



BMJ Open Regional variations in short stay urgent paediatric hospital admissions: a sequential mixed-methods approach exploring differences through data linkage and qualitative interviews

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ABSTRACT

Objectives The aim of this sequential mixed-methods study was to describe and understand how paediatric short stay admission (SSA) rates vary across Health Board regions of Scotland.

Design Exploratory sequential mixed-methods study. Routinely acquired data for the annual (per capita) SSA to hospital were compared across the 11 regions. Five diverse regions with different SSA per capita formed cases for qualitative interviews with health professionals and parents to explore how care pathways, service features and geography may influence decisions to admit.

Setting Scotland.

Participants All children admitted to hospital 2015–2017. Healthcare staff (n=48) and parents (n=15) were interviewed.

Results Of 171 039 urgent hospital admissions, 92 229 were SSAs, with a fivefold variation between 14 and 69/1000 children/year across regions. SSAs were higher for children in the most deprived compared with the least deprived communities. When expressed as a ratio of highest to lowest SSA/1000 children/year for diagnosed conditions between regions, the ratio was highest (10.1) for upper respiratory tract infection and lowest (2.8) for convulsions. Readmissions varied between 0.80 and 2.52/1000/year, with regions reporting higher SSA rates more likely to report higher readmission rates ($r=0.70$, $p=0.016$, $n=11$). Proximity and ease of access to services, local differences in service structure and configuration, national policy directives and disparities in how an SSA is defined were recognised by interviewees as explaining the observed regional variations in SSAs. Socioeconomic deprivation was seldom spontaneously raised by professionals when reflecting on reasons to refer or admit a child. Instead, greater emphasis was placed on the wider social circumstances and parents' capacity to cope with and manage their child's illness at home.

Conclusion SSA rates for children vary quantitatively by region, condition and area deprivation and our interviews identify reasons for this. These findings can usefully inform future care pathway interventions.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ One strength of the study is the exploratory sequential mixed-methods approach taken.
- ⇒ A second strength is that quantitative and qualitative data were obtained from across a whole nation.
- ⇒ A limitation is that SARS-Cov-19 meant that our intended recruitment strategy for interviews had to be changed to remote recruitment.
- ⇒ A further limitation is that since there are only 11 health board regions, the comparison of characteristics across regions was underpowered.

INTRODUCTION

There has been a recent rise in paediatric urgent admission rates in the UK,^{1,2} which is mostly explained by rising short stay admissions (SSAs).^{1,3} Reasons for the rise are complex and include changes in parents' health seeking behaviours, reduced capacity or time to see children in community or emergency department (ED) clinical areas and shorter length of stay in hospital with an associated rise in readmissions.^{4–7} There is a well-described need to develop solutions which safely reduce the number of urgent paediatric admissions,^{8,9} and perhaps 25%¹⁰ or 50%¹¹ of urgent paediatric admissions could be managed outside of hospital. However, there is a paucity of evidence of what interventions might be effective.¹²

Admissions vary fivefold across English local authorities for acute bronchiolitis,¹³ which is a common reason for an SSA. Developing an 'atlas of variation' of SSA comparing regions could give insights into the context and causal mechanisms and inform the design of interventions to improve care pathways.

The FLAMINGO study (Flow of Admissions in children and young people) used

a mixed-methods approach with public and patient involvement (PPI) throughout to improve understanding of SSAs in Scotland and our methods are described in full elsewhere.^{14 15} Qualitative interviews with parents and health professionals were used to explore contextual factors relating to SSAs that could not be gained from the quantitative data, including the experiences of parents and health professionals, the referral pathways that led to an SSA, and preferences for future interventions. The aims of this paper were to use the FLAMINGO dataset to (1) identify how SSAs varied across regions of Scotland and then (2) report relevant perspectives from interviews with parents and NHS staff from regions selected as cases representing both higher and lower rates of SSAs with the purpose of informing future care pathway interventions.

METHODS

Study design

An exploratory sequential mixed-methods approach was undertaken consisting of a quantitative data linkage component, followed by qualitative exploratory interviews; this allowed integration of the quantitative and qualitative components. The quantitative data analysis was completed prior to qualitative data collection. A priori propositions (or hypotheses) to be explored by mixed methods¹⁶ agreed by the team were:

1. SSA would vary across Scotland according to the care pathway, structure and processes of acute urgent care (before, during and after an SSA).
2. SSA would vary according to deprivation/inequalities/underserved populations.
3. Readmissions after an SSA would vary across Scotland according to the care pathway, structure and processes of acute urgent care (before, during and after an SSA).

In order to integrate quantitative and qualitative data, and per the Mixed Methods Appraisal Tool (mixed-methods studies),¹⁷ findings including similarities and discrepancies were presented immediately after each theme in the results section.

Our study included patient and public involvement throughout.

