

## **TRUST BOARD REPORT**

### **MORTALITY ASSESSMENT AT ALDER HEY Medical Director's Mortality Report**

The report is split into two sections. Section one is a review of the Hospital Mortality Review Group (HMRG) including the number and types of death at Alder Hey during the calendar year to date and how the HMRG is meeting its aims.

Section two is the Quarter 3 Mortality report which includes a review of statistical analysis in PICU and Cardiac Surgery, followed by more detailed analysis of the place of death, teams involved and specifics about expected v observed deaths.

#### **Section 1: Report from the Hospital Mortality Review Group (HMRG) Jan-Dec 2017**

This is still a period of change for the hospital mortality group as we continue to evolve our mortality review process following the document "Learning, Candour and Accountability: review of the way NHS Trusts review and investigate deaths" (Dec 2016). There have been a number of documents since trying to ensure there is effective mortality review and learning across organisations following a death.

The Alder Hey mortality review process was rewritten following these documents and national meetings. It was agreed across the Trust and the new process began in February this year.

The majority of the deaths in AHCH occur in PICU where there is a robust mortality process which is well established and has been for many years. Other teams who rarely have a death are the teams which we are trying to engage aiming for the same review process across the Trust regardless of where the child dies.

We are unusual as an organisation as we review every death due to our numbers being lower than the DGH's or adult Trusts. This ensures that we have assessed our care for every child and family so that we maintain a high level of care. The Hospital Mortality Group by undertaking a second review makes the process more independent than just a departmental review. The Hospital mortality review group is made up of people with a wide variety of expertise, experience and is a multi-disciplinary group.

Over the last year, the group has engaged with the bereavement team to provide the family's feedback on their child's care over the last admission and any previous care at AHCH. This is being done very sensitively as it is important that the review process is constructive for the family and helps their

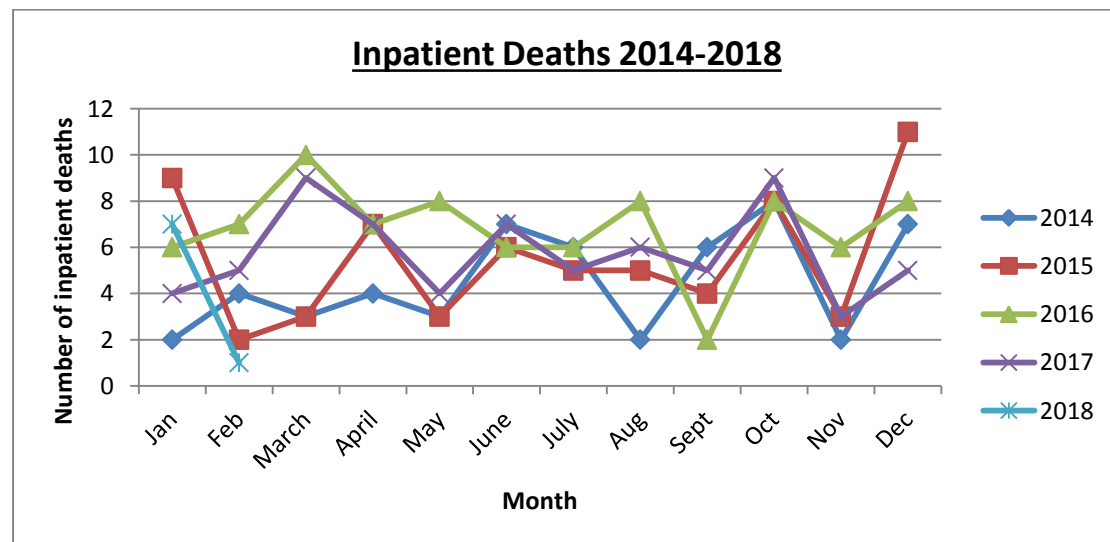
grieving. Some families may choose not to engage, and it may be appropriate at different times for them after their child's death.

The HMRG is linking in with other networks such as trauma and neonates.

To continue to develop the process;

- 1) Ongoing engagement with the families
- 2) Identification of mortality leads across the Trust (underway)
- 3) RCA findings to be shared with the teams involved in a timelier manner
- 4) Sharing of HMRG reviews with referring hospitals, GPs, CDOP process
- 5) Learning is the main area that needs to be developed. Currently learning points are communicated after the monthly meetings and the intranet aspect is being utilised more effectively. There needs to be more effective communication across the governance pathway and we need to explore different possibilities to ensure the learning is effective.
- 6) External peer review with other Paediatric hospitals
- 7) Re – introduce the review of deaths within 30 days of being discharged from the Trust. Currently we still monitor these but they do not have a formal review.

Nationally the paediatric mortality review process has not been finalised and there is still considerable uncertainty about a number of aspects about the initial proposal. At the meetings there was a lot of interest in the process we are operating in AHCH, and a number of organisations and NHS England asked for our policy and for information about our process.



Looking at the in-patient deaths over the last 4 years there is always variation but it does tend to balance out over the year. When there has been a peak, the hospital mortality group reviewed the cases quickly to check there were no concerning issues or factors.

### Summary Table

Number of deaths (Jan. 2017 – Dec. 2017)	69
Number of deaths reviewed	58
Departmental/Service Group mortality reviews within 2 months (standard)	58/69 (84%)
HMRG Primary Reviews within 4 months (standard)	45/64 (70%)
HMRG Primary Reviews within 6 months	46/52 (88%)

The HMRG is performing well with 70% of the reviews within the 4-month target that we set ourselves and 88% within 6 months. The 4-month target can be difficult/impossible to achieve if it is a coroner's case and if the RCA's are prolonged. The group is of the opinion that it is important to have all the relevant information to achieve a useful and complete review. Therefore, it is appropriate to wait, and it is unlikely that we will every achieve 100%. The standard of 4 month is useful so reviews are done in a timely manner and if there is a concerning trend it will be identified in a reasonable time period. The outstanding cases are related to RCA's or coroner's cases.

