-fifth required inpatient admission), and over half had no investigations. This combination, along with a static birth rate, gives rise to the possibility that parental fears and expectations may be key drivers, as reflected in one recent study wherein parents felt a same day clinical review was warranted even if their baby’s condition was not thought to be serious (17). A short period of observation provides reassurance, but for several reasons may be sub-optimal, including pathogen exposure and medicalisation of normal neonatal behaviours. Support and education for new parents highlighting these potential issues, while taking into account factors such as media-induced fear and access to primary care, are likely to be crucial interventions if this trend is to be reversed (18). Capitalising on technological advances may be of benefit, with one internet-based home monitoring system resulting in reduced neonatal ED attendances, (19) but such community based interventions may not always have the expected impact if attitudes towards ED use are not considered (20).

Any policy aimed at appropriate use of non-hospital healthcare resource should focus on some key patient cohorts, and ensure the model of care is feasible and acceptable. A larger proportion of neonates in this study were “well babies” when compared to European cohorts (9,21) though this may reflect literature-based or clinician differences in defining pathology. In this study, those with

no significant medical problem were more likely to be <14 days old, had a lower triage category, and were less likely to have multiple investigations than those with pathology. An additional cohort were diagnosed with non-emergency problems such as reflux and constipation, and common acute diagnoses included bronchiolitis and URTIs, conditions which may be manageable in community settings. However over two thirds of patients referred from other healthcare professionals were discharged home from the ED, many without investigations. These patients, particularly those diagnosed as "well babies" without investigations are likely the most amenable to be managed in a community setting; however additional training and resources are likely required. This could range from education to availability of advice and guidance, and is likely a situation for which there is not a "one size fits all" solution.

Almost half of neonates referred from GPs and two-thirds of those referred by midwives had at least one investigation before being ascribed as having "no significant medical problem". However it was beyond the scope of this study to determine the reasons for investigations in such cases. This may reflect the diagnostic approach taken by clinicians, especially when correlated with studies showing an increased likelihood of tests being performed by ED clinicians over primary care clinicians (22). However the reasons for this are likely to be more nuanced, reflecting flow processes in a system with time-based targets. For example, all parents of neonates presenting to our department are requested to collect a urine sample from their baby at the point of triage. This reduces inconvenience to the family by reducing their time in the department; as urine testing is commonly required in this age group it is more time-efficient to request the sample "in case" it is needed, rather than waiting to see a clinician before the process is commenced. These processes should be continually re-evaluated, in collaboration with families. Where felt to be of importance, they should be maintained, and also incorporated into community care pathways. However, if felt to be of little benefit, these should be modified to reduce unnecessary healthcare interventions.

For patients not requiring investigations, models of care which provide appropriate community-based resource and expertise can not only reduce hospital attendances, but also strengthen primary/secondary care relationships and increase knowledge. The Child Health Hub Model (23) is an example of a model which may bring benefits in the short and long term, by making expertise available at the point of care in the community, and by disseminating expertise to other healthcare professionals. Equally, collaborative work with families, identifying essential characteristics that would make community services the preferred option for neonatal issues, is essential to inform any such interventions.

Admission rates in this study were higher than in North America (5) but similar or lower than Europe. (7,8) Such differences may be multifactorial and reflect system/reporting differences, practice variation, or patient characteristics, but it is not possible to robustly interrogate these factors given the level of detail available in other reports. For example, direct admissions to specialty teams are included in Bristol CED workload, the 4 hour target for completion of care in the UK influences admission rates, and definitions of admission vary (in this study, SSU admissions were included which accounted for one-third of all admissions).

For neonates admitted to inpatient wards, suspected sepsis was the most common presumptive diagnosis, though the prevalence of IBI (positive blood or CSF culture) was only 4.7% in those screened for sepsis. Previous reviews of neonatal ED attendances have not given details of culture results, but rates of infection were similar to other literature (14) though this also varies depending on the cohort studied (<28days vs. <90days) and whether UTIs are included (IBI vs, non-IBI).

