



SOUTH WALES PAEDIATRIC  
INTENSIVE CARE SERVICE

ANNUAL REPORT  
2005

## SUMMARY

- This report details our activities in caring for critically ill children throughout Wales in the seventh year of the Lead Centre Paediatric Intensive Care Unit for Wales. It refers to the calendar year 2005, not the financial year in line with the Paediatric Intensive Care Audit Network.
- This year's annual report has slimmed down sections dealing with unit activity. More comprehensive information is available in the PICANet national report for 2005, which can be accessed as a pdf document on our website: [www.cardiffpicu.com](http://www.cardiffpicu.com).
- 287 children were admitted to the unit during the year 2005.
- In the year 2005, the retrieval team agreed to 108 requests for retrieval.
- There were no refused admissions due to the lack of an available staffed bed during the winter period of peak demand.
- The development of the Paediatric Critical Care Network has continued with multidisciplinary audit and feedback sessions held in all Trusts. The regional Practice and Development Nurse has been invaluable in progressing education and training within the network. The "Stabilisation of the Critically Ill Child" Study Days continue to evaluate well, as are the nursing secondments.
- The partnership between the Lead Centre PICU and the Welsh Burns Centre in Morriston Hospital continues.
- The UK Paediatric Intensive Care Audit Network Database (PICANet) has published its third report ([www.picanet.org.uk](http://www.picanet.org.uk)).

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## **CHAPTER 1**

### **THE LEAD CENTRE PAEDIATRIC INTENSIVE CARE TEAM**

|   |  |
|---|--|
| Dr Helen Fardy                            | Lead Clinician Paediatric Critical Care Service  |
| Mrs Paula Davies                          | Lead Nurse Paediatric Critical Care Service  |
| Dr Rim Al-Samsam                          | Consultant in Paediatric Intensive Care<br>- responsible for Audit and Research                  |
| Dr Malcolm Gajraj                         | Consultant in Paediatric Intensive Care<br>- responsible for Education and Training              |
| Dr Damian Pryor                           | Consultant in Paediatric Intensive Care<br>- responsible for Clinical Risk                       |
| Dr Mark Price                             | Consultant in Paediatric Intensive<br>Care/Anaesthesia<br>- responsible for Anaesthetic Training |
| Dr Allan Wardhaugh                        | Consultant in Paediatric Intensive Care<br>- responsible for Unit and Retrieval Audit            |
| Dr Dawn Edwards                           | Staff Grade in Paediatric Intensive Care   |
| Ms Alison Oliver                          | Regional Training & Development Co-Ordinator for<br>Paediatric Critical Care Services in Wales   |
| Mrs Louise Evans                          | Directorate Manager Critical Care Services   |
| Miss Mererid Jones/<br>Miss Kate Williams | Senior Physiotherapists  |
| Mrs Sue John                              | Dietician  |
| Zoë Taylor                                | Pharmacist   |
| Mrs Pat Davies                            | Personal Assistant to Lead Clinician   |
| Vacant post                               | Secretary  |
| Ms Zoey Taylor                            | Audit Clerk  |

#### **CONTACT NUMBERS:**

|                                 |  |
|---------------------------------|--|
| Dedicated Retrieval Line        | Tel: 029 20745413                      |
| Consultant via long range bleep | Tel: 029 20747747 (via switchboard)    |
| Pat Davies PA to Dr Helen Fardy | Tel: 029 20746423                      |
| Fax Line:                       | Tel: 029 20746443                      |
| Email:                          | Pat.Davies@Cardiffandvale.wales.nhs.uk |

## **CHAPTER 2**

### **THE SERVICE**

Our service has been developed based on multidisciplinary teamwork both within the Lead Centre and with our Paediatric, Anaesthetic and Emergency Medicine colleagues in the District General Hospitals throughout Wales.

#### **Consultant Staff**

This is the second year the service has benefited from a full and stable team following the final appointment to the funded posts in 2003.

The future depends on the implementation of the new consultant contract which is currently in progress.

#### **Specialist Registrars**

The Paediatric Intensive Care Unit has a dedicated rota of resident specialist registrars – three from the Welsh Paediatric Rotation and two from the Welsh Anaesthetic Rotation. This provides an important part of the training of paediatricians and anaesthetists of the future.

Training is provided in the recognition and care of the critically ill child, as well as safe transport of the critically ill child (the principles of which are transferable to adult and neonatal practice).

A key component of a centralised service is the requirement for resuscitation and stabilisation locally, prior to retrieval by PICU. It is therefore essential that junior staff, the consultants of the future, learn about critically ill children during their time in PICU. Much of this knowledge will be gained from direct experience managing patients, but given the limited time, shift working and variable patient numbers, this experience must be backed up by a rigorous educational programme.

Our junior staff are provided with guidelines and a self-directed programme, still in development, but which has been well received by the specialist registrars. This encourages independent study and strengthens understanding. Teaching ward rounds and a formal grand round once a week provide practical and specific knowledge, backed up by weekly tutorials on a wide curriculum pertinent to PICU.

Advanced airway skills are essential to medical staff working in intensive care. Without a patent and secure airway, all other medical interventions become irrelevant.

At the start of their attachment trainees attend a lecture and practical tutorial utilizing training mannequins. This helps emphasize the difference in anatomy, technique and equipment between infants, children and adults.

Paediatric trainees then spend time with a consultant anaesthetist, in the operating theatre. Here a range of airway management techniques, including endotracheal intubation, can be taught under close senior supervision and monitoring.

Theatre attachments used are those with exposure to multiple cases that require more involved airway management. A good example is day case Ear, Nose and Throat surgery. To maximize training both adult and paediatric lists, without any other trainees, are utilized.

The feedback from our trainees has been positive.

However, due to the changes in the anaesthetic training programme, it is becoming increasingly difficult to organise these attachments as it will interfere with the training of the anaesthetic trainees.

We would like to thank all the anaesthetic consultants involved for their time and interest.

Recruitment of anaesthetic specialist registrars continues to be difficult and we are working with the Regional Advisors to try and address this.

### **Nursing Staff**

During the last year, there has been continued development of the specialist nursing workforce within Paediatric Critical Care. Four nurses from Paediatric Intensive Care [P.I.C.] and two nurses from Paediatric High Dependency [P.H.D.U.] have undertaken further training at the Universities of West and Central England and will complete the course in May. We anticipate compliance with the W.A.G. [2002] Standards for Critically Ill Children by the end of 2007 with 50% of the total nursing workforce having additional qualifications in Paediatric Intensive Care.

In addition to this training, there is competency based training to aid the development of retrieval and haemofiltration skills. The Team-leaders are undertaking the Royal College of Nursing Leadership Programme within the Trust and we are also currently running an in house management development course for senior E grade staff.

Since June 2005, a P.I.C. & P.H.D.U. nursing rotation has commenced whereby two nurses undertake a 3 month rotational placement. This is the first stage of a move towards a combined paediatric critical care workforce, which aims to provide a seamless service to all children requiring critical care. This has required implementing change management strategies and working across two directorates. Feedback from nurses on both units has suggested that the rotation is beneficial and nurses are developing additional skills. It has also provided the opportunity to get to know our colleagues and develop stronger professional relationships. The work to date will ensure that we have a modern workforce in preparation for moving into Phase 2 of the New Children's Hospital.

In summary, there has been significant change during the last year. Despite this, we have continued to have a low number of staff leaving [turnover 6.3%] and our vacancy factor is currently 7.4 whole time equivalents. The Paediatric Critical Care Rotation continues to be an attractive opportunity for newly qualified staff and has resulted in four nurses returning to P.I.C. to take up substantive posts this year. The nursing team have worked hard to develop staff in the absence of a Practice Development nurse, which we are optimistic of recruiting to in the near future. We have continued to offer retrieval 24 hours a day relentlessly to the children of Wales and this has been largely due to the continued commitment of the senior nursing team.

We are all looking forward to another year during which the paediatric critical care team will continue to develop with a joint educator working across both the P.I.C. and P.H.D.U. We are committed to working in conjunction with the W.A.G. Standards for Critically Ill Children and have audited the service we provide in relation to the National Service Framework for Children, Young People and Maternity Services in Wales [2004].

## **Pharmacy Report**

### **Postholder – Ms Zoë Taylor Clinical pharmacy role on PICU**

A specialist clinical pharmacist visits PICU every day Monday to Friday. Their role is to promote the safe and effective use of medicines. All medications for every child are reviewed daily to check that they are appropriate for the age, weight and clinical condition of the child. The pre admission drug history will be checked with the parent/carer, GP or referring hospital.

Throughout the child's stay on PICU the pharmacist will advise on:

- Therapeutic drug monitoring,
- Drug dose adjustments in renal and hepatic failure
- Drug interactions
- Suspected adverse reactions to drugs
- Formulations of medicines
- IV compatibility issues
- Parenteral nutrition

The pharmacist will also provide advice in the preparation of guidelines and protocols, help with drug related audits, review any medication incidents and help with education and training.

To ensure as seamless care as possible, the pharmacist will contact the paediatric pharmacist from the ward or referring hospital that the child returns to once they leave PICU to hand over any pharmaceutical issues and answer any questions.

The pharmacist's role is to work as part of the multidisciplinary PICU team to ensure the best care possible for our patients.