Setting and participants

The National Health Service (NHS) for Scotland has 14 geographically distinct Health Boards (regions), each of which is responsible for healthcare provision to their region's population. Three Island Health Boards have no inpatient facility and are not included in this study. Characteristics of the 11 regions included are presented in [table 1](#). Quantitative analysis used anonymised details of paediatric admissions to hospitals in mainland Scotland throughout 2015–2017 and were provided by the Information Services Division of the Scottish Government, as described previously.¹⁴ The number of all urgent admissions and SSAs (standardised per capita)¹⁸ was identified for each region. Attendance at the ED where the child was not admitted to medical paediatric services was not

considered an admission. A child admitted under paediatric services to a short stay paediatric assessment unit was considered as having been admitted. For quantitative purposes, an SSA was defined as one where a child was admitted and discharged on the same date. Non-urgent admissions to medical specialties and admissions to surgical specialties were excluded from the analysis. SSA and composite diagnoses (ie, groups of conditions that are similar but coded differently) documented as the reason for admission were determined (see online supplemental table 1, also described previously).¹⁴ The number of admissions was calculated by adding all admissions between 2015 and 2017, dividing by the average population of <16 years 2015–2017 and then dividing by three to yield admissions/1000/year. Atlases of variation were created using R studio (R Core Team, R Foundation for Statistical Computing, Vienna, Austria) to compare admissions/1000/year in each board region for all urgent admissions and all SSA visually on maps of Scotland.

Following a review of the data linkage results by the FLAMINGO team, 5 of the 11 Health Board regions were purposively identified to act as 'cases' that varied in characteristics including: (1) high or low SSA rates (relative to the median), (2) very high or very low population density and (3) presence of either a paediatric-specific ED or ED for children and adults. This identification facilitated a more in-depth study through qualitative interviews to enhance understanding of both the a priori propositions and the quantitative data. Parents of children with a recent SSA and health professionals working in primary or secondary care within all eleven regions, but with a focus on the five case regions, were recruited to take part in interviews designed to explore their experiences and contexts relating to the care pathways between home and hospital leading to SSAs. PPI, through engagement with parents attending community groups and parent-toddler groups (n=10), was undertaken to invite parents to share their experiences and inform the project's interview topic guide and recruitment materials. PPI discussions revealed that many families were unsure at what time point in their hospital visit their child was officially classified as 'admitted'. Therefore, the definition of SSA used for interviews was an admission where a child is/was admitted and discharged within 24 hours. [Box 1](#) describes definitions used. Participants were purposively sampled to ensure a range of job roles across primary and secondary care and a range of family experiences. As the recruitment period for FLAMINGO took place during COVID-19 pandemic restrictions, alternative convenience sampling methods were also required, including online platforms and social media, press releases and newspaper advertisements. Separate semistructured topic guides for parents and health professionals (see online supplemental file 1) were developed with PPI contributions. During interview discussions, participants were asked to focus on

Table 1 Characteristics of the populations in each National Health Service Scotland mainland Health Board

NHS Health Board	No of resident <16 year olds (average 2015–2017)	Area covered by NHS Health Board, square miles (children/square mile)	Median deprivation quintile* (IQR, 1=most deprived)†	No of whole time equivalent GPs per 10 000 patients‡§	Median age of children* (quartile 1, quartile 3)	Health Board details. The average no of staffed beds for 2016/2017 is provided (the no in brackets corresponds to beds/10 000 children)¶	Mean weighted distance (km) from each data zone to hospital** ††
Ayrshire and Arran	62 038	1310 (47)	2 (1–4)	6.3	2.4 (0.8, 6.3)	One medical paediatric inpatient facility. 34 beds (5.5).	15
Borders	18 999	1831 (10)	3 (2–4)	8.3	3.1 (1.0, 8.1)	One medical paediatric inpatient facility. 16 beds (8.4).	20
Dumfries and Galloway	23 592	2400 (10)	3 (2–4)	6.4	2.3 (0.7, 6.7)	One medical paediatric inpatient facility. 31 beds (13.1).	32
Fife	64 262	512 (125)	2 (1–4)	5.9	2.5 (0.8, 7.0)	One medical paediatric inpatient facility. 52 beds (8.1).	15
Forth Valley	52 836	1020 (51)	3 (2–4)	5.7	3.0 (1.0, 7.8)	One medical paediatric inpatient facility. 44 beds (8.3).	11
Grampian	99 483	3360 (30)	3 (2–4)	6.0	2.0 (0.6, 5.7)	Two hospitals (65 miles apart) each with medical paediatric inpatient facility. 73 beds in total (7.3).	18
Greater Glasgow and Clyde	194 416	453 (429)	2 (1–4)	5.9	1.9 (0.6, 5.3)	Two paediatric inpatient facilities (11 miles apart). 154 beds (7.9). Also paediatric ED.**	9
Highland	53 059	12 507 (4)	3 (2–4)	9.0	2.2 (0.6, 6.0)	One medical paediatric inpatient facility. 45 beds (8.5).	148
Lanarkshire	118 165	883 (134)	2 (1–4)	4.9	2.4 (0.8, 6.5)	One medical paediatric inpatient facility. 68 beds (5.6).	12
Lothian	148 356	700 (211)	3 (2–4)	6.6	1.8 (0.5, 4.5)	Two hospitals (17 miles apart) each with a medical paediatric inpatient facility. 96 beds in total (6.5). The larger unit has a paediatric emergency department (ED).**	7
Tayside	67 872	2986 (23)	3 (2–4)	6.9	2.6 (0.9, 6.7)	One medical paediatric inpatient facility. 70 beds (10.3).	21

Details of the three Island boards are not included as they have no formal paediatric inpatient facility.

*With reference to children who were admitted.