When there was a delay in releasing 2 RCAs to the teams involved HMRG asked the Medical Director to intervene and he then organised the RCAs to be available to the teams. The cases could then be discussed at the next meeting but missed the 4-month target.

Month	Number of Inpatient Deaths	HMRG Review Completed	Dept. Reviews within 2-month timescale	HMRG Reviews within 4-month timescale	HMRG Reviews within 6-month timescale	Discrepancies HMRG- Dept	HMRG Review - Death Potentially Avoidable
Jan	4	4	4	0	3	2	3
Feb	5	5	5	4	5	2	
March	9	9	7	4	7	4	3
April	7	7	6	6	6	5	
May	4	4	4	4	4	1	
June	7	7	6	6	7	2	1
July	5	5	4	4	4	1	
Aug	6	6	6	6	6	1	
Sept	5	4	5	4	4	0	
Oct	9	6	8	6	6	0	1
Nov	3	1	3	1	1	0	
Dec	5						

## **Discordant Conclusions of the HMRG vs the Departmental/service group reviews**

Since the previous mortality report there have been 4 cases where there have been discrepancies between the service group and HMRG reviews. In one of the cases, the care was considered to be better than rated in the service group review. In another of the cases, the organisational issues were considered to be worse than the service group review. In the other 2 cases the HMRG reviewers decided there were aspects of care that were less than adequate and different management may have altered the outcome as oppose to the service reviews where they were rated as adequate.

### **Potentially modifiable factors and actions**

Since the last Trust Mortality report, there have been 3 in-hospital deaths where there are factors which may have played a role in the child's death.

1) One was a child who was brought into Emergency Department (ED) in cardiac arrest. Patient had been noted to be lifeless at home with their face was covered. Basic life support was started at home and the child arrived in asystole. Advanced resuscitation was continued in ED and there was return of circulation 5 minutes after arrival. Patient was transferred to Paediatric Intensive Care Unit (PICU) although very unstable on an adrenaline infusion and pupils were fixed and dilated. Unfortunately, patient started fitting and a CT scan showed severe ischaemic changes (in accordance with lack of oxygen to the brain). Despite full intensive care and multiple neurology reviews, patient had irreversible widespread brain injury. A few days after admission to PICU, bloods and urine toxicology came back positive. On PICU, patient remained comatose with irregular respiratory drive and brain dysfunction. There were multiple discussions with the family and they agreed to withdraw care.

There were no concerns about the care provided in Alder Hey Hospital but this was potentially avoidable death prior to cardiac arrest.

2) A patient with long-standing health problems, whilst being admitted with respiratory problems, was noted to have large tonsils and was listed for an elective adeno-tonsillectomy. The patient required oxygen overnight and had a slight temperature but was considered for discharge the day after surgery. Just prior to discharge the patient deteriorated and it was thought that to have a chest infection (CXR – showed changes). Antibiotics were started which were changed from Co-amoxiclav to cefotaxime and then to teicoplanin and ciprofloxacin. The patient continued to deteriorate on HDU and arrested 48 hours post operation, straight after intubation. Despite all possible treatment it

was not possible to resuscitate the patient. After death, a positive test result was felt to explain the long term health problems but it was not thought to be the cause of death.

An RCA was completed which found that there had been insufficient medical reviews. The PEW's score was high at one point but there were significant delays in recognising the patient's condition. Comments were made that the view of microbiology results on Meditech were limited so all results were not visible. There was no handover from the daytime to the night team and a high lactate was explained by squeezing rather than a true result. The opinions of the nursing team were not taken full account of and the Sudden Unexpected Death in Infancy (SUDI) protocol was not activated.