## **The Physiotherapy Service**

### **Postholders – Miss Mererid Jones Miss Kate Williams**

The specialist physiotherapy service to the unit is led and delivered by Mererid Jones PICU/Respiratory Paediatric Physiotherapist (Band 7) and Kate Williams PICU/Trauma & Orthopaedic Paediatric Physiotherapist (Band 7) with input from other specialist senior Paediatric Physiotherapists where indicated eg: neuro and oncology. Monday-Friday 8.00am – 4.30pm

Physiotherapy is provided on Saturday, Sunday and Bank Holidays via an emergency duty rota 9.00am – 4.30pm and a bleep service between 4.30pm – 7.30am (with a scheduled evening service 7.00pm – 10.30pm).

There is ongoing clinical education for the Physiotherapy staff to ensure consistent standards of Physiotherapy across the 24 hour period.

Teaching sessions for SpRs and new nurses regarding the role of physiotherapy in PICU are being undertaken as part of their induction programme.

### **Dietician's Report**

#### **Postholder – Mrs Sue John**

Dietetic advice is provided on the morning ward round five days a week. Developments implemented in the previous years have been maintained and may be enhanced by the introduction of analytical software programme which will benefit the unit by providing a profile of the macro and micro nutrient content of all enteral feeds used on PICU, thus making sure that the child's requirements are met.

To ensure continued awareness of the critically ill child, a rolling education programme is in place.

The dietician continues to liaise with colleagues, both within and outside the Trust to guarantee a seamless service.

### **Clinical Psychology Support for PICU**

#### **Postholder – Dr Jan Hill-Tout**

#### **Consultant Clinical Psychologist for the Critical Care Directorate**

The Critical Care Directorate, Cardiff and Vale NHS Trust, employs a Clinical Psychologist with an organisational health and employee wellbeing remit. Evidence suggests that employee wellbeing is strongly influenced by organisational factors and the Clinical Psychology service is designed to deliver individual and whole system support. In addition research has identified links between individual wellbeing, team working and communication, and patient outcomes. Management culture is also an important factor in overall organisational health, and the HSE are currently working with 5 Trusts across the UK, including Cardiff and Vale, to identify the management behaviours that are most strongly linked to workplace wellbeing.

Audit has featured prominently in the service this year. In addition to the annual Organisational Health Monitoring audit, there has also been an audit of the HSE Standard for the management of relationships at work. Both of these exercises support the service to identify service strengths and also factors that may need to be addressed. In addition for the last 12 months all nursing staff leaving the Directorate, including PICU staff, have been offered an exit interview. This information has been anonymised and fed back to senior staff as an aid to recruitment and retention.

One to one support has been enhanced this year by the development of a Trust wide staff counselling service. This new service offers confidential appointments to staff away from the work area and is by self referral only. This service has been actively promoted and all existing staff and new starters

have been issued with contact details. This year has also seen a repeat of the successful E to F Grade development programme and an article about this was published in the Health Service Journal in February. Team and multidisciplinary working continues to be a high priority in PIC and the Clinical Psychology Service undertakes a range of facilitation work to support this. Other services available and accessed by PICU include training events, incident debriefing and management consultation.

### **Family Bereavement Support**

**Laura Thomas**  
**Sister - PICU**

Family support remains a priority within PICU. We continue to audit the service we provide for children and their parents through written and verbal feedback, and by direct observation of care.

During the past year, we have been liaising with the "Contact a Family" charity to improve the follow up support we offer to families. We are very hopeful that by working together, we can make a huge difference to these families lives following a traumatic experience such as a PICU admission.

In November 2005, we held our third annual memorial service to remember the children who had died on PICU. It was very well attended with numbers in excess of 200. Many staff members were involved in the organisation and in reading poems and prayers. We were honoured to have an orchestra in attendance led by parents, in memory of their son.

It was good to see many parents returning for the third year, who take comfort from the opportunity to remember their children, and meet other parents at this annual event.

## **CHAPTER 3**

### **THE REGIONAL PAEDIATRIC CRITICAL CARE SERVICE**

There is a requirement with a centralised service to provide a regional service including a retrieval service

We have continued with a proactive approach in order to ensure that all parties caring for a critically ill child have equal input into, and ownership of the Regional Paediatric Intensive Care Service.

The establishment of a central Paediatric Intensive Care Service caused concern in many quarters that skills would be lost by health professions in hospitals throughout the region. Consequently, part of our remit in the establishment of the service was to ensure a high standard of education, in order that those skills that exist should be supported, as well as improving knowledge and expertise. We continue to provide education at a number of levels.

#### **Regional Education and Training Report**

**Alison Oliver**

**Regional Training and Development nurse for PIC Services in Wales**

This year training has continued in a similar fashion to previous years. A delay however in the agreement for the budget by Health Commission Wales has resulted in fewer staff being able to access training. This is because units were dealing with increased patient activity during the winter months and therefore senior medics and nurses found it more difficult to release staff.

One national and one local Stabilization of the Critically Ill Child Study Days were provided. The local course was held for the middle of our referral region and therefore Merthyr, Bridgend and Royal Glamorgan were invited to attend. Many nurses attended but again few medics could be released. The day evaluated well.

The national course was a great success and plans are already underway for another course this May.

Numerous visits across Wales took place again this year providing training and education, communicating and providing feedback. It has been a difficult time for colleagues in the network as there is uncertainty of how the reconfiguration of services will affect all trusts. The introduction of agenda for change has also caused the workforce to be unsettled this year with disappointment for some trust staff.

The commitment of senior nurses to their staff still enabled visitors to attend days on the PIC unit working alongside myself. This was funded for both nurses and medics and the uptake from nurses has been good. The feedback has been positive and it is hoped that these opportunities will continue.

Unfortunately North Wales have been somewhat neglected this year as time commitments to the South have not enabled me to travel up there as often as I would have liked. However I have been involved in the work for the future development of the formal Managed Clinical Network for the critically ill child and look forward to its further development. I have also visited the North's lead centre to try to enable visitors to spend time on the unit at Alder Hey as they do in Cardiff. This work is ongoing.

The Foundation in Caring for the acutely ill child course continues in Swansea but Cardiff did not run a course this year. Lead Centre staff are providing sessions on it. Teaching commitments also continue to the MSc in critical care and the pre registration training course.

The plan from the Critical Care Network Group was for this post to evolve into an All Wales Nurse Consultant post. The job description was approved by Health Profession Wales in 2004 and funding approved by Health Commission Wales. The post was advertised in December 2004, but there were no suitably qualified applicants. Uncertainty surrounding the funding of this post during the last financial year has meant that, to date we have been unable to resadvertise this post. Discussions continue, as we believe this post is central to the Paediatric Critical Care Network.

## **EDUCATION – Dr Malcolm Gajraj**

### **Education**

Education remains a high priority for our unit. We are keen to develop our staff, existing and new, and this is facilitated with in-house training days as well as encouragement to enrol in nationally delivered courses, leading to additional qualification and improved service delivery.

However, it is readily apparent that our unit is only a part of the network. In order to provide a successful service, children must be resuscitated and stabilised prior to our input. This is achieved to an excellent standard, despite concerns that personnel might become deskilled over time. This fear has not been realised but remains a risk. In acknowledgement of this risk, we have actively encouraged visits to our unit for medical and nursing staff, providing refreshers and some new information. We continue to deliver our programme of stabilisation courses. There are two separate days, each concentrating on different aspects and have been well received. Moreover, in acknowledging the expertise present throughout the region, increasing amounts of the teaching is delivered by non-PICU staff, enhancing their own confidence and providing useful links locally. The nationally advertised 2-day course continues to attract a high level of interest, with excellent feedback from participants. Ad-hoc teaching sessions are also arranged by liaison with link PICU consultants.

We also have a responsibility to the consultants of the future and endeavour to provide our trainees with skills and knowledge that will be helpful to them as the anaesthetists and paediatricians of the future. Our curriculum has

developed with the help of their feedback and now includes topics such as ethics, consent and communication, alongside the more obvious pathophysiological subject matter. We were well evaluated for our training day for PICS, and will continue to offer this.

We continue to contribute to the generic paediatric SpR training, and provide a small input into UWCM undergraduate teaching. We have generated a paediatric module for the MSc in Critical Care, and provide teaching on the course. A critical care module for the MSc in Child Health is currently in production.

We contribute regularly to in-house paediatric teaching and the UHW paediatric grand round.

Allan Wardhaugh has this year, become involved in setting special study modules for undergraduate medical students. An excellent article by one of the students is included at the end of this report.

### **Stabilisation of the Critically Ill Child Course - Mark Price 5<sup>th</sup> & 6<sup>th</sup> May 2005 City Hall , Cardiff**

#### **Organisers: Dr Mark Price and Dr Allan Wardhaugh**

In May of last year this two day national course was run within the historic environs of the City Hall, Cardiff. The format was a mixture of lectures and small group teaching.

The course aims to provide education and guidance on the initial management of the critically ill child presenting to a District General Hospital. Consultant and senior trainees from anaesthetics and paediatrics attended from all geographical points within the United Kingdom.

The course was rapidly oversubscribed and the feedback and final structured evaluation were extremely positive. This was the second successful running of the course, with a future course to be held at the same venue in 2006.