†The Scottish Government. Scottish index of multiple deprivation. <https://data.gov.uk/dataset/a448dd2a-9197-4ea0-8357-c2c9b3c29591/scottish-index-of-multiple-deprivation-simd-2016#:-:text=TheScottishIndexofMultiple,Governmentsfiftheditionsince2004.Updated2021.> Accessed 05/26, 2021.

‡Public Health Scotland. General practice workforce survey 2019. <https://publichealthscotland.scot/media/9866/2021-10-26-gpworkforcesurvey2021-report.pdf>. Updated 2021. Accessed Dec 15, 2022.

§Children seen and sent home in the ED are not considered an admission.

¶Public Health Scotland. Beds, hospital care. <https://www.isdscotland.org/Health-Topics/Hospital-Care/Beds/>. Updated 2020. Accessed Dec 15, 2022.

**Nuffield Trust. Distance from home to emergency care. https://www.health.org.uk/sites/default/files/QualityWatch_FocusOnDistanceFromHomeToEmergencyCare.pdf. Updated 2014. Accessed Dec 15, 2022.

††Where there were two hospitals in a region the larger of the two hospitals was used.

GPs, general practitioners.

their experiences pre SARS-Cov-19 before discussing any changes experienced during or resulting from the pandemic. All interviews were carried out over the telephone between December 2019 and March 2021 by experienced qualitative researchers (EK and CM) with backgrounds in health services research (EK and CM) and clinical paediatric nursing (CM). Interviews were audio recorded, anonymised, transcribed verbatim and lasted between 18 and 55 min.

Data analysis

For quantitative data, mean number of admissions/1000/year were presented with stratification by region and Scottish Index of Multiple Deprivation (SIMD). For the 10 most common diagnoses, known to explain 52% of SSAs,¹⁴ the coefficient of variation for each diagnosis across regions was calculated by dividing the SD of number of admission/1000 by

the mean and expressed as a percentage. These data informed the qualitative methods.

For qualitative data, our conceptual approach to analysis was informed by critical realism, which is critical of the notion of ‘factual truth’ while maintaining that a reality exists in recognition of the fact that interviews are at the same time ‘factual’ and reconstructions of events.^{19 20} A thematic framework approach to analysis was adopted.^{21 22} Our approach to analysing the complete FLAMINGO interview dataset is reported in detail elsewhere.¹⁵ In this paper, we focus on additional analysis and interpretation of the data to address the specific aims of this paper, that is, to better understand variations in SSAs. The main relevant themes from the FLAMINGO project coding framework (service -structure of buildings and place; non-medical/clinical factors influencing decisions; readmission and aftercare) were analysed in depth

Box 1 Definitions used for this study

Urgent admission: An unplanned (or emergency) admission to a medical paediatric inpatient facility. This does not include cases seen in emergency department (ED) and discharged.

Readmission: Where two urgent admissions occur within 30 days for the same diagnosis.

Scottish Index of Multiple Deprivations (SIMD, see footnote table one): A small-area-based index where the population is evenly distributed across quintiles and where 1 is the most deprived. The 2016 version was used.

Short stay admission (SSA): For quantitative analysis, this was an urgent admission where a child is admitted and discharged on the same calendar day. For qualitative analysis, the definition of SSA used for interviews was an admission where a child is/was admitted and discharged within 24 hours; this was because many families were unsure at what time point in their hospital visit their child was officially classified as 'admitted'.

Health Board: Territorial Health Boards are geographical areas in Scotland where healthcare is administered for the population in this area by a single organisation. There are 11 mainland Health Boards in Scotland and 3 Island Health Boards where there are no inpatient facilities for children. Two of the 11 mainland Health Boards have 2 inpatient facilities for children (NHS Grampian and NHS Lothian). Two hospitals with inpatient facilities for children have EDs staffed by paediatricians (NHS Greater Glasgow and Clyde and NHS Lothian).

NHS24: A telephone decision service which can be the first point of contact for patients who are acutely unwell.

with further line by line coding conducted by three members of the FLAMINGO team (EK, CM and EF). Differences were discussed and debated at weekly project team meetings and final themes confirmed once consensus was reached. The qualitative interview reporting adhered to the Consolidated Criteria for Reporting Qualitative Studies guidelines.²³

RESULTS

Data linkage: SSA variation across Scotland

There were 171 039 urgent hospital admissions, including 92 229 SSAs. The number of SSAs varied across the 11 regions between 14 and 69/1000/year, and for all urgent admissions between 37 and 105/1000/year (figure 1, table 2). Across regions, SSAs and all urgent admissions were higher for children in the most deprived (SIMD1) compared with least deprived communities (SIMD5), online supplemental figure 1. The coefficient of variation for SSA between regions was 41%, and the ratio of highest to lowest SSA admissions was 4.9:1 (online supplemental table 2). When diagnostic condition for the SSA was considered, the coefficient of variation was lowest (31%) for convulsions and highest (64%) for upper respiratory tract infection (figure 2 and online supplemental table 2). The ratio of highest to lowest number of SSA/1000/year for condition between regions was lowest (2.8:1) for convulsions and highest (10.1) for upper respiratory tract infections (online supplemental table 2). The number of readmissions varied between 0.80 and 2.52/1000/year (table 2); there was a positive correlation between SSAs and readmissions ($r=0.70$, $p=0.016$, $n=11$), online supplemental figure 2. Median distance from home to the nearest hospital with paediatric services, available for a subset of 18 941 admissions, and was 6 (3, 16) miles for 10 502 SSA and 5 (3, 12) miles for 8 439 non-SSA admissions, Mann-Whitney U test $p<0.001$. Online supplemental figure 3 presents scatter plots comparing SSA/1000/year and the following characteristics of the 11 regions: number of children/square mile; number of general practitioners (GPs)/1000; mean distance from hospital and number of paediatric hospital beds/1000.