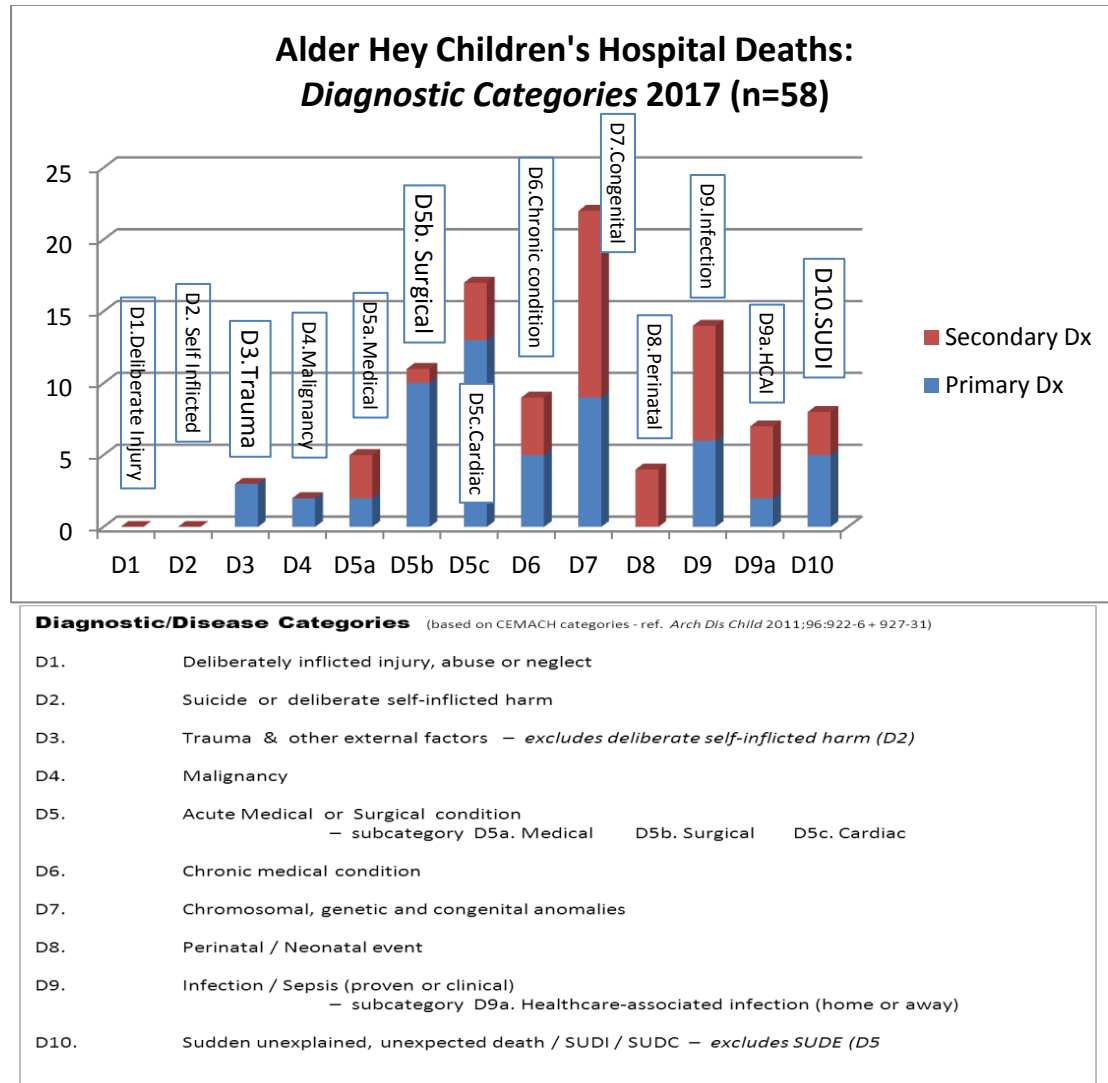
There was a delay in the RCA findings being available to the people involved and the HMRG asked the Medical Director to intervene to clarify the procedure for dealing with an overlap between the mortality review and RCA processes. This clarification will assist in any similar future situations.

The Group reviewed this as potentially avoidable death.

3) A child who as a neonate had required admission to SCBU for treatment and monitoring and was discharged home and a month later had an out of hospital cardiac arrest. The patient was co-sleeping with the parents. The patient had fed well and then when the alarm went off for the next feed it was noticed that they were floppy, pale and not breathing. Parents started cardiopulmonary resuscitation and the ambulance crew continued resuscitation. On arrival to AHCH resuscitation continued. Cardiac output returned after at least 42 minutes. The patient was so unstable that when transferred by North West Transport Service they required hand ventilation and multiple inotropes on PICU. The patient deteriorated on PICU and following discussion with the family the decision was made to withdraw care. This was an avoidable death due to the co-sleeping. There is an on-going safe to sleep campaign in Merseyside.

## Primary Diagnostic Categories

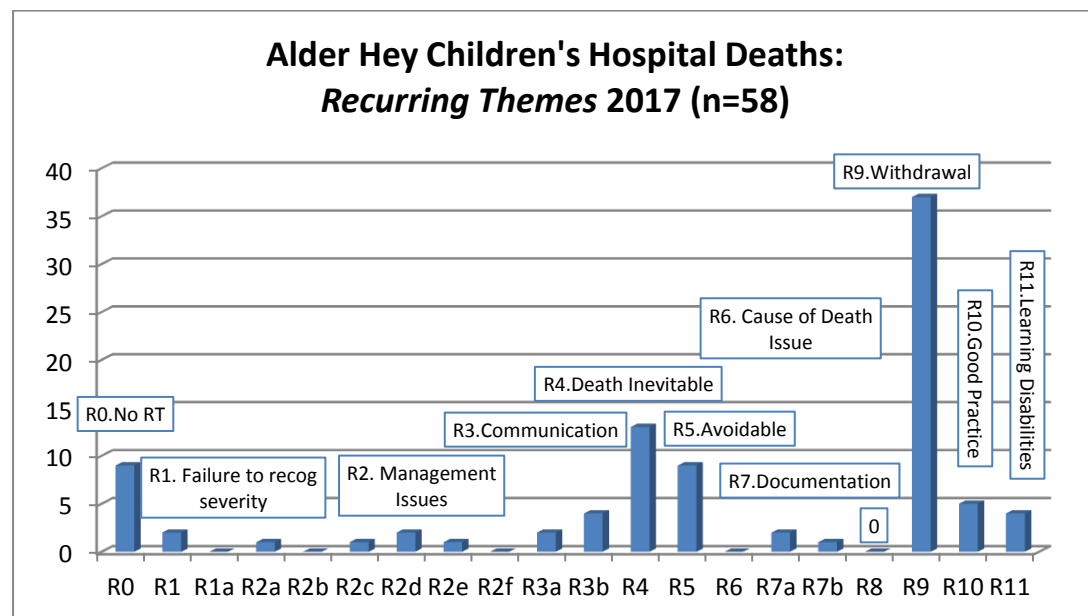
The chart below shows the deaths by primary diagnostic categories.