NICE guidelines (24) have a low threshold for investigation of febrile neonates, suggesting those presenting with a fever (≥38°C) have a full septic screen, including CSF culture. Research is ongoing, focusing on the development of prediction tools to identify infants at low risk of IBI (25), both with and without results of investigations as predictor variables (26). Tools which include inflammatory

markers (particularly Point of Care Tests; POCT) may reduce neonatal attendances and admissions, as these could be rapidly completed and interpreted both in primary and secondary care. This same principle could be applied to a number of conditions for which management pathways follow test result thresholds (e.g. jaundice, weight loss), but there is to date little published research such applications of POCT in neonates.

Since completing this study, a number of targeted actions have been implemented internally to the department, and externally through stakeholder engagement. Further regular education has been provided to all ED staff on normal neonatal presentations, and pathways of care have been refined. Engagement with local neonatal units, primary care, and community care organisations has increased to further refine and support these care models. This has resulted in delivery of measures including an advice and guidance phone line, wider correct use of bilirubinometers, and access to neonatal units for feeding difficulties and similar presentations. Re-direction to neonatal services ensures new parents access appropriate midwife support which can be difficult to facilitate in ED settings. Activity data to 2019 show some potential impact, with a slower rise in neonatal attendances compared to CED attendances, and a fall in neonatal admissions.

As in other UK EDs during the COVID-19 pandemic, (27) attendances dropped significantly in 2020. Neonatal attendances, although fewer than in 2019, did not decrease drop to the same extent; however the proportion admitted showed a continued decrease. It is likely that during the pandemic, throughout which community services were reduced, the CED continued to be viewed as a suitable location to provide assessment and reassurance on neonatal issues which continued to concern parents and healthcare professionals, many of whom could only offer remote assessment.

To our knowledge, this is the largest European review of neonatal presentations to a CED but there are still some limitations. The main limitation is the single-centre retrospective observational design. Retrospective chart review relies on good coding and documentation which may not always be

present. However, we selected variables more likely to be completed more fully and accurately, as they are contemporaneously captured on electronic systems. A single clinician reviewed the majority of medical notes and this type of review is recognised to have potential for misclassification bias. All categorisations and definitions were therefore agreed a priori by consensus of the study team, with a route to second reviewer clearly identified. As a tertiary centre, the findings from this study may not be generalisable to other settings, but the function of the ED in providing secondary level care to a wide mixed urban and semi-rural catchment area mitigates this. In addition, provision of community neonatal services may be different in our regions compared to other regions, though currently policy reports and literature reflect similar challenges and changes on a national level.

CONCLUSION

Whilst neonatal attendances to this CED were increasing disproportionately to other cohorts, large proportions were clinically well and discharged home without investigation. Policy makers should consider implementing collaborative models of infant healthcare outside hospitals, which may reduce ED neonatal attendances if feasible to deliver, and acceptable to families. Further focus should be on the development of safe, evidence based prediction tools which support clinician decision making in primary and secondary level care.

COMPLETE LIST OF ABBREVIATIONS USED

AXR: Abdominal X-ray

BRHC: Bristol Royal Hospital for Children

CED: Children's Emergency Department

CSF: Cerebrospinal Fluid

CXR: Chest X-ray

ECG: Electrocardiogram

ED: Emergency Department

GORD: Gastro-oesophageal Reflux Disease

GP: General Practitioner

IBI: Invasive Bacterial Infection

NG Tube: Nasogastric Tube

NICE: National Institute for Health and Care Excellence

NPA: Nasopharyngeal Aspirate

PICU: Paediatric Intensive Care Unit

POCT: Point of Care Tests

SD: Standard Deviation

SSU: Short Stay Unit

SVT: Supraventricular Tachycardia

URTI: Upper Respiratory Tract Infection

UTI: Urinary Tract Infection

Conflicts of Interest and Sources of funding: none

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Table 1: Demographics, and ten most common presenting complaints and diagnoses