### **STABILISATION OF THE CRITICALLY ILL CHILD STUDY DAYS**

| <b>Hospital</b>                                      | <b>Date</b>                    |
|--|--------------------------------|
| West Wales General Hospital<br>(Stabilisation Day I) | 16 <sup>th</sup> February 2005 |

The following contact numbers may be of use to staff that need access to courses outlined in the Standards:

|                                       |  |
|---------------------------------------|--|
| Resuscitation Officer – Gwent<br>APLS | Angela Barber<br>Royal Gwent Hospital<br>Newport<br>Tel: 01633 234234              |
| Resuscitation Co-ordinator<br>APLS    | Kate Graham<br>University Hospital of Wales<br>Cardiff<br>Tel: 029 20748297        |
| Resuscitation Officer<br>APLS/PALS    | Cheryl Morling<br>Ysbyty Gwynedd<br>Bangor<br>Tel: 01248 384384                    |
| Resuscitation Officer-<br>PALS        | Harry Stephens<br>Prince Charles Hospital<br>Merthyr<br>Tel: 01685 721721          |
| Resuscitation Officer                 | David Edwards<br>Wrexham Maelor Hospital<br>Wrexham<br>Tel: 01978 727409           |
| Child Health Education                | Fay Valentine<br>Eastgate House<br>Newport Road Cardiff<br>Tel: 029 20927732       |
| Child Health Education                | Carwyn Earles<br>University of Swansea<br>Sketty Road Swansea<br>Tel: 01792 295789 |

## REGIONAL NETWORK MEETINGS

The following table shows the details of all the Multidisciplinary and Nursing Meetings held:

| HOSPITAL                    | Multi Disciplinary Visit | Nursing Visit             |
|-----------------------------|--------------------------|---------------------------|
| Singleton Hospital          | 20 Oct 2005              |                           |
| Morrison Hospital           | 21 June 2005             | 8 April 05                |
| Royal Glamorgan Hospital    | 24 Nov 2005              |                           |
| Princess of Wales Hospital  | 28 June 2005             | 20 Sept 2005              |
| West Wales General Hospital | 22 Sept 2005             | 18 Oct 2005               |
| Withybush General Hospital  | 22 Sept 2005             |                           |
| Prince Phillip Hospital     | 22 Sept 2005             |                           |
| Neath/Port Talbot Hospital  | 20 Oct 2005              |                           |
| Prince Charles Hospital     | 5 July 2005              |                           |
| Llandough Hospital          |                          |                           |
| Nevill Hall Hospital        | 6 Dec 2005               |                           |
| Bronglais Hospital          | 22 Sept 2005             |                           |
| Brecon Memorial Hospital    |                          |                           |
| Royal Gwent Hospital        | 23 Nov 2005              |                           |
| Glan Clwyd Hospital         | N/A                      |                           |
| Ysbyty Gwynedd Hospital     | N/A                      |                           |
| Wrexham Maelor Hospital     | N/A                      |                           |
| Alder Hey Hospital          | N/A                      | 10 <sup>th</sup> May 2005 |

### Nursing Teaching Days

|                   |  |  |
|-------------------|--|--|
| Princess of Wales | 16 <sup>th</sup> Nov 2005<br>23 <sup>rd</sup> Nov 2005 |  |
| Aberystwyth       | 29 <sup>th</sup> Nov 2005                              |  |

As can be seen from the table, multidisciplinary meetings have been held with all our referring hospitals. These have enabled clinicians to clarify issues in relation to the service and make suggestions on future developments as well as providing the opportunity to discuss referred/retrieved patients. These meetings will continue on a yearly/twice yearly basis depending on the number of referrals from each hospital.

### **Future Plans for the Network**

Each PICU Consultant is linked to a group of hospitals. He/She is responsible for arranging the joint audit and feedback session at that hospital.

| <b>HOSPITAL</b>            | <b>DGH LINK</b>               | <b>PICU LINK</b> |
|----------------------------|-------------------------------|------------------|
| Singleton Hospital         | Ingo Scholler                 | Rim Al-Samsam    |
| Morrison Hospital          | Rachel Evans/<br>Wynne Rogers | Rim Al-Samsam    |
| Royal Glamorgan Hospital   | Lynne Millar-Jones            | Damian Pryor     |
| Prince Charles Hospital    | David Deekollu                | Damian Pryor     |
| Princess of Wales Hospital | Nirupa d'Souza                | Damian Pryor     |
| Bronglais Hospital         | John Williams                 | Allan Wardhaugh  |
| West Wales Hospital        | Vinay Saxena                  | Allan Wardhaugh  |
| Withybush Hospital         | Gustav Vas Falcao             | Allan Wardhaugh  |
| Prince Phillip Hospital    | via West Wales                | Allan Wardhaugh  |
| Neath/Port Talbot Hospital | via Singleton                 | Rim Al-Samsam    |
| Nevill Hall Hospital       | Marcus Pierrepoint            | Malcolm Gajraj   |
| Royal Gwent Hospital       | Marion Schmidt                | Malcolm Gajraj   |

### **Children & Young People's Specialised Services Project (CYPSS)**

We, in line with paediatric colleagues across Wales continue to work with the CYPSS with the aim of developing the "informal" network we have set up over the past 6 years from the lead centre into a formal Managed Clinical Network.

## CHAPTER 4

### UTILISATION OF THE LEAD CENTRE PAEDIATRIC INTENSIVE CARE UNIT

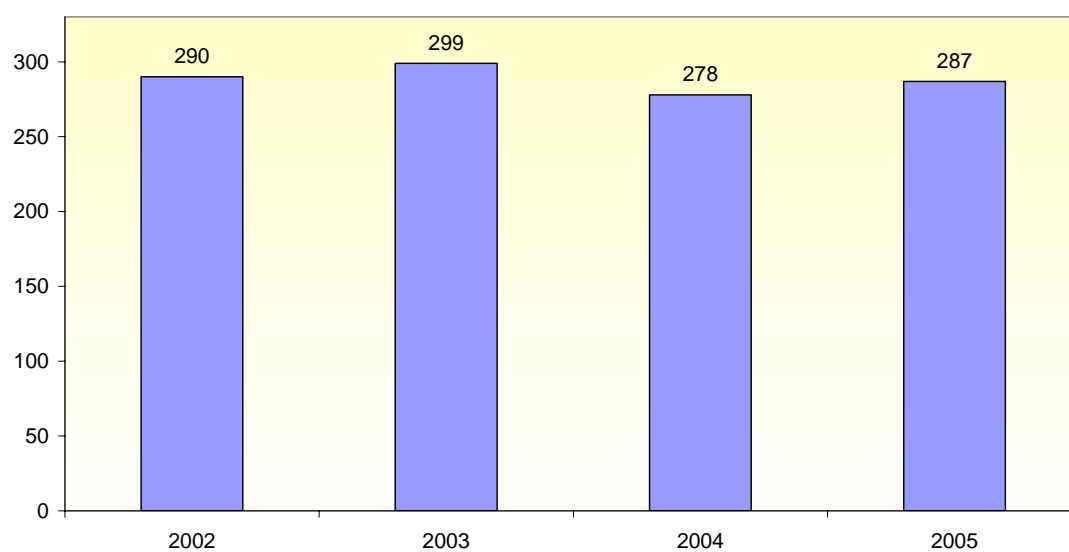
#### PICU inpatient activity

The data presented here are those for the period 1<sup>st</sup> January – 31<sup>st</sup> December 2005.

#### Overall admissions

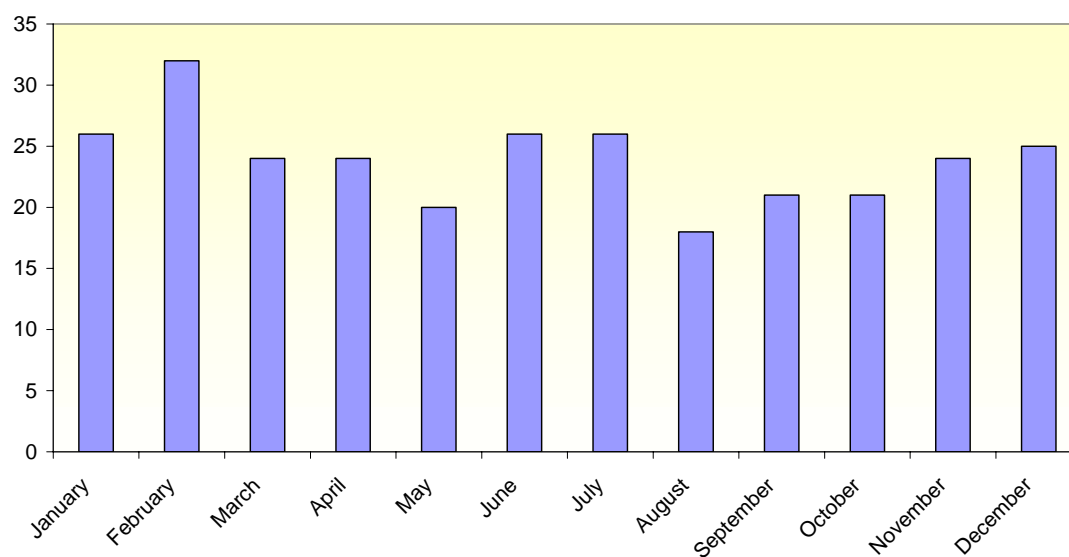
A total of 287 patients were admitted to PICU, an increase of 20 in the last report

#### Annual admissions



The monthly admission figures are shown below.

