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ORIGINAL ARTICLE

Readmission within 30 days of discharge (ReAd): a quality-of-care indicator in paediatric surgery

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Abstract

Purpose Following a previously published 1 year audit of readmissions, this is a reaudit of our readmission rate (ReAd) in paediatric surgery, asking: is ReAd reproducible, can it be an indicator of quality of care in paediatric surgery, and can it be improved?

Method Prospectively collected Hospital Episode statistics were used to identify readmissions over 1 year. Patients were subdivided into emergency vs elective regarding the first admission and outcomes compared including with our previously published ReAd data.

Results 2616 children (67% male) were admitted during 2016: 1398 (53%) elective and 1218 (47%) emergency admissions. The overall ReAd was 0.9%, comparable to and lower than our previously published rate of 2%. The commonest cause for readmission was appendicitis-related (22%). The emergency cohort ReAd was 1.5% (18/1218) compared to 0.4% (5/1398) in the elective cohort, 4× higher ($p = 0.002$). In the emergency cohort, the commonest causes for readmission were abdominal pain and perforated appendicitis. 80% of elective group readmissions were related to urological procedures. More of these required surgical intervention to treat (80% vs 22%) ($p = 0.03$).

Conclusion (1) ReAd is a reproducible and reducible quality-of-care indicator in paediatric surgery. (2) Emergency admission is a risk factor for readmission. (3) Appendicectomy was associated with the highest ReAd.

Keywords Paediatric surgery · 30-Day readmission · Readmission · Quality-of-care indicator

Introduction

Thirty-day readmission is defined as an unplanned admission, with an overnight stay, within 30 days of an elective or emergency hospital episode [1].

In England, this readmission rate is used by the National Health Services (NHS) Care Quality Commission (CQC) as a quality-of-care parameter in adult practice, with the stated rationale being that 'a high rate of emergency readmissions may indicate problems with the quality and safety of care.' [1]. It is seen as an important indicator of quality of surgical care, because it is to some extent preventable [2].

Worldwide, and particularly thoughout North America, readmission data are becoming increasingly adopted as a quality-of-care indicator [3–6]. The Department of Health issued a notification in 2011 that hospitals will not be reimbursed for emergency readmissions within 30 days of discharge following an elective admission and all other readmissions within 30 days of discharge will be subject to locally agreed thresholds, set to deliver a 25% reduction, where possible [1]. The current estimated cost of readmissions in the National Health Service (NHS) in England is £1.6 billion per annum [7]. There are limited readmission data for paediatric surgery. We published the first report from the UK in 2016 [8], investigating ReAds in the setting of a tertiary paediatric surgical centre.

The aim of this study was to reaudit our service with the following outcome aims: is the readmission rate reproducible? That is, can ReAd data be reliably collected and compared year on year to chart change in the ReAd? Already widely in use in adult surgery as an indicator of quality of care, can the ReAd also be collected for use as an indicator

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of quality of care in paediatric surgery? Can the readmission rate be improved with the implementation of our previous recommendations? [8].

Method

Hospital Episode statistics software was used to identify all readmissions for paediatric surgery and urology in a paediatric department based within a large tertiary hospital which treats all adult and paediatric specialities. The audit timeframe was 1st January to 31st December 2016. Hospital Episode Statistics are collated prospectively from electronic patient records. Further clinical information regarding each ReAd case was obtained retrospectively from electronic patient records. Audit approval was sought and granted by the local audit department.

Unplanned readmissions with an overnight stay, within 30 days of discharge from the primary admission, were included. Primary admissions included daycase surgery but not those who had been assessed and discharged from the emergency department without admission to hospital. Planned readmissions, re-presentations that did not require an overnight stay and neonates were excluded. Neonates were excluded as they are more frequently readmitted for non-surgical reasons.

Demographics collected included: patient sex, age, co-morbidities, date and nature of initial presentation, ASA (American Society of Anaesthesiologists) score, length of hospital stay, diagnosis on readmission, length of stay and treatment provided including surgery at both the primary admission and readmission episode.

Patients were subdivided into emergency vs elective regarding the first admission and outcomes between these 2 groups were compared. Data were analysed using Graph Pad software. *P* values ≤ 0.05 were considered to be statistically significant.