The commonest diagnostic category is cardiac with 25% this can be partially explained by a number of babies that come to Alder Hey for cardiac assessment and then are found to be inoperable or no real treatment options. This has resulted in discussion in the HMRG meetings as to whether it is appropriate and necessary to bring the babies and families to AHCH so isolating some of the families from their support network. The feedback from the cardiologists is that they can do a far more detailed assessment and the cases can be extremely complex and need considerable discussion. The next highest group is surgical 19% and there are a number of explanations for this. The surgical team here takes referrals for line accesses across the region where they are finding it extremely difficult to obtain an intravenous line. The surgical team provides a central line so solving the problem but a number of

these babies are precarious with many being extremely premature and with a number of complex issues. These babies may deteriorate either en route to AHCH or on arrival and then unfortunately pass away whilst here. There is another group of surgical patients with very similar issues and these are the babies who are referred as ?NEC – necrotising enterocolitis. This is a condition which typically occurs in premature babies and is characterised by variable damage to the intestinal tract. The first line treatment is intravenous antibiotics and resting the bowel but if they deteriorate they may need an operation. They are therefore referred to AHCH and the group did notice that there were a number of babies which were too unstable to even make it to theatre. There has been feedback via the neonatal network as to whether it is appropriate to refer these babies to AHCH if they are so unstable with multiple co-morbidities.

### **Primary Recurrent Themes**



### Recurring Themes

R0.	No RT
R1.	Failure to recognise severity of illness – subcategories: R1a. Failure to ask for Senior/Consultant review
R2.	Possible management issues – subcategories: R2a. before Arrival      R2b. Delay in Transfer      R2c. in Alder Hey R2d. Delay in supporting services or accessing supporting service R2e. Difference of opinion re: Rx – Patients & families R2f. Difference of opinion re: Rx – Clinical teams
R3.	Communication issues – R3a. Patients & families      R3b. Clinical teams
R4.	Death inevitable before admission
R5.	Potentially avoidable death – subcategories: R5a. Alder Hey      R5b. Medical      R5c. External
R6.	Cause(s) of death issue – subcategories: R6a. Incomplete or inaccurate Death Certificate R6b. Should have had a post-mortem      R6c. Not agreed R6d. Failure to discuss with the HM Coroner
R7.	Documentation – subcategories      R7a. Recording      R7b. Filing
R8.	Failure of follow-up
R9.	Withdrawal
R10.	Example of Good Practice

The commonest theme is withdrawal of care in 71% of cases which shows that the intensive care team are providing the best possible care until they feel all treatment options are futile, then with full agreement of the family and the other teams involved withdraw intensive care and ensure that the child has as peaceful a death as possible. Although these are difficult discussions, it is important that the team is proactive thus preventing unnecessary suffering and it done in a very caring and compassionate way.

The next commonest theme is that death is inevitable in 25% of cases so regardless of the care provided in AHCH the child unfortunately was going to die. There are other cases where the child is clearly extremely poorly but the decision that the condition or illness is not survivable is not made until detailed assessment has been made and these are not put in this category.

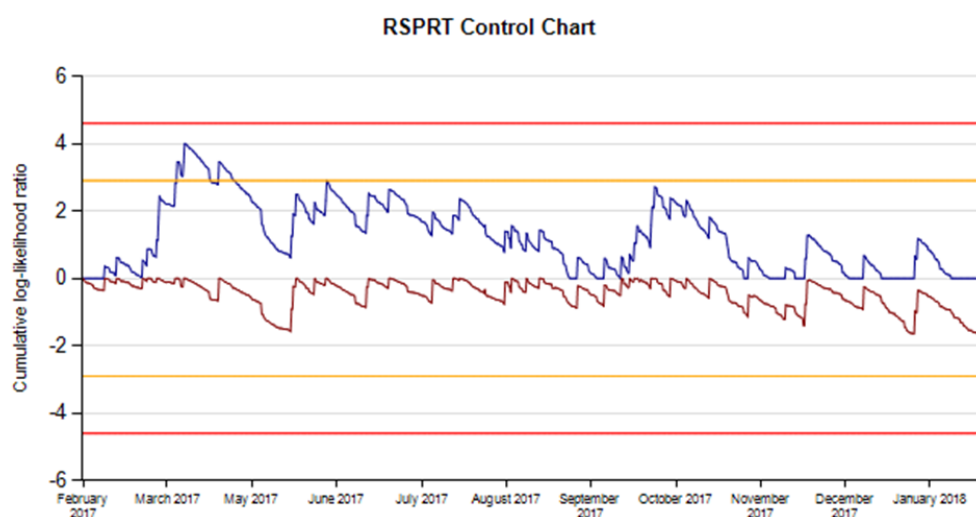
In accordance with national recommendations we are recording children with learning difficulties in our mortality process and this is 8% for this quarter. The national guideline was to 4 years of age but we have reported younger ages as there are some conditions where the child will clearly have learning difficulties. The impact on the family and their interaction with medical practitioners may well have occurred from a very young age so it is important to record these and ensure there are no issues.

## Section 2: Quarter 3 Mortality Report: October 2017 – December 2017

### 1) Statistical analysis of mortality:

#### a) RSPRT (Risk-adjusted resetting probability ratio test)

In the RSPRT (Risk-adjusted resetting probability ratio test) Plots present the mortality of your unit cumulatively, based on what is predicted by PIM2 score. Between the orange lines is a 'safe zone' with the variability you might expect day to day. Between the red lines at the top of the chart can be regarded as a 'warning zone'.



Until there is a death, the top line stays flat and the bottom line gradually drops. When a death occurs, the top line moves up and the bottom line moves

closer to zero. When either line touches the red line, the graph resets to zero.