#### 2005 admissions



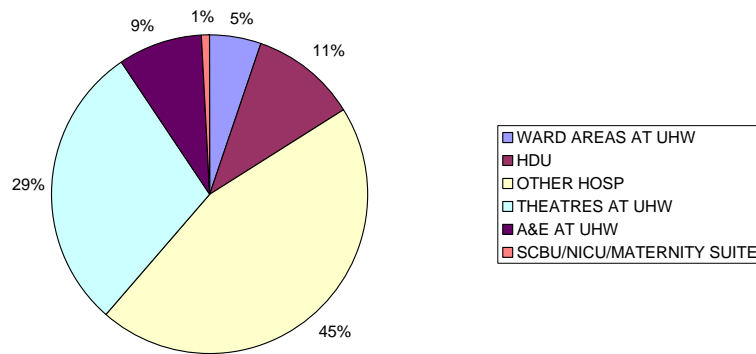
In comparing admission figures with other institutions, it has to be borne in mind that there may be differing admission criteria. PIM will help to adjust for this in analysing outcomes, but in terms of comparing the clinical throughput of level 2 patients in a unit, the number of ventilator days is useful – nearly all level 2 patients will be ventilated.

69% of patients received invasive ventilation at some point during their PICU admission – the national average is 57.9%.

As we do not have a paediatric cardiac surgical unit, our unplanned admissions are 69% compared with an average of 61.7% for the UK.

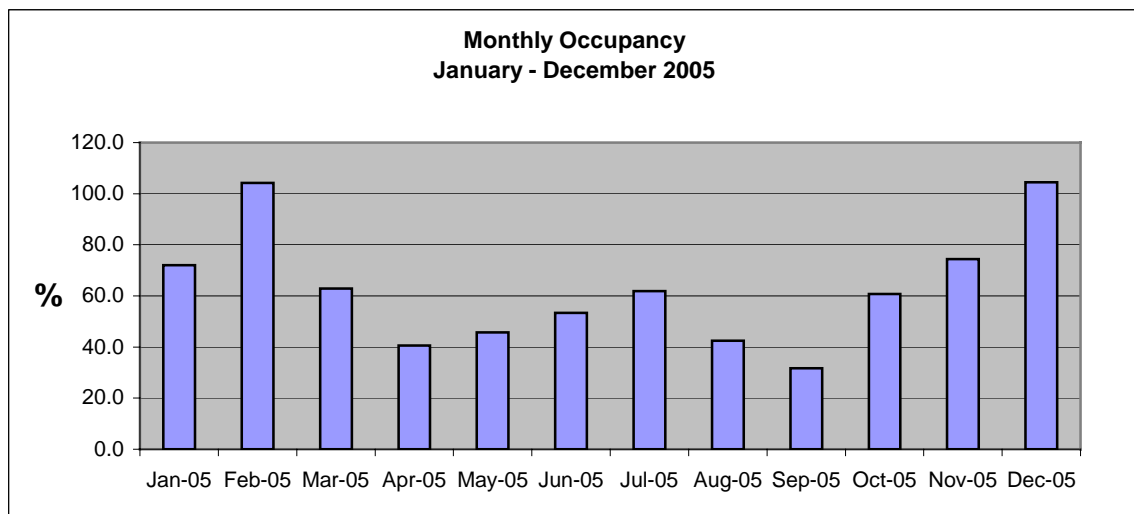
### SOURCE OF ADMISSION

Source of admission 2004-5

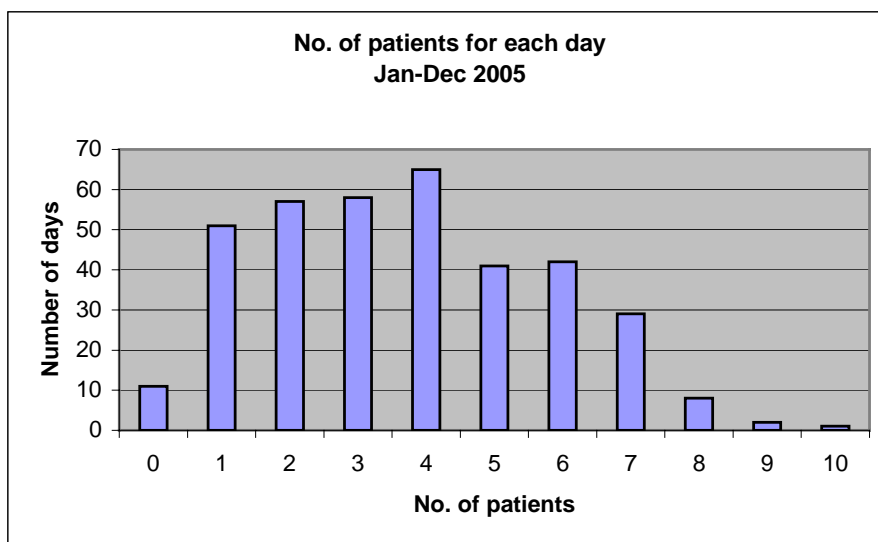


### BED OCCUPANCY

Occupancy is shown below. Again, this reflects the marked winter peak in admissions.



The occupancy figures are often below 60% during the summer months, but this is a consequence of the need to accommodate seasonal swings in demand. The unit remains commissioned for 6 beds and an additional bed to allow a retrieval with the flexibility to expand to 8 beds with an additional retrieval bed. This flexibility has enabled the service to remain open on every day this year, with us not having to turn down any admissions. On 8 days there were more than 7 patients and on 29 days there were exactly 7 patients. Without the flexibility therefore, the service would have been "closed" on 37 days of the year.



### Length of stay by age

The graph below is taken from the PICANet report and shows the median length of stay compared to other UK trusts – Cardiff and Vale is NHS trust C.

| NHS trust | Age group (years) |       |        |       |        |         |        |         |
|-----------|-------------------|-------|--------|-------|--------|---------|--------|---------|
|           | < 1               |       | 1-4    |       | 5-10   |         | 11-15  |         |
|           | Median            | (IQR) | Median | (IQR) | Median | (IQR)   | Median | (IQR)   |
| A         | 3                 | (2-8) | 2      | (2-5) | 2      | (2-4)   | 2      | (2-3)   |
| B         | 2                 | (1-2) | 2      | (1-3) | 2      | (1-2)   | 2      | (1-3)   |
| C         | 4                 | (2-7) | 3      | (2-7) | 2      | (2-5)   | 2      | (2-3.5) |
| D         | 4                 | (2-7) | 3      | (2-7) | 2      | (2-5)   | 3      | (2-6)   |
| E         | 5                 | (3-8) | 3      | (2-8) | 3      | (2-5)   | 3      | (2-6)   |
| F         | 4                 | (2-8) | 3      | (2-4) | 3      | (2-5)   | 2      | (2-3)   |
| G         | 2                 | (1-8) | 4      | (2-8) | 3      | (2-4)   | 3      | (2-4)   |
| H         | 3                 | (2-8) | 2      | (2-5) | 3      | (2-5)   | 3      | (2-5)   |
| I         | 4                 | (2-7) | 2      | (2-4) | 2      | (2-3)   | 3      | (2-4)   |
| J         | 2                 | (2-3) | 2      | (1-2) | 2      | (1-2)   | 2      | (1-2)   |
| K         | 4                 | (2-8) | 2      | (2-5) | 2      | (2-3)   | 2      | (2-4)   |
| L         | 4                 | (2-7) | 2      | (2-5) | 2      | (2-4)   | 2      | (2-3)   |
| M         | 4                 | (2-8) | 2      | (2-5) | 3      | (2-4.5) | 2      | (2-4)   |
| N         | 4                 | (2-7) | 2      | (2-5) | 2      | (2-3)   | 2      | (2-6)   |
| O         | 4.5               | (2-8) | 3      | (2-5) | 2      | (2-3)   | 2      | (2-3)   |
| P         | 4                 | (2-7) | 2      | (2-6) | 2      | (2-4)   | 2      | (2-4)   |
| Q         | 4                 | (2-7) | 3      | (2-6) | 2      | (2-5)   | 2      | (2-3)   |
| R         | 3                 | (2-5) | 2      | (2-4) | 2      | (2-5)   | 2      | (2-4)   |
| S         | 3                 | (2-7) | 2      | (1-3) | 2      | (2-3)   | 2      | (2-4)   |
| T         | 2                 | (2-5) | 2      | (2-4) | 2      | (2-4)   | 3      | (2-4)   |
| U         | 5                 | (3-8) | 3      | (2-8) | 3      | (2-5)   | 2      | (2-5)   |
| V         | 4                 | (2-8) | 2      | (2-4) | 2      | (2-5)   | 3      | (2-5)   |
| W         | 4                 | (3-8) | 3      | (2-5) | 3      | (2-5)   | 3      | (2-4)   |
| X         | 3                 | (1-7) | 2      | (1-3) | 1      | (1-2)   | 2      | (1-3)   |
| Y         | 4                 | (3-8) | 3      | (2-8) | 3      | (2-4.5) | 3      | (2-4)   |

## OUTCOMES

### *Crude mortality*

There have been 12 deaths on PICU in the last year. This gives a crude mortality rate of 5%. The crude mortality in the last PICANet interim report for all participating units is 5%.