Results

A total of 2616 children (67% male) were admitted during the study period. Elective admissions including daycases accounted for1398 (53%) admissions, whilst 1218 (47%) were emergency admissions. Sixty-nine readmissions in total were identified, of which 23 met the 30 day readmission inclusion criteria. The overall readmission rate was, therefore, 0.9% (23/2616). This was comparable to and lower than our previously published study's readmission rate of 2% [8]. The readmission group consisted of 83% ($n=19$) male children. The median age for readmission was 118 months (9.8 years) (range 2 7 months–17.5 years). 6/23 (26%) children had associated co-morbidities. Seventy-eight percent (18/23) of readmissions were from the emergency cohort compared to 22% (5/23) in the elective cohort. The mean length of hospital stay during the first admission and second admission with the number of days between the 2 admissions is shown in Table 1, as is the need for further surgery during the readmission.

Overall, the commonest cause for readmission was related to perforated appendicitis treated at the primary admission (22%, 5/23). The remaining cases were a range of diagnoses.

The readmission rate in the emergency group was 1.5% (18/1218) compared to 0.4% (5/1398) in the elective group, which is 4× higher and is statistically significant, $p=0.002$.

In the emergency cohort, the mean age at initial presentation was younger at 9.7 years (range 2 months–16.5 years) than in the elective cohort at mean 14.1 years (range 10 months–17.5 years), but this was not statistically significant. In elective procedures, 100% of readmissions were males.

The length of stay at either the first or readmission stay was not found to be statistically significant between the emergency and elective cohort (Table 1). Neither were the days between primary admission and readmission (mean 7.3 days in the elective group vs 10.2 days in the emergency group).

Table 1 Comparison of emergency and elective admission cohorts

	Elective case read-missions	Emergency case readmissions	*p* value
Number/percentage	5 (0.4%) (2 day cases, 3 inptients)	18 (1.5%)	0.002
Male/female	100% ♂	3.5♂ : 1♀	
Median age (years)	14.1 (10 months–17.5 years)	9.7 (2 months–16.5 years)	
LOS on 1st admission (days)	2	3.4	
LOS on 2nd admission (days)	5.8	5.5	NS
Days between discharge and readmission	7.3	10.2	NS
Comorbidity %	2/5 (40%)	4/18 (22%)	0.5
Need for further surgery n/%	4/5 (80%)	4/18 (22%)	0.03

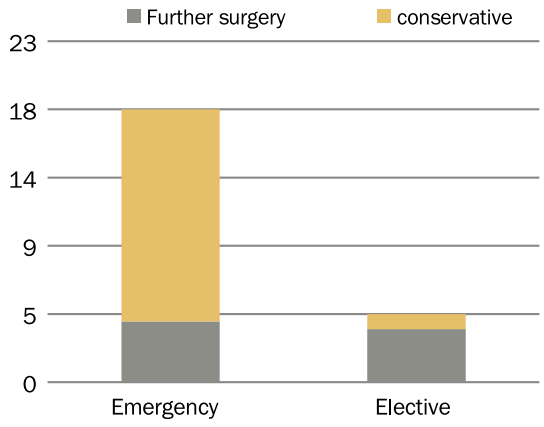

Fig. 1 Management of readmissions

Readmissions following elective procedures required a higher rate of surgical intervention to treat (80% vs 22%) ($p = 0.03$) (Fig. 1).

In the elective cohort, 80% of readmissions were related to urological procedures (Table 2).

In the emergency cohort, the commonest causes for readmission were abdominal pain (9/18) and perforated appendicitis (5/18) (Table 3). Of the nine patients initially diagnosed and discharged with a diagnosis of non-specific abdominal pain, 6 received different diagnoses at readmission, including two appendix masses, one VP shunt blockage, and one renal colic (Table 3). One child who had a normal lipase level at initial presentation was found to have an elevated blood lipase at their subsequent admission and was treated conservatively for pancreatitis. One non-verbal child with severe learning difficulties was found on readmission to have a discoloured scrotum, which was explored and orchidectomy for testicular torsion was performed. Only

Table 2 Diagnosis and management at readmission (elective cohort)

Elective procedure	Reason for readmission	Management
Nuss bar for pectus excavatum	Pleura effusion, fever	Chest drain
Circumcision	Haematoma	Evacuation of haematoma
Pyeloplasty	Urinary tract infection	Early removal of JJ stent
Laparoscopic hitch of crossing vessels for PUJO	Acute hydronephrosis	Initial nephrostomy then JJ stent insertion by interventional radiology
Cystoscopy and Botox injection to bladder	Haematuria	Conservative

Table 3 Diagnosis and management at readmission (emergency cohort)