Perspectives of professionals and parents

Forty-eight health professionals and 15 parents were interviewed. Online supplemental table 3 summarises characteristics of the five case regions. Online

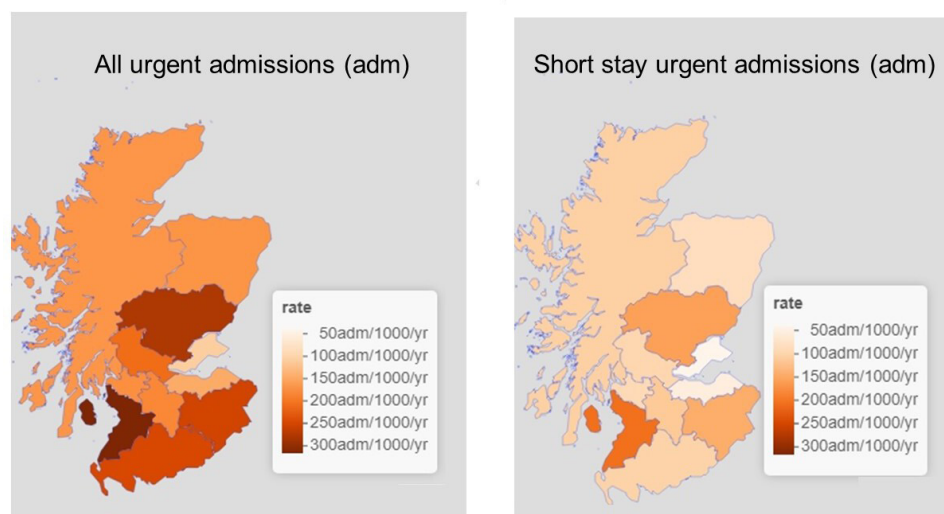


Figure 1 Map of Scottish Health Boards showing the number of all urgent (left panel) and short stay urgent admissions (right panel) of children less than 16 years old to hospital between 2015 and 2017 per 1000 under 16 years. adm/1000/year=number of admissions per 1000 children (<16 years) per annum.

Table 2 The number of all urgent and short stay urgent admissions stratified by Health Board

NHS Health Board	All urgent admissions 2015–2017 (n=171 039)		Short stay urgent admissions (SSA) 2015–2017 (n=92 229)			No of readmissions between (n/1000 children/year)
	Absolute no	No/1000/year (rank, 1=highest)	Absolute no	No/1000/year (rank, 1=highest)	% of all admissions which are SSA (rank, 1=highest)	
Ayrshire and Arran	19583	105.2 (1)	12797	68.8 (1)	65 (1)	1.99
Borders	4799	84.2 (3)	2739	48.1 (3)	57 (5)	1.31
Dumfries and Galloway	5827	82.3 (4)	2471	34.9 (6)	42 (9)	1.39
Fife	7171	37.2 (11)	2680	13.9 (11)	37 (11)	0.80
Forth Valley	11 063	69.8 (5)	5236	33.0 (7)	47 (8)	0.96
Grampian	17 016	57.0 (8)	8794	29.5 (9)	52 (7)	1.47
Greater Glasgow and Clyde	34 159	58.6 (7)	18 400	31.5 (8)	54 (6)	1.13
Highland	9000	56.5 (9)	5784	36.3 (5)	64 (2=)	2.52
Lanarkshire	21 682	61.2 (6)	13 768	38.8 (4)	64 (2=)	1.88
Lothian	21 777	49.0 (10)	8707	19.6 (10)	40 (10)	1.13
Tayside	18 681	91.8 (2)	10 749	52.8 (2)	58 (4)	1.57

supplemental table 4 describes the number of participants recruited in each Health Board. Characteristics of health professionals and parents are described in online supplemental tables 5 and 6.

Overview of themes

Broad themes identified from the interviews and relating to the a priori propositions were:

1. Access to services (primary and secondary care), which included two subthemes: (1) proximity to hospital and (2) navigating pathways through the NHS (including structure of local services and national policy which impacted on admissions).
2. Socioeconomic circumstances and deprivation.

3. Readmissions.

Access to services (primary and secondary care)

Proximity to hospital

Referring clinicians discussed how the distance to hospital can impact on their decision of whether or not to refer. In situations that would require a long journey to hospital, primary care clinicians used their professional judgement about safe management: deciding whether the long journey to hospital was necessary and considering the risk of deterioration in a child managed at home.