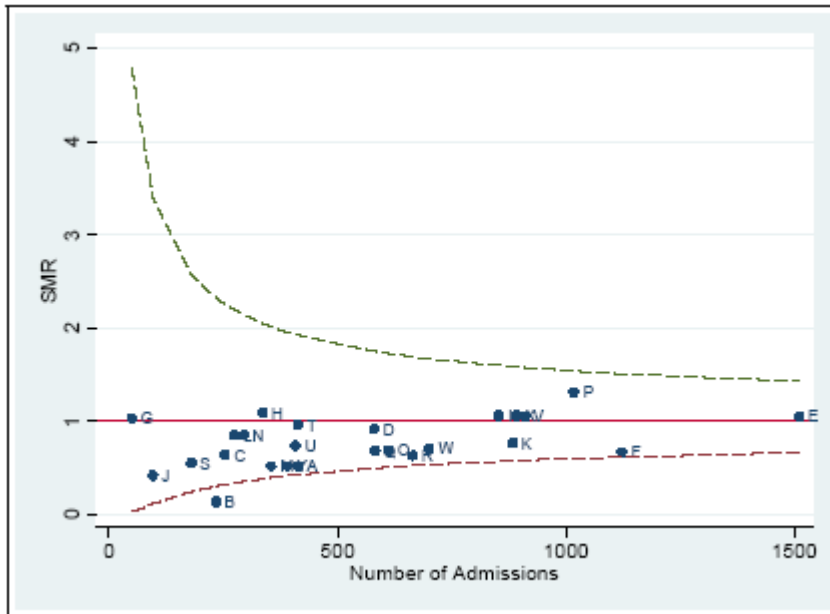
The crude mortality rate does not take account of illness severity and case-mix. This is adjusted for using the Paediatric Index of Mortality (PIM), from which a standardised mortality ratio (SMR) can be calculated. A SMR of less than 1 means there were fewer deaths than the PIM model predicted. The table below shows the SMR for the last 7 years data, and allows the calculation of the cumulative SMR for the unit.

| Year      | Crude mortality rate | SMR         |
|-----------|----------------------|-------------|
| 1999-2000 | 5.60%                | <b>0.56</b> |
| 2000-2001 | 5.30%                | <b>0.63</b> |
| 2001-2002 | 3.80%                | <b>0.40</b> |
| 2002-2003 | 6.40%                | <b>0.63</b> |
| 2003-2004 | 6.80%                | <b>0.67</b> |
| 2004-2005 | 6.70%                | <b>0.58</b> |
| 2005      | 5%                   | <b>0.64</b> |

PIM is inaccurate for calculating SMR if the number of expected deaths is less than 20, so the annual SMR is less reliable than the cumulative SMR. However, analyzing cumulative SMR over a long period of time may mask a relatively sudden change in mortality rate. PICANET data show our cumulative SMR for 2004-5 is 0.66 (95% CI 0.37 – 1.06) which is well within the expected range.

The table will report calendar year as opposed to financial year from now on, as this is how PICANET returns the information to us.

The following graph is from the PICANet report 2005 giving a UK perspective of outcomes using PIM. The South Wales unit is represented by the letter C.

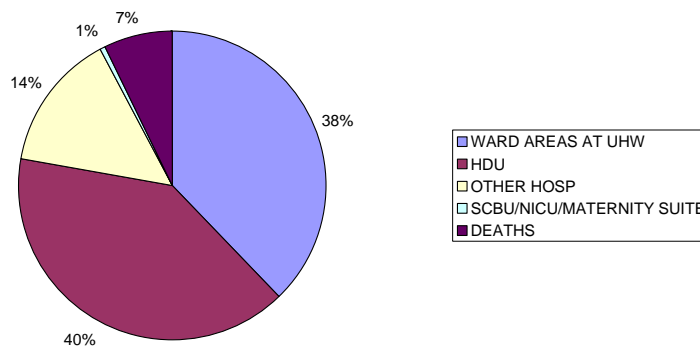


*PICU risk adjusted (PIM) standardised mortality ratios by NHS Trust with 99.9% control limits 2005<sup>1</sup>*

### **DESTINATION ON DISCHARGE**

Our aim is to discharge children back to their referring hospital as soon as possible. However, the majority are discharged to step down HDU care, and many of the others are discharged to wards at UHW for continued involvement of tertiary paediatric specialty input.

Discharge destination



<sup>1</sup> Paediatric Intensive Care Audit Network, MRC Unit Sheffield. May 2006.

## **CHAPTER 4**

### **PAEDIATRIC HIGH DEPENDENCY CARE AT THE LEAD CENTRE**

In June 2003 a briefing was provided to Health Commission Wales on the proposed work of improving the interface between PIC and PHDU at UHW. It stated that an appropriately commissioned and staffed HDU can also avoid certain children being admitted to PIC, by providing adequate step up care from the wards.

The most cost effective and efficient use of resources would be achieved by a combined multi-speciality HDU (NHS Executive 2001). A joint group was set up with membership from PICU and HDU to review the current service.

This group agreed :

- 1 The vision for the service :
  - 24 hour, 7 days a week, consultant led service
  - Physically integrated facilities, service and workforce
  - Shared Training/Competency Frameworks: Nursing, SpRs and SHOs
  - Shared audit in place
  - Access to specific skills in medical and nursing staff
  
- 2 A plan for achieving the vision Phase I (9<sup>th</sup> November 2003 to May 2004). Utilization of the 8<sup>th</sup> and 9<sup>th</sup> beds on PICU (not currently commissioned by HCW) as paediatric critical care beds. This has provided opportunities for training and development in paediatric critical care for identified nurses from the Child Health Directorate.

There has also been a specific consultant rota for covering HDU utilising general paediatricians who have some background in critical care and the paediatric intensivists.

A formal evaluation demonstrated benefits to staff as well as patients and highlighted factors that would need to be addressed in designing a new integrated critical care unit as part of Phase II of the Children's Hospital.

#### **PHASE II**

We have now moved forward to the second phase of the integration. The two beds have been relocated within the Paediatric HDU.

The joint consultant rota continues and there will now be a two way rotation of D/E grade nurses between HDU and PICU nurses.

The nursing team is now managed as an integrated workforce. This is initially as a pilot until December 2005. It is anticipated that this will form a sound basis for the development of a skilled paediatric critical care workforce in preparation for an integrated unit in Phase II of the Children's Hospital for Wales.

## CHAPTER 5

### THE RETRIEVAL SERVICE



#### RETRIEVAL AND TRANSPORT ACTIVITY

The consultant delivered retrieval service continues to perform well. There are 6 consultants and one staff grade delivering medical input, 12 nurses and 5 ambulance crew. Our commissioned remit is to be able to offer retrieval for 95% of the year. This is largely due to the good will of our nursing staff in providing cover for the service beyond their required commitment. We are continuing to train more nursing staff to undertake retrievals, so we should become less reliant on staff sacrificing their time off.

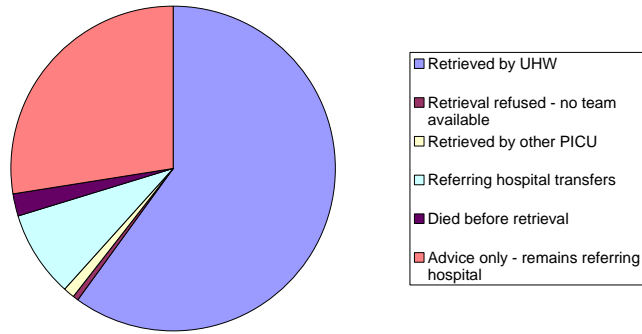
196 calls were made to the service to discuss retrieval, and 108 cases were retrieved by the PICU team – this is the same number as last year.

7 cases were transported to PICU by the referring hospital – 2 were patients transferred in by the Bristol team, 3 were neurosurgical emergencies, one child had acute upper airway obstruction secondary to a foreign body, and one was transferred to us by the neonatal team as there was no surgical neonatal cot available.