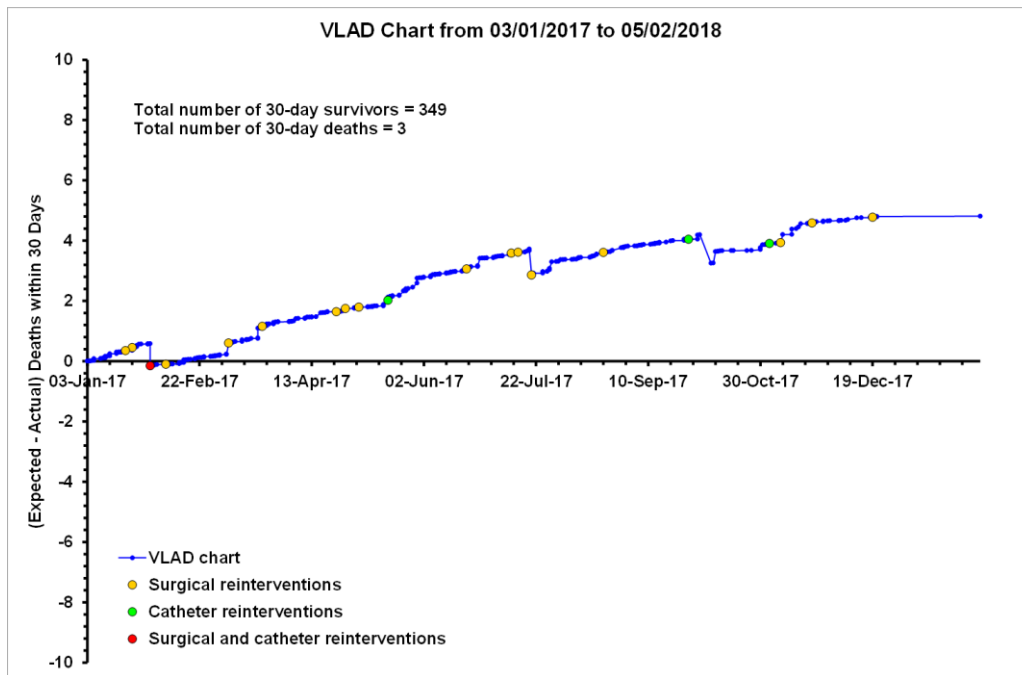
This data is nationally validated because generated by PICANet.

In the above RSPRT chart - RSPRT resets in mid-March 2017 but since April 2017 has remained in the 'safe zone' till date. We had n= 6 deaths in March 2017 and all the deaths have occurred in the patient group who belonged to "Death inevitable on PICU admission" in retrospect- (n=3 Out of hospital cardiac arrest, n=2 Preterm VLBW neonates with NEC + MOSF , n=1 Restrictive cardiomyopathy + MOSF). The second peak occurred between September and October where we had n=13 deaths. One death was of that a child with fulminant meningococcal sepsis who had refractory shock who died despite Extra-corporeal life support (ECLS). Rest of the n=12 deaths occurred in the patient groups who belonged to "Death inevitable on PICU admission (in retrospect) and multiple co-morbidities which have obviously impacted on the RSPRT trends. All PICU deaths + RSPRT trends are discussed in the following month and monitored regularly.

## **b) Statistical analysis of mortality in Cardiac Surgery: PRAiS and VLAD charts**

A risk adjustment model Partial Risk Adjustment in Surgery (PRAiS) has been developed to calculate the estimated risk of death within 30 days of a primary paediatric cardiac procedure in children under 16. The PRAiS model uses the risk factors including specific procedure, age, weight, diagnoses and comorbidities. The National Institute for Cardiovascular Outcomes Research (NICOR) will use this information to produce funnel charts comparing the Standardised Mortality Ratio (SMR) across centres.

The PRAiS risk model has also been used to develop variable life-adjusted display (VLAD) charts for each centre. VLAD charts display the cumulative difference between expected and observed mortality over time. The plotted line goes up for a survival and down for a death; for higher risk patients who survive the line is steeper than low risk survivals; for low risk deaths the line is steeper than deaths for high risk patients. If the outcomes are as expected the line will be close to zero. The line will rise less steeply for a run of survivals than it will decrease for a run of deaths. Re-interventions are displayed as circles on the plotted line. Monitoring of VLAD charts provides additional quality assurance.

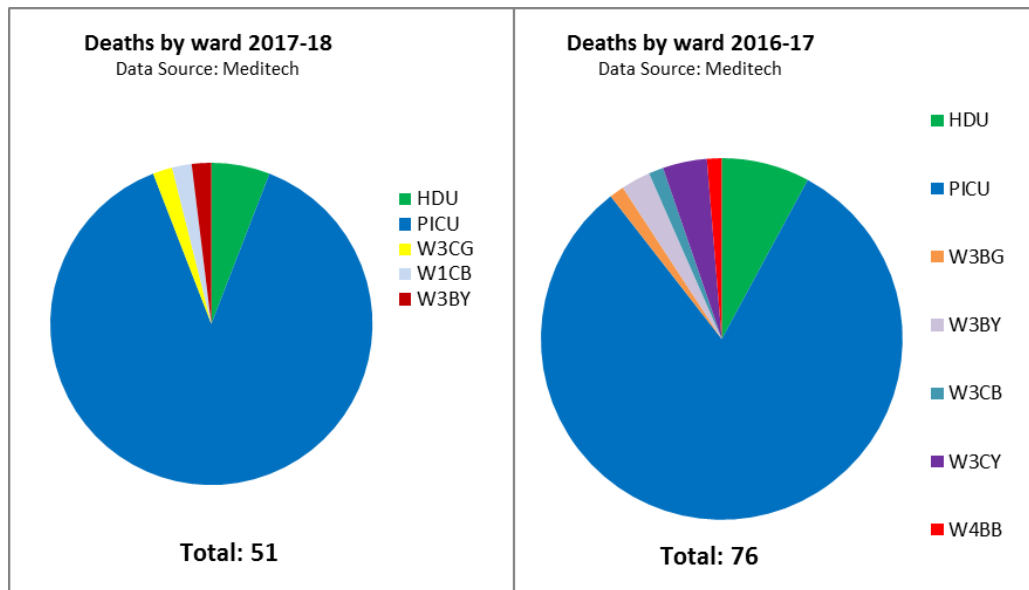


The VLAD chart above shows mortality is occurring lower than expected for the twelve months from January 2017 to December 2017. The survival rate at 30 days was 99.1% against an expected rate of 97.8%.