	Frequency (%) of attendances
Male	679 (56.4)
Female	526 (43.6)
Age (Mean 14 days; SD +/- 8 days)	
0-7 days	326 (27.0)
8-14 days	347 (28.8)
15-21 days	280 (23.2)
22-28 days	252 (20.9)
Secondary care level ED attendance	1049 (87.1)
Referred for tertiary opinion/investigation	156 (12.9)
Day of Attendance	
Weekday	882 (73.2)
Weekend	323 (26.8)
Time of attendance	
07:00-11:59	146 (12.1)
12:00-17:59	440 (36.5)
18:00-22:59	347 (28.8)
23:00-06:59	272 (22.6)
Referral Method	
Self	584 (48.5)
General Practitioner	255 (21.2)
Midwife	155 (12.9)
Health Visitor	18 (1.5)

Transfer	158 (13.1)
Asked to attend by speciality team	33 (2.7)
Presenting Complaint	
Breathing Difficulty	218 (18.1)
Vomiting	100 (8.3)
Poor Feeding	99 (8.2)
Contrast Study*	89 (7.4)
Fever	71 (5.9)
Specialty Admission	62 (5.2)
Unsettled	61 (5.1)
Unwell	53 (4.4)
Rash/Skin Problem	52 (4.3)
Jaundice	44 (3.7)
Diagnosis	
No significant medical problem	504 (41.8)
Without investigations	*247 (20.4)*
With investigations	*257 (21.3)*
Bronchiolitis	126 (10.5)
Sepsis (Suspected or confirmed)	121 (10.0)
GORD	74 (6.2)
Surgical Problem	67 (5.6)
Upper Respiratory Tract Infection	48 (4.0)
Local/Cutaneous Infection	26 (2.2)
Head Injury (minor)	24 (2.0)
Constipation	23 (1.8)

Birth Injury	20 (1.7)

SD: Standard deviation; GORD: Gastro-oesophageal Reflux Disease
**Patients from other institutions requiring a contrast study are transferred to the CED, for a joint care pathway in liaison with the paediatric surgical team, following which admission/repatriation decision is made*

Table 2: Diagnoses, disposition of patients, and proportions requiring no investigations by community referral source

	Whole Cohort (N = 1205) n (%)	GP (N=255) n (%)	Health Visitor (N=18) n (%)	Midwife (N=155) n (%)	Self (N = 584) n (%)
Common Diagnoses					
No significant medical problem	504 (41.8)	82 (32.2)	10 (55.6)	84 (54.1)	255 (43.7)
With Investigations	*257 (21.3)*	*34 (13.3)*	*4 (22.2)*	*56 (36.1)*	*96 (16.4)*
Without Investigations	*247 (20.5)*	*48 (18.8)*	*6 (33.3)*	*28 (18.0)*	*159 (27.2)*
Bronchiolitis	126 (10.5)	35 (13.7)	1 (5.6)	4 (2.6)	84 (14.4)
Suspected Sepsis	121 (10.0)	27 (10.6)	0 (0.0)	16 (10.3)	62 (10.6)
GORD	74 (6.1)	29 (11.4)	4 (22.2)	6 (3.4)	22 (3.8)
URTI	51 (4.2)	15 (5.9)	1 (5.6)	3 (1.9)	32 (5.5)
Disposition					
Discharged	754 (63.0)	162 (63.5)	15 (83.3)	106 (68.3)	366 (62.6)
SSU	155 (12.9)	28 (10.9)	2 (11.1)	15 (9.7)	101 (17.3)
Ward	280 (23.4)	63 (24.7)	1 (5.6)	34 (21.9)	110 (18.8)
PICU	10 (0.8)	2 (0.8)	0 (0.0)	0 (0.0)	7 (1.2)
Proportion requiring no investigation	601 (49.9)	132 (51.7)	14 (77.8)	59 (38.1)	330 (56.5)

GP: General Practitioner; GORD: Gastro-oesophageal Reflux Disease; URTI: Upper Respiratory Tract Infection; SSU: Short Stay Unit; PICU: Paediatric Intensive Care Unit