No retrievals were refused because of lack of staff or beds. The clinicians at the District General Hospital made the decision to observe the other patient and he improved.

| Months        | Retrieved by UHW | Transferred by us to other PICU | Retrieval refused - no team available | 2 South West of England Patients trans in | Referring hospital transfers | Died before retrieval | Advice only – remain referring hospital |
|---------------|------------------|---------------------------------|---------------------------------------|---|------------------------------|-----------------------|---|
| <b>Totals</b> | <b>108</b>       | <b>1</b>                        | <b>0</b>                              | <b>2</b>                                  | <b>5</b>                     | <b>2</b>              | <b>80</b>                               |

Outcome of referral calls

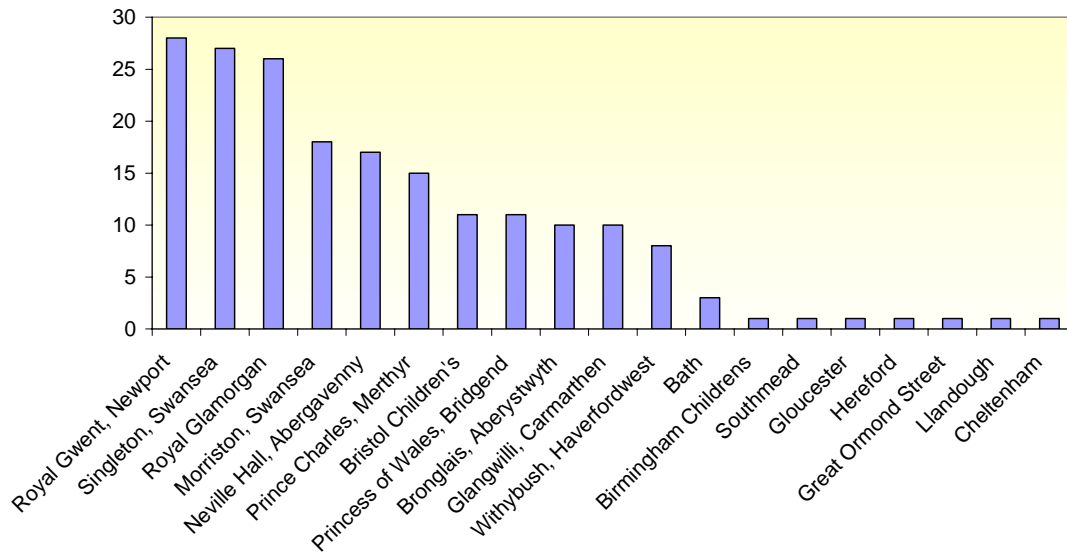


The breakdown of calls and retrievals for individual hospitals is shown below.

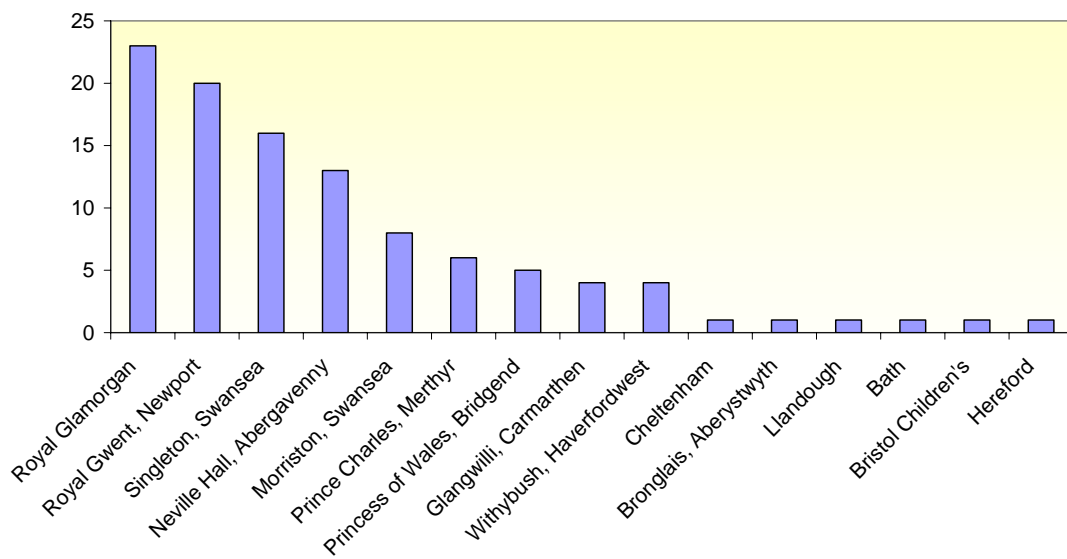
|           | Retrievals | Calls      |
|-----------|------------|------------|
| January   | 10         | 15         |
| February  | 15         | 20         |
| March     | 8          | 13         |
| April     | 11         | 15         |
| May       | 6          | 15         |
| June      | 6          | 13         |
| July      | 8          | 16         |
| August    | 9          | 15         |
| September | 6          | 12         |
| October   | 7          | 13         |
| November  | 11         | 23         |
| December  | 10         | 22         |
|           | <b>107</b> | <b>192</b> |

| <b>Hospitals - retrievals</b> |    |
|-------------------------------|----|
| Royal Glamorgan               | 23 |
| Royal Gwent, Newport          | 20 |
| Singleton, Swansea            | 16 |
| Nevill Hall, Abergavenny      | 13 |
| Morrison, Swansea             | 8  |
| Prince Charles, Merthyr       | 6  |
| Princess of Wales, Bridgend   | 5  |
| Glangwilli, Carmarthen        | 4  |
| Withybush, Haverfordwest      | 4  |
| Cheltenham                    | 1  |
| Bronglais, Aberystwyth        | 1  |
| Llandough                     | 1  |
| Bath                          | 1  |
| Bristol Children's            | 1  |
| Hereford                      | 1  |

### Referral calls by unit

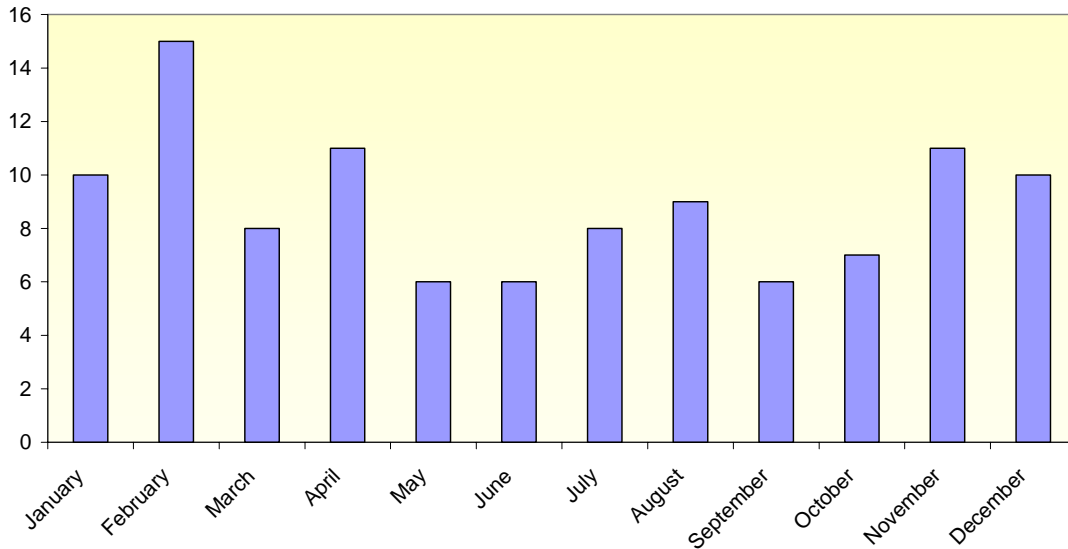


### Retrievals 2005



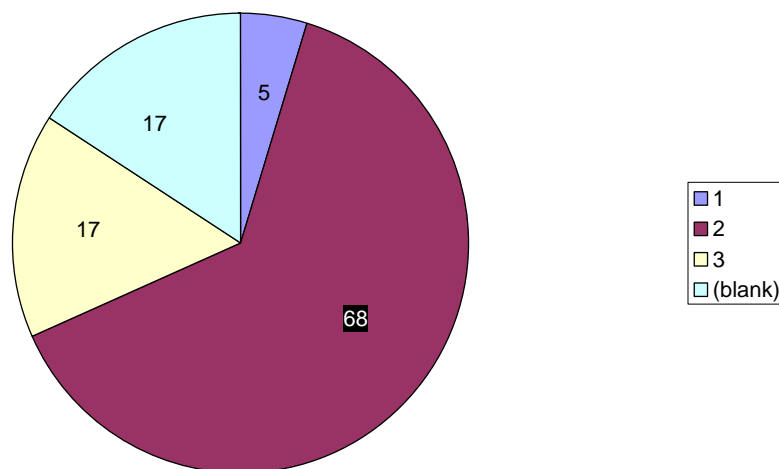
The service, not surprisingly shows seasonal variability. The monthly breakdown for calls and retrievals is shown below.

## 2005 retrievals



The level of illness in children retrieved, as defined by the Welsh Assembly Government standards document, is usually level 2. Level 1 cases (High Dependency) should be managed in the referring units as far as possible. In some cases these children may require tertiary referral, but not PICU involvement, and the retrieval team is not involved in these transfers. A few level 1 cases are still retrieved in exceptional circumstances, although the service is not commissioned to undertake these. This is usually explained by a rapid change in the patient's condition.

Levels of care for retrieved patients



Transfer of critically ill children who have been diagnosed with congenital heart disease, and require surgical evaluation are retrieved by Bristol Children's Hospital PICU retrieval team. We have an agreement with Bristol that we will retrieve these children if they are not available, but Bristol should be the first point of contact once transfer is deemed necessary. Neonatal units are not covered by this arrangement, and the organisation of neonatal services in South Wales is currently being reviewed separately by HCW. Neonates with congenital heart disease requiring retrieval can be discussed with Bristol, but the referring unit may need to undertake the transfer themselves.

## CHAPTER 7

### CLINICAL GOVERNANCE/AUDIT/RESEARCH

#### RIM AL-SAMSAM

##### Lead Centre Audit:

As part of the lead centre audit we continue to collect data for the all Wales Audit of Critically Ill Children and PICANet. These data are reported earlier in the report. We continue to collect also severity of illness data in the form of the Paediatric Index of Mortality. Our retrieval service is continually audited and we have monthly clinical governance sessions as well as quarterly morbidity and mortality meetings.