## 2) Real time monitoring of mortality

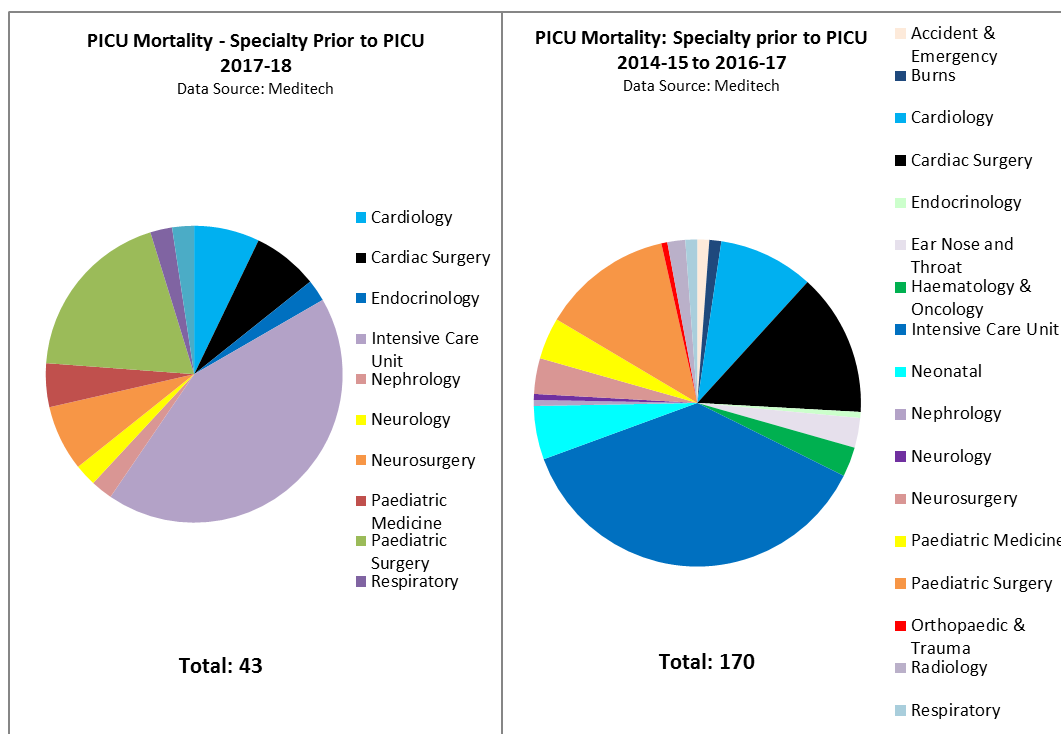
Mortality is now being monitored in real time and analysed by year, ward, specialty, deaths within 30 days from admission and over 30 days from admission.

- i) Below are the charts showing mortality by ward for 2017-18, and the previous year 2016-17.



The charts show the highest number of deaths occur in the PICU department. This enables observations of deaths in specific ward areas over time and thus identifies any potential unusual patterns, particularly in non PICU wards.

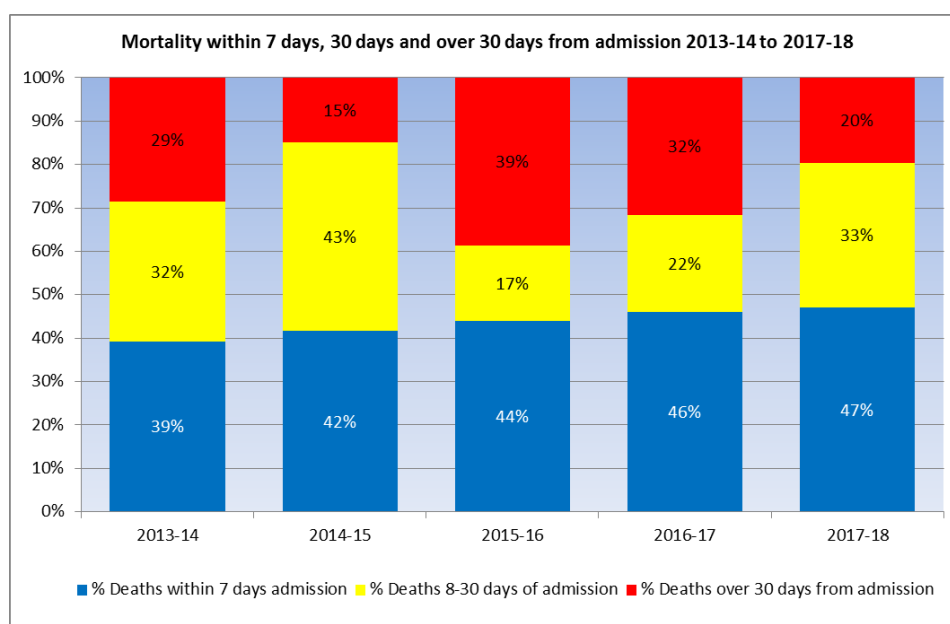
- ii) Below are the charts showing mortality by specialty prior to PICU for 2017-18, and the previous 3 years 2014-15 to 2016-17.



These charts show the breakdown of PICU deaths by the specialty the patient was under during their episode before admission onto PICU. A large number of patients were under PICU on their first episode.