Table 3: Common diagnoses, and proportions requiring investigation and treatments categorised by disposition

	Discharged (n=754) N (%)		**Short Stay Unit (n=155) N (%)**		**Inpatient Ward (n=280) N (%)**		**PICU (n=10) N (%)**	
Top 5 Diagnoses	No significant medical problem	411 (54)	No significant medical problem	76 (51)	Suspected sepsis	105 (38)	Suspected sepsis	5 (50)
	Bronchiolitis	58 (8)	Bronchiolitis	27 (18)	Surgical problem	51 (18)	Bronchiolitis	2 (20)
	GORD	53 (7)	URTI	14 (9)	Bronchiolitis	35 (13)	Metabolic	1 (10)
	URTI	31 (4)	Reflux	13 (9)	No significant medical problem	17 (6)	Seizures	1 (10)
	Constipation	20 (3)	Gastroenteritis	5 (3)	Congenital Heart Disease	9 (3)	SVT	1 (10)
Investigations performed*	283 (37)		104 (67)		207 (74)		10 (100)	
Treatment given*	79 (10)		15 (10)		165 (59)		10 (100)	

**Refers to number of patients, not number of individual investigations or treatments; PICU: Paediatric Intensive care unit; URTI: Upper Respiratory Tract Infection; SVT: Supraventricular Tachycardia; GORD: Gastro-oesophageal Reflux Disease*

Table 4: Comparison of patients diagnosed as "no significant medical problem" against those with other diagnoses

	No Significant Medical Problem (n=504) Frequency (%) of attendances	Other Diagnoses (N=699) Frequency (%) of attendances
Age		
0-7 days	184 (36.5)	140 (20.0)
8-14 days	156 (31.0)	191 (27.3)
15-21 days	86 (17.1)	194 (27.8)
22-28 days	78 (15.5)	174 (24.9)
Day of Attendance		
Weekday	353 (70.0)	528 (75.5)
Weekend	151 (30.0)	171 (24.5)
Time of attendance		
07:00-11:59	57 (11.3)	89 (12.7)
12:00-17:59	180 (35.7)	259 (37.1)
18:00-22:59	138 (27.4)	208 (29.8)
23:00-06:59	129 (25.6)	143 (20.5)
Triage Category†		
1	0 (0.0)	6 (0.9)
2	124 (24.6)	269 (38.5)
3	167 (33.1)	176 (25.2)
4	136 (27.0)	110 (15.7)
Not done	77 (15.3)	138 (19.7)

Investigations performed		
No investigations	247 (49.0)	360 (51.5)
Single investigation	182 (36.1)	148 (21.1)
Multiple investigations	75 (14.9)	191 (27.3)
Investigation types		
Bloods*	111 (22.0)	194 (27.8)
Blood Gas	80 (15.9)	181 (25.9)
Urinalysis	66 (13.1)	152 (21.7)
GI Contrast	65 (12.9)	32 (4.8)
ECG	17 (3.4)	20 (2.9)
CXR	12 (2.4)	42 (6.0)
AXR	4 (0.8)	6 (0.9)
Ultrasound scan	3 (0.6)	15 (2.2)
Skin Swab	3 (0.6)	8 (1.1)
Echocardiogram	3 (0.6)	4 (0.6)
NPA	2 (0.4)	32 (4.6)
CT Scan	2 (0.4)	5 (0.7)
Eye Swab	1 (0.2)	13 (1.9)
Stool Culture	1 (0.2)	8 (1.1)
Limb x-ray	1 (0.2)	3 (0.4)
Lumbar Puncture	0 (0.0)	96 (13.7)

CXR: Chest x-ray; ECG: Electrocardiogram; NPA: Nasopharyngeal Aspirate; AXR: Abdominal x-ray; NG Tube: Nasogastric tube

**Refers to laboratory blood testing, including biochemical and haematological tests; †Triage system in use at time: Manchester Triage System*

Figure 1: Neonatal attendances, neonatal admission rates and overall ED attendances from 2008-2020 with Catchment Area Births from 2008-2016