##### Research & Audit:

##### Ongoing Research:

- ***Cardiff and Vale Paediatric Early Warning System (C&VPEWS).***  
**Dawn Edwards, Alison Oliver, and Colin Powell**

Suboptimal care may contribute to physiological deterioration of patients with major consequences on morbidity, mortality and requirement for intensive care. Paediatric Early Warning System to identify children at risk of critical illness might be developed using simple physiological parameters suitable for bedside application.

Two Phase Study:

Phase 1: Validation of the Cardiff and Vale Paediatric Early Warning System.  
Phase 2: Effectiveness of a Paediatric Emergency Team activated by a paediatric early warning system.

- ***Correlation of Bilateral BIS with Comfort sedation score in assessing level of sedation in critically ill children.***  
**N Goodwin, M Price, M Chawathe, J Mecklenburgh, JE Hall**

Introduction: Adult work has shown BIS scores asymmetry when the right side was compared to the left. Bilateral BIS asymmetry has been demonstrated in children during recovery from anaesthesia, but not examined in Intensive Care. A case series was commenced investigating whether hemispherical asymmetry could be demonstrated in this group. The early data suggest that there is a significant difference between each hemisphere. This could have an impact on assessment of depth of sedation on Intensive Care, when BIS is used.

##### Publications:

- Do cuffed endotracheal tubes increase the risk of airway mucosal injury and post-extubation stridor in children?  
Ashtekar CS., Wardhaugh A. *Archives of Disease in Childhood.* 90(11):1198-9, 2005 Nov.

- The use of steroids in children with septicemia: review of the literature and assessment of current practice in PICUs in the UK.  
T. Hildebrandt, M. Mansour, and R. AL Samsam. *Pediatric Anesthesia* 15: 358–365, 2005.

### **Completed Non-Core Audit Project:**

- **Retrospective audit of blood transfusion practice in the PICU.**  
**Yifan Rannan-Eliya & R AL-Samsam.**

Retrospective notes review of PICU admission over a 10 weeks period. The aim was to identify patient who received any blood products and evaluate the adherence to the trust blood transfusion policy. Only 7 (65%) of possible 20 patients' records were obtainable therefore no firm conclusion could be drawn. Which highlight the difficulty in the system in obtaining notes for retrospective review. However, all 7 notes lacked documentation of the indication for transfusion. 6% of patient transfused had inadequate prescription. Almost half of these transfusion lacked documentation to prove proper checking of the product. Actions taken: The trust has already revised the blood transfusion policy which addresses the documentation and tracing of the products. The PICU will institute stamps to be used when any blood product is subscribed to document the indication, type and quantity of the specific blood product.

### **List of Ongoing Audits:**

1. Review of indication of the use of HFOV. M Joshi & Allan Wardhaugh
2. Compliance with Cardiff and Vale policy on writing prescriptions on PICU. Zoë Taylor, Alison Oliver and Allan Wardhaugh.
3. Accidental Extubation on PICU, Are there any common themes or system failures? Alison Oliver.
4. Audit: Children with a life-limiting illness who die in intensive care. Donna Khalil, Helen Fardy and Richard Hain.
5. Retrospective review of the initial management of PICU patient with status epilepticus in relation to the current APLS guideline. Damian Pryor.
6. Prospective review of PICU patient with Bronchiolitis. Damian Pryor.
7. A prospective audit of the adherence with the new TBI guideline protocol, Max Nathan and Rim AL-Samsam.

### **Project undertaken as apart of RCN Clinical Leadership Programme**

**Clinical leader Chris Morris**  
**G Grade team leader**

As part of the RCN clinical leadership I undertook observations of care on P.I.C.U and patient stories which in our case were parent stories. The purpose of the observations of care was to reflect and improve upon current practice with a senior nurse unfamiliar with this area and its specialism and therefore without bias.

The purpose of the parent stories was to look at the parent experience and areas in which this could be improved upon.

### **Observations of Care**

These took place on P.I.C.U over a period of 30 mins on 4 occasions. The area specified was observed by myself and another clinical leader. Everything observed was recorded and the written record was available to staff if they wished to read it. If any unsafe care/practice was observed then interventions would have been made. Observations of care was explained prior to commencing by as many people as possible being written to who may enter P.I.C.U during each episode.

#### **The following Areas for Improvement were identified.**

- Dirty cups on unit
- Paper cups in plastic bag next to water machine (? peoples hands clean when putting hand in bag)
- Chest drain knocked over on floor
- Nitric Oxide cylinder dragged along floor
- Redundant T.V. stands on wall
- Jugs containing water for suction (? how often changed)
- Contact numbers on walls were scruffy making some illegible
- Privacy when curtains around

#### **The following areas of Good Practice were identified**

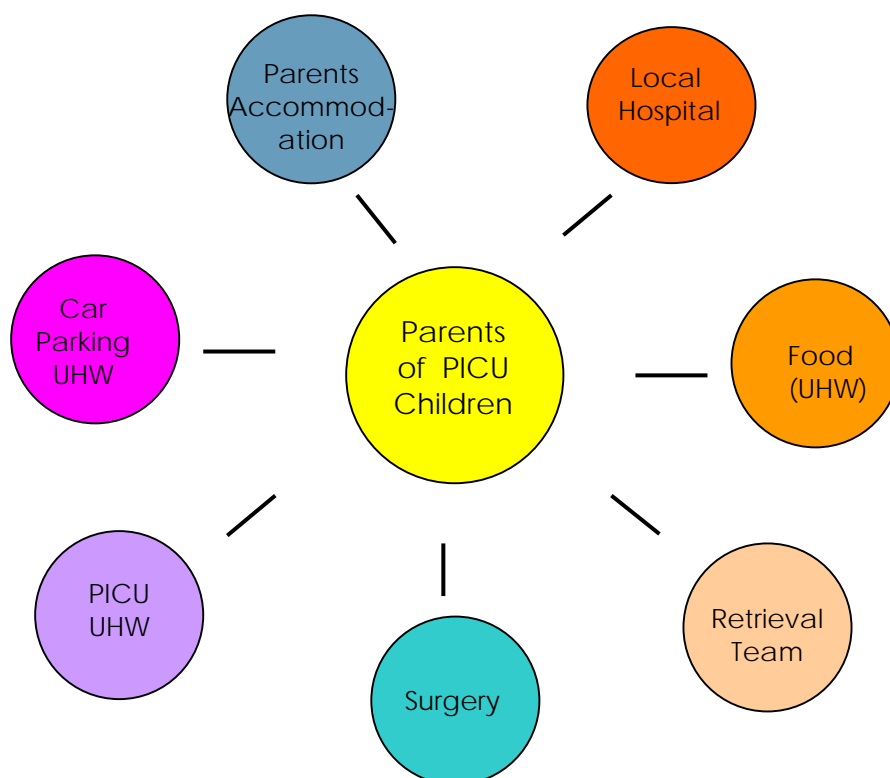
- Good atmosphere on P.I.C.U.
- Bright cheerful environment
- Good handwashing practice
- Excellent protocol for drug administration
- Good communication to patients and their families
- Uncluttered bed spaces, good storage

Feedback was given at the time to those observed and action plans were written for the areas of improvement. Further feedback will be presented to the paediatric intensive care unit management group and in poster format to the staff on the unit.

### **Patient Stories**

Six families were chosen at random who followed the set criteria which were children that required mechanical ventilation for more than 24 hours. The parents signed consent and were interviewed in private and the interview was taped with the tapes later being destroyed.

The common themes were mapped so that action plans were made (see diagram below).



**Some of the comments made by parents are identified below**

Staff were very friendly  
The unit was informal  
The doctors were always contactable  
Nothing negative about PICU  
Open visiting ideal  
Doctors and nurses "best of the best"  
Requested and saw a priest  
Fantastic support  
Consultant explains initially then nurses always followed info up  
PICU spotless

There were common themes amongst the parent stories. These issues will be fed back to the management team in PICU and acted upon by myself and others with the aim of improving the family experience during their admission. I found this exercise beneficial as I have worked in this clinical area for some time. It not only enabled me to view common practices and the clinical environment differently but will be useful in improving the experience for families in paediatric critical care.