Emergency admission diagnosis	Diagnosis at readmission	Management
Abdominal pain	Appendix mass	Antibiotics
Abdominal pain	Appendix mass	Antibiotics & interval appendicectomy
Abdominal pain	VP shunt blockage	VP shunt revision
Abdominal pain	Recurrent non-specific abdominal pain (NSAP)	Conservative
Abdominal pain	NSAP	Conservative
Abdominal pain	NSAP	Conservative
Abdominal pain	Pancreatitis	Conservative
Abdominal pain	Renal colic	Conservative
Abdominal pain	Testicular torsion	Orchidectomy
Perforated appendicitis	Adhesion obstruction	Conservative
Perforated appendicitis	Intra-abdominal collection	Conservative
Perforated appendicitis	Fever no collection	Conservative
Perforated appendicitis	Diarrhoea	Conservative
Perforated appendicitis	Wound infection/dehiscence	Conservative
Irreducible hernia	Recurrent irreducible hernia	Laparoscopic hernia repair
Irreducible hernia	Bronchiolitis	Referral to medical team
Ruptured ovarian cyst	Allergic reaction to tranexamic acid	Antihistamines
Testicular torsion (viable testis)	Wound infection/dehiscence	Conservative

three of the patients originally diagnosed with non-specific abdominal pain continued to be managed with this diagnosis at readmission.

Discussion

Despite comprehensive reporting by NHS statistics on the UK wide adult readmission data, the equivalent data for the < 16-year-old patient cohort has been the least studied territory. In the USA, Berry et al. [9] used hospital episode statistics to demonstrate a readmission rate for all paediatric patients of 6.5%, and Feudtner et al. [10] a readmission rate within a month of 4.7% across the USA. Bardach et al. [6] found that 30-day readmission rates for the seven most common paediatric diagnoses across the United States were less than 5%. Burjornrappa [5], again in the USA, published a readmission rate of 6.5% for paediatric surgery. Our ReAd data for paediatric surgery compare favourably to these.

Since then, little more has been published. The current paper describes a reaudit of our previously published ReAd data in 2016 [8]. We used an identical data collection method and our method of identifying readmission cases was the same. The only difference was that for our reaudit, we used a calendar year, whereas for our previous audit, a period of 1 year from September to September was used. Table 4 shows the comparative data between the two audit periods.

The number of admissions was higher in the second study period. A higher proportion of these were emergency admissions (47% vs 23%). Both studies found that emergency admission was associated with a higher readmission rate; in our study, 78% of readmissions were from the emergency cohort. This is in line with the official NHS statistics for all adult readmissions, with 70% being emergency admissions at the first admission [11]. The emergency cohort readmission rate in adults is 11.5% [11], far higher than our paediatric equivalent figure of 1.5–3.5%.

Despite the higher proportion of emergency admissions in the second time period, the overall readmission rate was still significantly lower (0.9% vs 2%). The readmission rate for elective operations had dropped to less than a third (1.5–0.4%), and that for emergency admissions by more than half (3.5–1.5%). Our figures, therefore, buck the national trend towards increasing readmission rates, particularly for emergency admissions, with a 27% increase in emergency case readmissions in adults across the UK in the last 10 year period for which statistics have been published [11].

Sixty-seven percent of the children in the total group were boys yet 83% of ReAd were boys. Looking at the surgical conditions which led to the readmissions, three were for specific male conditions (two readmissions related to testicular torsion and one following a circumcision) and three further admissions were following procedures which are more commonly carried out in males (inguinal hernia repairs and the Nuss procedure), which may account for this difference.

As before, appendicectomy was found to be the surgical procedure associated with the highest readmission rate, perhaps reflecting the fact that appendicectomy is also one of the commonest emergency surgical procedures. Berry et al. [9] also found that the commonest paediatric surgical case to be readmitted was appendicitis with post-operative infection. He reported a readmission rate for appendicitis of 4.5%, whilst Bardach et al. [6] reported a similar (3.7%) readmission rate for appendicitis. All of the readmissions for appendicitis were in children who had had perforated appendicitis.

Two-thirds of the patients readmitted following a diagnosis at initial admission of non-specific abdominal pain were found to have other diagnoses at readmission. A record-linkage study of over 250,000 children in the UK with a diagnosis of NSAP found that 5.8% were subsequently readmitted with bowel pathology and 5% with a specific functional disorder [12]. A study by Parker et al. [13] found that only 46 out of 1238 children with NSAP (3.7%) were readmitted within 30 days, of which only around a third, 19, were given a revised diagnosis. It would seem prudent to advise being particularly wary of a child representing with abdominal pain and to provide a full and in depth reassessment including repeat investigations in case of a missed diagnosis. Certainly, this could be a focus for efforts to further reduce our ReAd.