For those whose first episode was not PICU, the largest number of patients had been under the specialties Paediatric Surgery, Cardiac Surgery and Cardiology. This provides an opportunity for looking at unusual trends within specialties.

- iii) Below the chart shows mortality broken down by the time from admission to death, mortality within 7 days, 30 days and over 30 days from admission.



The chart shows that usually the highest percentage of deaths occurs within 7 days of admission, around 40-44% of deaths occur within this time frame. In the current year 47% occurred within 7 days of admission, 33% occurred within 8-30 days from admission, and 20% deaths occurred over 30 days from admission.

### 3. External Benchmarking

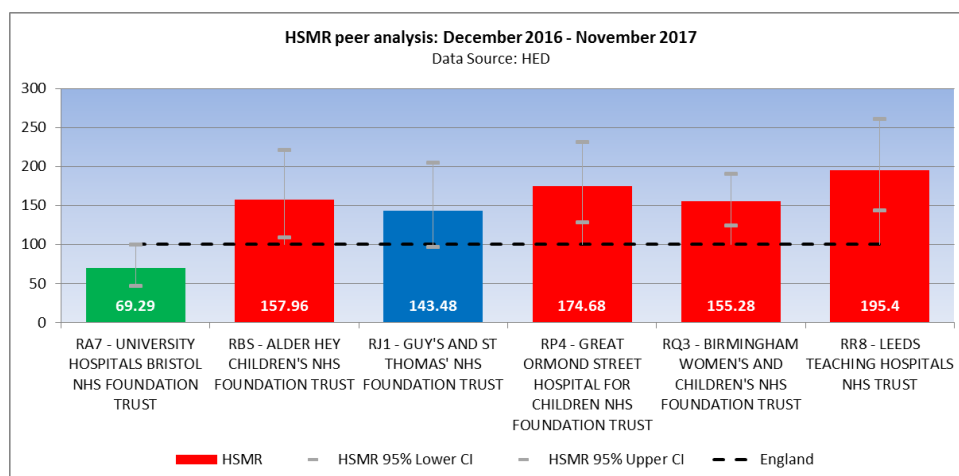
#### a) Hospital Standardised Mortality Ratio (HSMR) – HED

HED allows the Trust to monitor and benchmark a number of hospital performance indicators including mortality. The HSMR is the ratio of the observed number of in-hospital deaths divided by the number that is expected, and is based on 56 diagnoses. Although the scores are based on a

basket of diagnoses that are more commonly found in adults, it allows a comparison of the performance of Alder Hey against other Trusts.

The peer group Alder Hey will be assessed against are Trust's with a similar patient case mix. This is still a work in progress. On this occasion we have included Trusts with comprehensive children's services including cardiac surgery. Patients aged 0-17 years have been selected to ensure adults are excluded from the HSMR. All specialties are included; therefore those Trusts with Neonatal Units may have a higher relative risk of mortality than expected. The Trust with the closest profile to Alder Hey is Birmingham Children's Hospital. Guys and Leeds both have neonatal units. It is not clear what Bristol include in their submitted data.

The chart below compares HSMR for Alder Hey against its peers for the period December 2016 to November 2017.

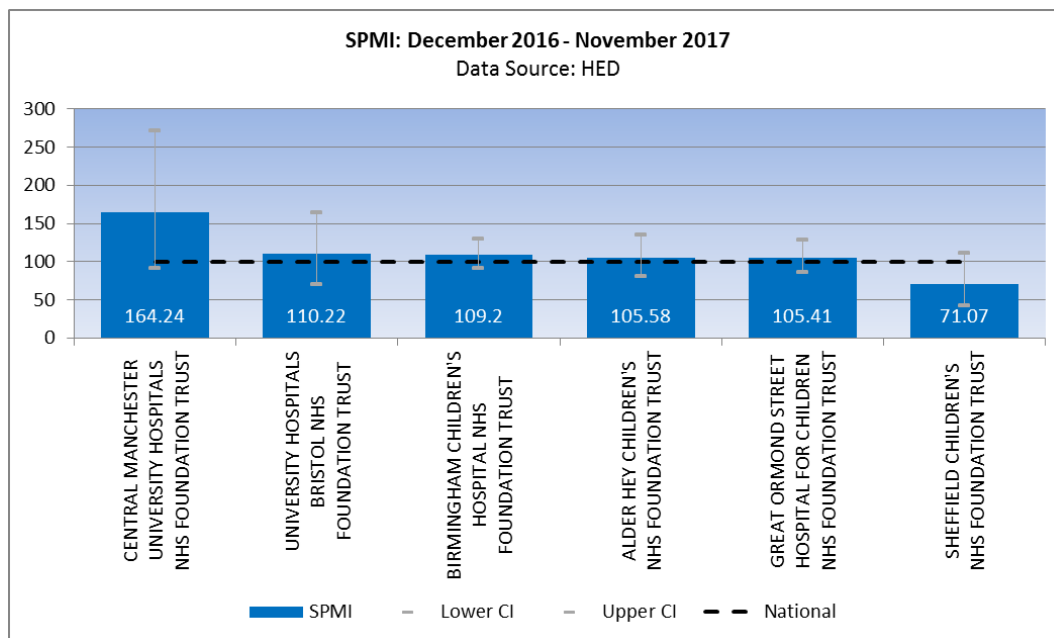


A figure of 100 means that the outcome is completely expected compared to England. A figure greater than 100 indicates the risk of the outcome is greater than expected. A figure less than 100 indicates the risk of the outcome is less than expected.

The above chart shows that the relative risk of mortality for Alder Hey was higher than expected compared to England, as were all the peer groups with the exception of University Hospitals Bristol NHS Foundation Trust.