So when you're in [City] you wouldn't have a qualm about saying to someone 'can you nip up to the kids

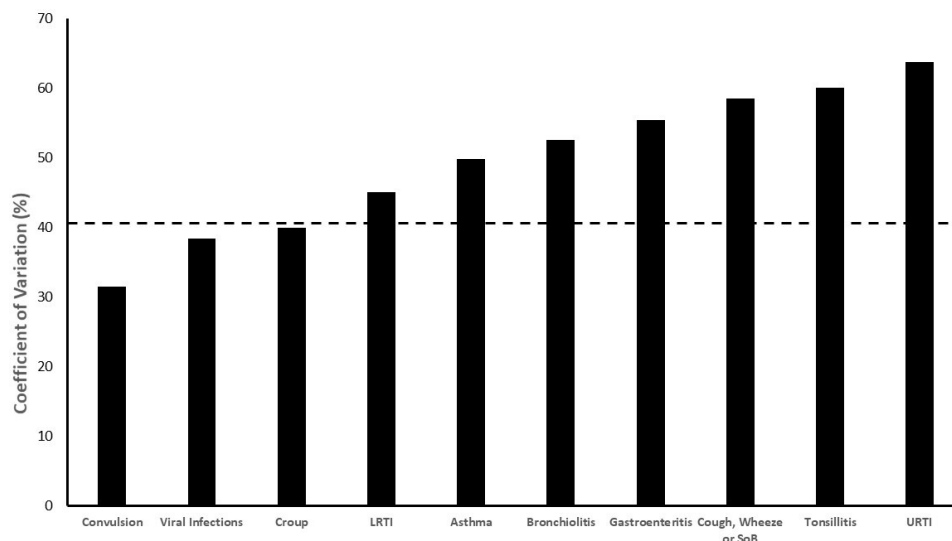


Figure 2 Bar chart showing the coefficient of variation (expressed as %) for short stay urgent admissions where the diagnosis was one of the ten most common diagnoses. The horizontal dashed line is the coefficient of variation for all short stay admissions (41%). LRTI, lower respiratory tract infection; SoB, shortness of breath; URTI, upper respiratory tract infection.

ED and they'll check you over and might do an x-ray and send you home' but you're not going to do that for someone who's, you're talking about a six or seven hour round trip, so you would be thinking I'm only going to really do that if it's absolutely necessary or can we manage that maybe a bit more conservatively at home, but yeah if you get it wrong then yeah you've taken all the risk and you're sort of opening yourself up to a complaint or a problem. (GP HB4)

Referring clinicians explained how those with less experience of acutely unwell children were less comfortable and confident in decision-making. Parents described their experiences of having to make the difficult decision between travelling a long distance to hospital or 'waiting it out' at home and balancing up which is the safer approach.

Most of the time that I've needed to use [NHS24] they've been fantastic, particularly here where the decision to go to ED can be quite a difficult one because it's not necessarily on your doorstep, and the weather conditions as well, like, if there's a blizzard or something, you're asking yourself do I really want to risk taking my child out in this to go to hospital or am I safer waiting it out at home? (Parent 4 HB4)

For paediatric staff, a shorter distance from home to hospital influenced decision-making with participants having a lower threshold to send a child home if they were confident that the family could return to hospital fairly quickly should the child deteriorate.

I guess one thing with our geography... whenever [junior doctors] ask me for advice about kids I'm always like 'where do they stay?' and they're like 'why does that matter?' but once you get to know our geography, so we cover the whole of [area] and that can be down as far as [town] for example which can be over an hour to get back to the hospital, so I'd be more likely to bring those kids in, particularly out of hours, if they've got croup or bronchiolitis or something, sometimes they'd get watched overnight, whereas if they were very close to the hospital you would send them home. (Consultant HB1)

Time of day influenced professionals' decision-making around whether to refer, admit or discharge a child both in situations where the family lived a considerable distance from hospital as well as situations where they lived relatively close to hospital.

In [Health Board region], especially because of the distance, sometimes we do keep them overnight because they go all the way back to say, [place name], so we don't feel safe to send them home, you know, at midnight. (Consultant HB4)

So sometimes we might just put them in a bed [admit child] if we've got beds for overnight and then send them home in the morning, that can play a lot into

the decision making, you know, say it's like three in the morning, I don't often feel like sending a baby home at that time, so sometimes we just keep them. (Non consultant doctor HB4)

There is some contrast in findings from quantitative analysis (patients with SSA lived marginally further from their local hospital compared with those with longer admissions) and qualitative analysis (strong theme for shorter admissions for those living closer to the hospital). This is likely explained by confounding quantitative findings by factors such as the threshold for admitting children living closer to the hospital being higher than for children living further away.

Navigating pathways through the NHS

Ease of access to services influenced how and where families first sought healthcare. Despite media campaigns by the NHS encouraging people to call NHS 24 for initial advice, health professionals reported parents often continue to take their children directly to the ED. The ED was perceived by health professionals as being the place where parents felt most confident going when they are worried about their acutely unwell child.

They don't phone NHS24, they just come up with their kids, but again I think the service in [City] has evolved in that way and it's not really fair to criticise parents for that. I think they just come up [to out of hours or ED] when they're worried and many parents that I meet in general practice are worried appropriately because they've tried lots of different measures, you know, they've given [anti-pyretic], they've done the usual sort of common-sense things and they're coming up because they just feel the child isn't picking up. (GP HB3)

Some referring clinicians experienced local hospital policy which required their child to be transferred to another hospital for ongoing care if not well enough for discharge home within 24 hours.