Table 4 Comparison of 2013–2014 cohort of previously published readmission data and current paper data

	2013–2014	2016
Total admissions (male:female)	2378 (2.2:1)	2616 (2:1)
Total readmissions: number (%)	47 (2%)	23 (0.9%)
Total emergency admissions: number (%)	541 (23%)	1218 (47%)
Emergency readmissions: number (%)	19 (3.5%)	18 (1.5%)
Commonest emergency operation requiring readmission	Appendicectomy	Appendicectomy
Total elective admissions number (%)	1837 (77%)	1398 (53%)
Elective readmissions	28 (1.5%)	5 (0.4%)
Commonest elective procedure for readmission	Central line insertion	Urological operations

Forty percent of elective and 22% of emergency patients had co-morbidities. In adult readmission data, co-morbidities have been shown to play a direct role in the need for readmission, particularly co-morbidities such as ischaemic heart disease, diabetes, and atrial fibrillation, with acute heart failure being the commonest cause of readmission in adult medical patients [14].

In our previous paper [8], we reported that we believed that discharge planning played an important role in decreasing readmissions.

Following our first ReAd audit, therefore, we introduced a number of measures to improve our discharge process. We employed a ward-based paediatric surgical Physicians Associate (PA), who is responsible for writing all the discharge summaries. She has been in continuous service since 2014, in contrast to our junior doctors who rotate through our speciality on a four monthly basis. She has, therefore, been able to provide consistently comprehensive and detailed discharge summaries of a high quality, containing clear, written, 'safety netting' advice. This may have been a factor in the reduction in ReAd that we have shown between the two study periods.

In our first year of ReAd data collection, post-operative infection accounted for 30% of readmissions, with 5 out of 14 of these being superficial wound infections without dehiscence [8]. This is in contrast to the current set of readmitted patients, where we had two admitted with wound infection and dehiscence but not wound infections alone. It is possible that such readmissions may have been prevented with better written and oral advice on discharge to patients detailing the signs and symptoms of wound infections with advice to seek early and prompt treatment from their general practitioner.

We also have nurse specialists who provide oral advice to parents and patients at discharge, and are a point of contact for the parents if they have concerns following discharge. Managing expectations, and providing access to phone advice has, we believe, reduced the number of unnecessary readmissions. Arguably, only those with recurrent non-specific abdominal pain and the child with diarrhoea might not have required readmission. The fact that the other children all required hospital management means that we had given appropriate safety netting advice.

A further significant number of readmissions in the previous audit cycle were due to displacement of newly inserted gastrostomies and catheters (accounting for three readmissions) and infections of recently inserted central lines (four readmissions). Again, we had no such readmissions in our second audit cycle. Such admissions may have been prevented with improved pre-discharge teaching of catheter and central line care, which is one of the specific remits of our nurse practitioners.

Other studies also recommended improved discharge planning to reduce the readmission rate: a meta-analysis by Hansen et al. [15] identified the above two factors, amongst others, that we have focussed on: namely formally assigning a physician, physician's associate, or nurse practitioner the discharge planning responsibility, and providing written information at the time of discharge. The use of a designated person to coordinate discharges is also in alignment with the NICE guidelines [7] on transition between inpatient and community setting for adults with social care needs. This emphasised the use of a 'designated discharge coordinator' to 'reduce the lack of integration and planning that contribute to hospital readmissions.' [7]. Many hospitals do not yet provide this service; Bradley et al. [16] found that in 86% of cardiac units in the USA, discharge medicine coordinating was not formally assigned to any one person.

A limitation of this paper is that only readmissions to our own hospital will have been identified using the methods described. It is possible that some patients may have been readmitted to another hospital. However, this number is likely to be very small as as we are a regional tertiary referral centre for paediatric surgery. District hospitals are usually very prompt to transfer back any patients that have previously been assessed or treated at our unit.

Hospital Episode Statistics pulls data from our inpatient electronic records and is thus updated in real time, as patients are logged in to our electronic records system. Patients will not have been 'missed' due to spending the 24 h in the emergency department without formal admission, as there is a 4 h legal time limit in the UK after which patients must be either admitted or discharged from the emergency department.