HED has developed a Standardised Paediatric Mortality Index (SPMI); this is a paediatric specific ratio of the observed to expected in-hospital deaths (multiplied by 100). A value of greater than 100 indicates higher mortality level than the average NHS performance, and a value of less than 100 indicates lower mortality level. The expected deaths are calculated from logistic regression models with a case-mix of: age, sex, ethnicity, trust type, emergency surgery flag, chronic condition flag, paediatric risk category,

paediatric life-limiting conditions flag and diagnosis group. Diagnosis groups where there are less than 10 death events are excluded from the model. Children up to and including the age of 15 are included. The model is available in pre-release and the most recent data available is for the period 1 December 2016 to 30<sup>th</sup> November 2017.



The chart shows that Alder Hey has a higher mortality level than the average NHS performance with 64 deaths against 60.6 expected deaths.

## b) External benchmarking against comparator organisations for specific patient groups in addition to HED.

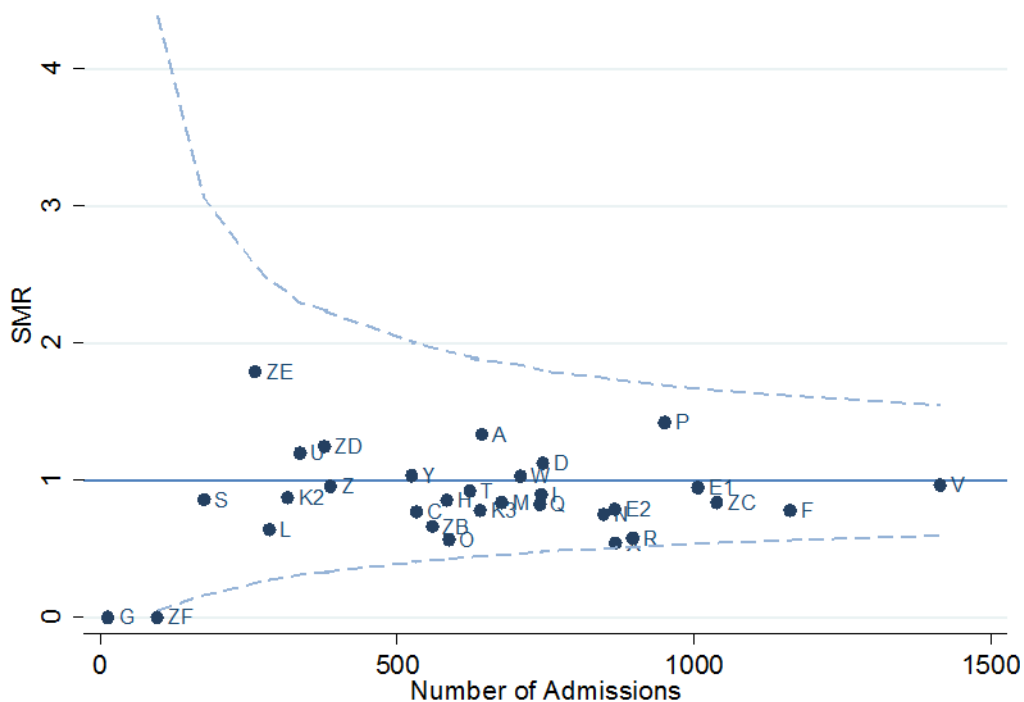
As previously reported Alder Hey benchmarks externally for PICU (<http://www.picanet.org.uk/documentation.html>), congenital cardiac disease <http://nicor4.nicor.org.uk> and oncology.

### PICU

It is important to recognise that 85-90% of our deaths occur in PICU as in other children's trusts. In the most recent PICANet report (2017 Annual Report of the Paediatric Intensive Care Audit Network January 2014-December 2016), mortality is displayed in funnel plots. The Standardised Mortality Ratios (SMRs) for each organisation are plotted against the number of admissions. The risk adjusted SMR is the ratio of the observed number of deaths in the population against the expected number of deaths predicted by PIM3. Control limits are displayed on the funnel plots; variation within these limits is termed common-cause variation; variation outside of these limits is special-cause variation. Points above the upper control limit indicate higher

than normal mortality; highlighting the need for further investigation into the mortality rate.

The chart below is taken from PICANet's most recent report, and shows the PICU SMRs by organisation with 99.9% control limits, 2016: PIM3 adjusted.



The funnel plot above shows Alder Hey at point 'P'. The SMR for Alder Hey is within the control limits of the funnel plot, suggesting mortality is under control.

## **Conclusions**

The HMRG is functioning well and is continuing to adapt and improve according to national recommendations. We continue to review every in-patient death in HMRG and the majority of deaths have at least one departmental/service group review in addition. In the deaths where concerns were raised the medical director acted rapidly to support the group's requests to ensure that the learning from the RCA's was accessible.

There is clearly considerable amount of work to be done to improve the process and increase engagement and communication across the Trust. There is awareness of the limitations in our process and we are working to address them. Learning from deaths is the key goal and we are now trying to ensure that this occurs across the organisation. It will be a slow process but we are trying to establish robust processes.

The statistics relating to paediatric deaths are difficult as they are so many variables and different figures cover slightly different aspects.

The Trust that is the most comparable to AHCH is probably Birmingham children's Hospital NHS Foundation Trust and we are comparable to them with both SPMI and HSMR which is reassuring.

Alder Hey uses VLAD charts to monitor the trend in mortality in cardiac surgery; the latest chart shows observed mortality is lower than expected mortality. All cardiac surgery patient deaths will be reviewed in the Cardiac M&M meetings and also the HMRG.

Reports have been produced to allow real time monitoring of mortality. Deaths will be analysed by year, ward, and specialty, deaths within 7 days, 30 days and over 30 days from admission. There are no current indications of patterns of concern.