But they have a rule in the ward in Healthboard11 that they won't keep children longer than 24 hours, that's their rule. If the child needs to stay in hospital beyond 24 hours the child needs to go to Hospital and I think that's a good sort of... I don't know if it's written down. (GP HB9)

Parents reported mixed experiences with some describing relative ease in accessing primary care, and others struggling to get GP appointments or prompt guidance from NHS24 and resorting to attending the ED. With EDs being so busy and under constant pressure, families often experience extended waiting times and, arguably, would not be seen any quicker.

I phoned NHS24 who obviously were too busy and asked me to hold on for a nurse to call me back. In that hour his temperature raised to over 39 so I took him to the children's hospital in [City]. I was there at

half eleven. They were very, very busy at the time so I wasn't seen until half two. (Parent 1 HB3)

Local policy and structure impacting on admission data

Parents reported how due to their local hospital's paediatric unit being closed at certain times, such as evenings or weekends, they were admitted directly to another hospital.

It was a Friday morning and that's when [health professional] said they're 'not comfortable that he's well enough to go home yet, however it's a Friday, our ward will shut over the weekend, you need to stay in, we're not going to discharge you so you need to now go to [hospital] and I was like 'well, I don't have transport' and they were like 'that's okay, we don't have an ambulance for you but we do have a taxi' so they put me in a taxi to [hospital]. (Parent HB5).

Clinicians described how during the evening, some short stay assessment units (SSPAU) closed and children were admitted direct to a paediatric medical ward elsewhere in the hospital, but might have been discharged later in the evening had the SSPAU remained open.

When a child is admitted during the night, we don't have nursing staff for our Paediatric Assessment Unit so therefore the child goes straight to inpatients and is admitted as an inpatient overnight, cause generally the majority of them that come in overnight stay for the morning anyway. (Non consultant doctor, HB 4)

Secondary care professionals explained how children may also be admitted directly to a more distant hospital in order to receive specialist paediatric care.

Yeah, so I suppose being [City] we get a fair number of referrals over the course of various different shifts from the likes of [Towns], all these sorts of places and I guess, as you say, yeah these are the sorts of families that even if the child is reasonably well the initial referring centre either might be worried about the child clinically whenever they present or they might feel that they don't quite have the experience from a paediatric perspective to manage them and they then get referred down. (Non-consultant hospital doctor, HB3)

Hospital clinicians observed that the structural configuration of different hospitals was believed to impact on their levels of recorded admissions. Hospitals in some regions had dedicated SSAU which allowed children to be moved out of the ED for ongoing observation beyond the 4-hour ED target. A UK-wide government directive that requires a patient arriving in an ED to be either admitted, transferred or discharged within 4 hours. The SSAUs were located close or adjacent to the hospital's ED or in smaller regions the SSAU could consist of a few beds in the main paediatric ward.

The quantitative analysis (online supplemental figure 2) found no link between SSA and either population density or number of beds, but qualitative analysis suggested that

SSAs might be higher in hospitals which are continuously open and surrounded by larger populations. Quantitative data may be confounded, for example, by larger hospitals having paediatric EDs where children are seen and discharged without being 'admitted'.

National policy impacting on admission data

Individual regional targets and data recording approaches could also impact on the number of children admitted for SSA. Secondary care professionals explained how the national 4-hour ED target was a factor informing their practice.

[...] all of the patients that come through our emergency department are subject to the Scottish Government's unscheduled care four hour target, so obviously that target does drive our practice and behaviour to a certain extent. [...] we had set up an adjacent area and badged it as a clinical decision unit to essentially allow our department to continue to function with the volume of patients that we expected to allow patients to flow in and flow out of the back, whilst still obviously being able to meet that target. (Consultant, HB3)

Clinicians also commented that differences in definitions of an admission contributed to the quantitative variation in SSA data.

you're right it gets terribly confusing—how do you actually count referrals, admissions, turnarounds, whatever? The way our unit is set up, the assessment unit has [number] beds in it and it is physically, geographically next door to the ward and I think if, for whatever reason, the child is transferred through to the ward, then that becomes an admission. Otherwise, it is not counted as an admission. (Consultant, HB6)

The paediatric ward does have a short stay area so some of our 'admissions' will be zero day admissions because they'll go straight to the short stay ward and then subsequently be discharged. (Consultant HB1)

Socioeconomic circumstances and deprivation

Health professionals acknowledged the impact of inequalities on child health outcomes, recognising that area deprivation was an influencing factor that may account for regional variations in SSAs. However, a note of caution to avoid any widespread generalisations with respect to deprivation was raised by several participants.

In my experience I think most children are admitted on their clinical grounds not their social grounds. The pattern of use of out of hours might be slightly different and I don't know the data and obviously that would be interesting to look at deprivation—use of out of hours, A&E, paediatric A&E by deprivation, but my feeling is that having worked in out of hours where we see people across the whole spectrum of, because out of hours is for everybody, it's not just localised to [deprived district] or whatever, some of

the sickest children that I've seen are from very middle class households, babies in particular where the parents have been persisting with what they think is appropriate supportive treatment when it's been a really unwell baby and they just haven't picked that up. And that's been interesting to me...So I don't really think that class deprivation is really the biggest issue about the patterns of referral into short stay admissions. (GP HB3)

Instead, participants emphasised the importance of assessing a parent's ability to cope and manage their child's illness without prejudice. Secondary care professionals also emphasised that when giving safety netting advice, they require some assurance that the family will be able to return to hospital if their child's condition worsens. Another health professional emphasised the importance of assessing parents' ability to cope and manage with their child's illness without prejudice.