We acknowledge that using ReAd as a proxy for quality of care has limitations. Not all unplanned readmissions are due to poor quality of care, as there are many factors involved and some complications are unavoidable. In fact, ReAd is only one of a number of quality-of-care indicators used by the NHS—others include deaths within 30 days, return to usual place of residence and timely surgery [11]. A low readmission rate has, however, been shown to be strongly linked to a lower surgical mortality rate [4] which lends some support to its inclusion as an indicator of quality of care. However ersatz a proxy for quality of care the ReAd may be, it is now in widespread use. Regarding paediatric surgery, we have shown that the ReAd is a reproducible piece of data. Walraven et al. [2] published that only around 23% of readmissions are avoidable. We have achieved an over 50% reduction in readmissions with the implementation of our previous recommendations. As this is only the second year that we have published ReAd data, further years of data collection will be required to prove a sustained reduction in ReAd and to further validate ReAd in paediatric practice.

Conclusion

The readmission rate is a reproducible indicator in paediatric practice. The implementation of our previous study's recommendations has resulted in an over 50% reduction in the readmission rate in the second audit cycle.

A higher readmission rate was found following emergency admission, which could thus be considered a risk factor for readmission.

As previously found, appendicectomy was the surgical procedure associated with the highest readmission rate.

Compliance with ethical standards

Conflict of interest No conflicts of interest to declare.

References

1. Intelligent monitoring NHS acute hospitals indicators and methodology (2014) Care quality commission. http://www.cqc.org.uk/files/20141127. Accessed 1 May 2018
2. van Walraven C, Jennings A, Forster A (2012) A meta-analysis of hospital 30-day avoidable readmission rates. J Eval Clin Pract 18(6):1211–1218
3. Gani F, Lucas DJ, Kim Y et al (2015) Understanding variation in 30-day surgical readmission in the era of accountable care effect of the patient, surgeon, and surgical subspecialties. JAMA Surg 150:1042–1049
4. Fischer C, Lingsma HF, Maran-van de Mheen PJ (2014) Is the readmission rate a valid quality indicator? A review of the evidence. PLoS One 9(11):e112282;1–9
5. Burjonrappa S, Theodorus A, Shah A, Cohen IT (2015) Pediatric surgery readmissions: a root cause analysis. Pediatr Surg Int 31(6):551–555
6. Bardach N, Vittinghoff E, Asteria-Penaloza R, Edwards J, Yazdany J, Lee H, Boscardin WJ, Cabana M, Dudley RA (2013) Measuring hospital quality using pediatric readmission and revisit rates. Pediatrics 132(3):426–429
7. NICE:Costing statement: Transition between inpatient hospital settings and community or care home settings (2015) https://www.nice.org.uk/guidance/ng27/resources/costing-statement-2187244909. Accessed 1 May 2018
8. Sinha CK, Decker E, Rex D, Mukhtar Z, Murphy F, Nicholls E, Okoye B, Giuliani S (2016) Thirty days readmission in paediatric surgery: the first UK experience. J Ped Surg 51:1877–1880
9. Berry J, Toomey S, Zaslavsky A, Jha A, Nakamura M, Klein D, Feng J, Shulma S, Chiang V, Kaplan W, Hall M, Schuster M (2013) Pediatric readmissions and variability across hospitals. JAMA 309(4):372–380
10. Feudnter C, Pati S, Goodman D, Kahn M, Sharma V, Hutto J, Levin J, Slonim A, Hall M, Shah S (2010) State-level child health system performance and the likelihood of readmission to children's hospitals. J Ped 157(1):98–102
11. NHS Digital Official Statistics (2015) Compendium—emergency readmissions within 28 days of discharge. https://digital.nhs.uk/data-and-information/publications/clinical-indicators/compendium-of-population-health-indicators/compendium-hospital-care/current/emergency-readmissions-to-hospital-within-28-days-of-discharge. Accessed 1 May 2018
12. Thornton GCD, Goldacre MJ, Goldacre R, Howarth LJ (2015) Diagnostic outcomes following childhood non-specific abdominal pain: a record-linkage study. Arch Dis Child 101:299–299
13. Barker P, Jutley R, Youngson G (2002) Hospital re-admission in children with non-specific abdominal pain. Pediatr Surg Int 16(5–6) 341–343
14. Donze J, Lipsitz S, Bates D, Schnipper J (2013) Causes and patterns of readmissions in patients with common comorbidities: retrospective cohort study. BMJ 347:f7171
15. Hansen LO, Young RS, Hinami K, Leung A, Williams MV (2011) Interventions to reduce 30-day rehospitalization: a systematic review. Ann Intern Med 155:520–528
16. Bradley E, Curry L, Horwitz L, Sipsma H, Thompson J, Elma MA, Walsh M, Krumholz H (2012) Contemporary Evidence about hospital strategies for reducing 30-day readmissions. J Am Coll Cardiol 60(7):607–614