Often people are living a very difficult life or are socioeconomically deprived but it doesn't mean that they're not a good parent with good coping skills, so I think we can be a bit judgemental about that are well. But yeah, it's definitely part of an assessment that you make. (Consultant HB1)

A common finding across both primary and secondary care professionals was the requirement to assess health literacy and the extent to which parents understand the safety netting advice being given to them including signs and symptoms to be concerned about, worsening advice and the point at which they should seek further medical help either from their GP, NHS24 or the ED via an ambulance. One participant explained how in situations where they have judged that understanding to be lacking, this would lower their threshold to ensure the child is reviewed at hospital. Identifying parents who may be struggling to cope with safely managing the child's illness at home, regardless of socioeconomic status, was a factor prompting referral or admission. Identifying parents who may be struggling to cope to safely manage the child's illness at home, regardless of socioeconomic status, was a factor prompting admission:

Certainly I think there's some families who have less resilience, less resources to cope with problems at home. I think that's a very individual basis. It's hard to make broad sweeps about that. But there are a number of these families who are frequent attenders with their young children. (GP HB4)

Socioeconomic circumstances can impact on families' ability to access services for an acutely unwell child.

We're in quite a mixed area where we are so bits of it are quite deprived and lots of it are quite deprived and lots of families don't have a car, they don't have money that they could take, you know, they could get a taxi up. Sometimes they will be able to get a family member or a friend to run them up but there has

been occasions that we've had to get an ambulance to take them to hospital. If they're very acutely unwell then that's absolutely fine and if not they can be here for between two to four hours waiting on transport. (Primary care nurse, HB1)

In some situations, a child who is well enough to go home is admitted to hospital because the family do not have access to transport.

There are very occasional what I would regard inappropriate admissions where, for social reasons, you will admit the child to a bed. For example, if the child is referred up at three o'clock in the morning, comes by ambulance and the parents have no transport then you might admit them to a bed, and that I guess would be one definition of an inappropriate admission. (Consultant HB6).

The quantitative and qualitative analyses were consistent and suggested that higher areas of deprivation were associated with higher SSA (figure 2). The analysis additionally found that clinicians considered factors other than the financial resources of the child's family within a more holistic and nuanced approach to deprivation.

Readmissions

Readmissions were reported for parental anxiety, for children who had previously presented early in an infection (particularly bronchiolitis) and were now worsening. Clinicians did not see readmission as a bad thing and parents were generally encouraged to reattend if they were unsure how their child's condition was progressing. After a few presentations, referring clinicians sometimes felt it was prudent to admit.

ED has quite a high return rate and it's when a child comes back the second or third time that they then kinda maybe say 'well maybe we should just bring them in overnight'. But yeah, there certainly is here seemingly that people come back a lot more for reassurance and to check that things are right. (Doctor, HB5)

Similarly, some children presented to ED or direct to the ward after an SSA, but were not admitted. This was reported as parents needing reassurance or the clinicians in ED able to change medication without the need for longer observation.

So we got out say about lunchtime-ish. I was given an inhaler to take home. He was much more settled during the day but of course at night that's when he clearly, clearly struggled and yeah I just phoned, I think I got to about four o'clock in the morning and I phoned the ward and said 'no he's just not, he's struggling' and they said 'not a problem, straight back in' so I was straight back into the assessment bay, straight onto the nebuliser with him, that settled him and obviously helped and then we left and we just went to the short stay triage area, we weren't admitted to the

ward and we were discharged from the triage area at probably about half past six in the morning, and then he was home and he slept most of the morning. It clearly had an impact cause even sleeping propped up he had struggled so he just needed that little bit extra. (Parent, HB4)

Clinicians acknowledged that with shift work and open access they might not be aware of children being readmitted unless readmissions were specifically audited. Many perceived rates to be low and more likely in winter, with diagnoses of bronchiolitis and winter vomiting virus.

So I think it's [readmission] probably something that we see more frequently in winter particularly with kids that have bronchiolitis and I guess the other cohort that we might see it in is kids that have a vomiting illness. ... not that it's expected but given the progression of the disease we do expect to see some children as they progress through day kinda four to day six they might get a bit worse and we do expect to see some of them again. (Doctor, HB3)

Yeah, yeah, yeah we do and indeed that is one of our whatever you want to call it, one of our performance indicators, we look at readmissions, those that have been turned away and we specifically look at each of the cases. Again part of it is about confidence in assessing the child, sometimes it's a health professional that has re-referred the child, sometimes it's the parents that come back again having felt that their child is getting more unwell. For a significant proportion of them again turned away or turned round quickly and they do not need admission, and these ones it's harder to say whether the admission is purely for medical reasons or to try and support parents who have become a little bit more anxious. So it's a relatively small number and the number that actually end up sick is very small, so they're a complicated group of youngsters but we do look at them closely and there hasn't been a single factor that has been identified or any specific factors that can help you predict which of these children might come back or which ones are going to get sick or whatever. (Consultant, HB7).

A number of reasons were described that could explain the regional variation in readmission rates. For examples, the presence of a dedicated paediatric ED, where a child representing after an SSA may be more likely to be seen and sent home; availability of primary care staff who could support parents and children at home, and in some cases, proactively saw children after discharge from an SSA.

There was also variation in how 'open access' was managed postdischarge. Most hospitals offered children a 24 or 48 hours open access to phone or return directly without referral, however, this varied as to whether children returned to the ward, through ED or to the SSAs unit. As discussed previously this impacts on whether a child returning is counted as an 'admission' in the quantitative data.

No we do see readmissions. So if they're within probably a week if they've been up with the same issue and they represent they will come directly into [short stay assessment unit], if they're a medical patient, so they will come directly in and they will be reassessed again. If they represent certainly a couple of times we will

have a look at them to see whether actually they need to stay in to give the parents more support. (Nurse, HB3)

Interviewees also reported that the offer of open access actually lowered readmission rates, possibly by supporting parents and reducing parental anxiety about access to services.

So we've actually found, that [open access] came in quite a number of years ago, I'd say about over five/six years ago that came in, and we found actually that it dropped our readmission rate surprisingly, we actually thought it would increase it but it actually dropped it and I think it's just because it's reassuring for the parents to know that they've got somewhere to come to if need be, some things we can manage over the phone so it ends up stopping them re-attending. Yeah, so it has actually helped and it's quite reassuring for them (Doctor, HB4)

Parents also reported feeling reassured that they could phone for advice, or that readmission was an option if their child's condition worsened.

They basically came through and said that there was no point keeping her in the hospital any longer and to send her home but they had an open admission for her so they said 'if she has another seizure you don't need to phone 111, you don't need to do anything, just come straight here, even if it's the middle of the night, and we'll take her straight in' and they gave me the direct telephone number for the paediatric department as well, so it meant I didn't have to keep trying to go through on the general A&E number or anything like that, so that was reassuring knowing that if anything happened that I could take her straight in, and in the meantime they just arranged further tests for her to be done. (Parent, HB4)

The quantitative analysis identified how readmissions are positively correlated with SSA, and thus variable across the country. Our interviews identified how some health-care staff were more aware of readmissions than others. Healthcare staff identified parental anxiety while parents identified recurring symptoms as drivers for readmissions.

DISCUSSION

Our study used a sequential mixed-methods approach to improve understanding of SSA rates in Scotland. Our main finding was a fivefold variation between SSAs across regions confirming our a priori proposition, and this variation was higher for some conditions compared with others. Themes identified as explaining this variation included proximity to hospital, local service structure, national policy, socioeconomic factors and readmission process. For some factors, for example, proximity to hospital, the relationships with SSA seen in quantitative and qualitative analyses were apparently contrary. These results give insight into the complexity of understanding decision-making in urgent care pathways, and the benefits of taking a mixed methodology approach.

Bronchiolitis admissions are known to vary by fivefold¹³ and our study confirms and extends these findings by demonstrating other conditions have more or less than a fivefold difference. The reason for such variation across a nation might be explained by differences in health

seeking behaviour or disease severity and prevalence. However, our mixed-methods approach suggests that differences are a manifestation of regional differences in healthcare systems and processes, including configuration of local services and targets which are set nationally.

There is a low level of evidence for community-based or hospital-based interventions being effective in reducing urgent admissions,¹² and studying variation in healthcare resources may give insight into how to develop healthcare services.²⁴ The regions with relatively higher number of admissions for a given individual clinical presentation also tended to have higher admissions for other conditions, and this suggests that a whole system rather than condition-specific approach is needed to reduce SSA.

Low SSAs were not explained by some regions having a policy of keeping children in hospital for a longer period of time, as regions with relatively lower SSAs also had lower SSA rates relative to all urgent admissions. There is evidence that hospital support of community services, for example, professional to professional communication, can reduce admissions²⁵ and a hypothesis emerging from our exploratory analyses is that regions where community services are more able to manage mild symptoms in children will have fewer SSAs.

This is the first Atlas of Healthcare Variation study to consider all urgent admissions in children and to include qualitative interview data to assist interpretation. This compliments Atlases of Healthcare Variation for England²⁶ and Scotland²⁷ and regional variations for admissions are described.²⁸ Limitations are the exploratory nature of our results as there are only eleven NHS Health Boards with inpatient facilities, limiting meaningful quantitative comparison. Our quantitative analysis preceded the SARS-CoV-19 pandemic and qualitative study was during the pandemic which meant face to face recruitment and site visits were impossible. Staffing resources, health-seeking behaviour and use of remote consulting technology have changed since our analyses. As our health professional interview data identified, some of the variation in SSA may be explained by differences in coding practice between regions and this warrants further investigation.

Quantitative data for our study were collected before the SARS-CoV-2 pandemic and our qualitative data were collected during the pandemic. It is possible that changes in parent/carer health-seeking behaviour as a direct consequence of the pandemic and pressures on the NHS which have followed the pandemic may have affected the generalisability of our results. However, we believe that the themes of access to services, socioeconomic circumstances and readmissions remain relevant to parent and healthcare staff in today's NHS, and potentially also in healthcare systems in other nations.

This Atlas of Healthcare variation for children's admissions complemented by insights from qualitative interviews with health professionals and parents reveals the complexity of urgent paediatric care systems and can provide a baseline for the design of care pathway

interventions for acutely unwell children in future. A separate paper will describe recommendations which arose from interviews and at a stakeholder event for interventions which could provide an alternative to SSAs.

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