**Student Selected Component 58**

**Transporting critically ill children between hospitals**

**The Centralisation of Paediatric Intensive Care Units and the  
role of Specialist Retrieval Teams**



**By James Davidson**

Supervised by Dr Allan Wardhaugh

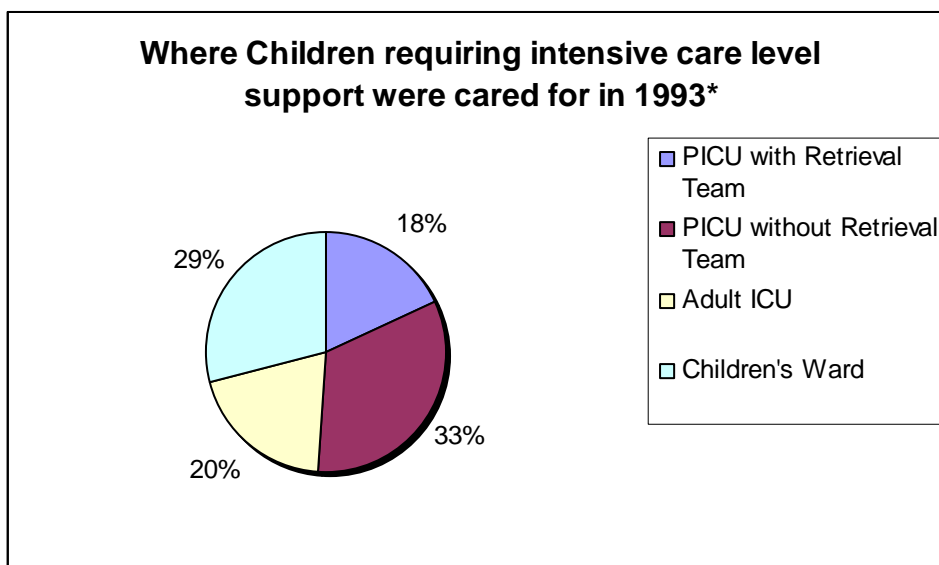
## Introduction

In 1997 the Department of Health published 'Paediatric Intensive Care: A framework for the future'; this document established the desired organisation of paediatric intensive care for England and Wales. It acknowledged that 'children needing intensive care should no longer be looked after in the inappropriate location of general children's wards' (1) and recommended that such children should receive care in specialised tertiary centres; staffed by doctors and nurses trained in PIC. In this essay I will detail the evidence and reasoning behind this decision and highlight the development and role of specialist retrieval teams as a consequence. [96]

### **How did paediatric intensive care develop and why was there a move towards centralisation?**

Paediatric Intensive Care is a high cost, low volume specialty that cares for the most critically ill children who require specialist intervention and organ system support. While the specialty developed from the 1960s onwards (2), based on the increased understanding that children 'have special healthcare needs because they are physically and emotionally different from adults,' (3) large numbers of critically ill children remained in the care of adult intensivists or by paediatricians on children's wards even during the 1990s. With the average admittance of children requiring intensive care at roughly 1.2 in 1000 children per year (4), the numbers are small yet significant.

A 1997 study from Scotland found that seven out of fourteen hospitals treating children requiring the level of care equivalent to a PICU received less than ten such patients a year (5). Even among the dedicated PICUs ten of the twenty-nine PICUs at the time had fewer than three beds and only six had ten or more (6). The fragmented provision of care made inefficient use of equipment and resources. Some units' staff had insufficient experience in the management of critically ill children, less than 2% of nurses in adult intensive care units had a children's nursing qualification (7). A working party report in 1993 by the British Paediatric Association came to this conclusion (8) commenting that PIC is 'fragmented into too many small units' (9) and highlighted serious concerns over staffing levels because 16% of patients were refused admission (10). The delivery of care to critically ill children was not universally meeting a satisfactory standard.



**Figure 1** - Provision of PICUs in 1993 (\*using data collected by the multidisciplinary working party on paediatric intensive care (11))

These inherent problems were tragically highlighted by the death of Nicholas Geldard in 1995, bringing the problem to national attention, forcing changes to be made in the structure of the service. The government announced extra money to fund more paediatric intensive care beds (12) and published 'Paediatric Intensive Care: A framework for the future' (13) setting out how the service should be developed. Drawing on research and models from other countries it became clear that a centralised paediatric intensive care network needed to be set up.

The centralisation of care leading to improved outcomes has been proven in cancer treatment (14) and major trauma (15). It is assumed that by concentrating patients into regional tertiary referral centres then the staff there will gain more experience in their management leading to better outcomes. However it must be mentioned at this point that studies suggest the opposite is true in adult intensive care (16) and in paediatric trauma care where, 'the increasing mortality... seen in the high volume centres may reflect over demand on resources' (17).

The main study proposing the case for centralisation is provided by Pearson et al. (18). This compared the performances of PICUs in the Trent region, where there was a fragmented PICU service and those in Victoria, Australia, which was highly centralised. The study showed that children were twice as likely to die in the Trent regions PICUs as in Victoria when comparing actual deaths to predicted deaths based on a paediatric index of mortality model. The inference from this was that between 200 and 700 children died in intensive care units in the UK a year because of poor standards of care. The study suggested that 'a centralised system staffed by full-time specialists in paediatric intensive care delivers a higher quality and much greater efficiency.' (19).

**Summary of 'Should paediatric care be centralised?  
Trent vs. Victoria'  
by Pearson, G. et al. (1997)**

|  | Trent              |        | Victoria        |                    |        |                 |
|--|--------------------|--------|-----------------|--------------------|--------|-----------------|
| Expected Mortality   | Number of Patients | Deaths | Expected Deaths | Number of Patients | Deaths | Expected Deaths |
| <1%  | 381                | 5      | 2.4             | 528                | 1      | 4.2             |
| 1-4%   | 374                | 17     | 8.4             | 416                | 7      | 9.5             |
| 5-14%  | 226                | 36     | 16.9            | 185                | 15     | 14.5            |
| 15-29%   | 11                 | 4      | 2.4             | 19                 | 8      | 4.2             |
| >30%   | 22                 | 12     | 12.2            | 46                 | 29     | 27.6            |
| <b>Totals</b>  | 1014               | 74     | 42.3            | 1194               | 60     | 60              |
| <b>'Preventable Deaths' -</b><br>(Differences between observed and predicted deaths) |                    |        | 31.7            |                    |        | 0               |

|   | Trent | Victoria |
|---|-------|----------|
| <i>Child ICU Admissions per 1000 children</i> | 1.22  | 1.18     |
| <i>Mean Length of Stay / days</i>             | 3.93  | 2.14     |
| <i>Child ICU Days per 1000 children</i>       | 4.80  | 2.53     |

**Table 1** - Data demonstrating the lower mortality rate associated with centralised paediatric intensive care (18).

The study does not outline whether there is a single factor responsible for the improved outcomes, but the 'combination of large units and full-time specialist staff is clearly beneficial' (20). The statistics produced in this study may have been misleading because the analysis was based on admissions data. Therefore many children in Australia were counted twice as they were transferred and so had two sets (21). The effect this had on the results is unclear; however this study is used as evidence to support the case for the centralisation of PICU.

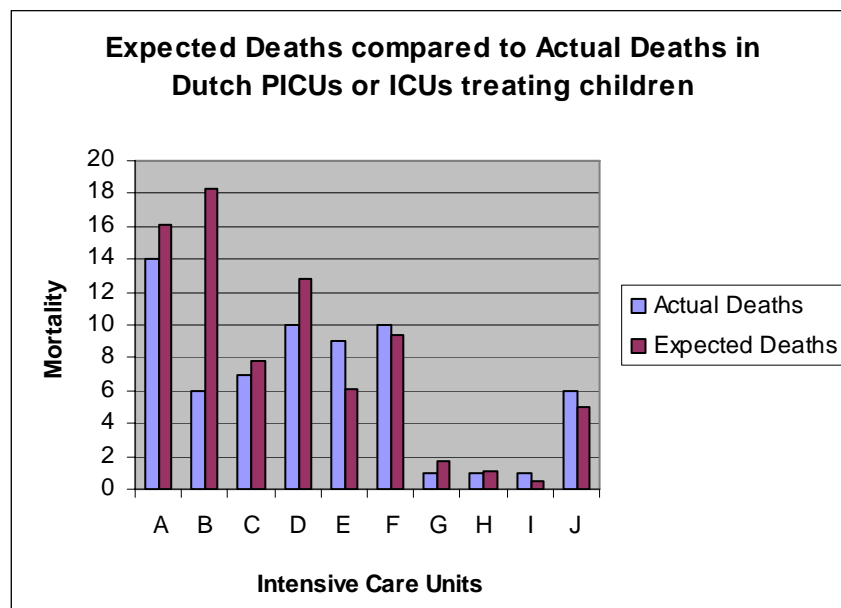
**Table 2** - Data highlighting the benefits in terms of efficiency of centralising paediatric intensive care when comparing areas with similar admissions rates (18).

A similar study from America (22) indicated that a patient in the highest risk group was eight times more likely to die in a non-tertiary centre than in a tertiary centre. The situation in Dutch PICUs was very similar; patients with the highest risk of mortality had a lower than predicted mortality when cared for in a tertiary unit (23). The evidence overall suggests that the centralisation of PICU would lead to a better standard of care for the patients. However any benefits of centralisation would need to outweigh the risks of carrying out retrievals. The South Thames service carried out four times their predicted number in 2000 (24) demonstrating the huge burden centralisation places on transport services.

Summary of 'Improved outcomes from tertiary center pediatric intensive care:  
 A statewide comparison of tertiary and non tertiary care facilities'  
 by Pollack, M.M. et al. (1991)

|   |
|---|
| <b>Mortality Risk Category</b><br>0-5%<br>5-30%<br>>30%   |
| <b>Totals</b><br>Expected (calculated using PRISM Scores)   |
| <b>Table 3</b> - Data comparing the expected and actual numbers of survivors and deaths in tertiary and non-tertiary PICUs in the state of Oregon and southwest Washington from June to November 1986. Expected values were calculated using the Paediatric Risk of Mortality score. The z scores indicate how close the figures are to the expected values (22). |
| <b>Z score</b>  |

Summary of 'Comparative assessment of pediatric intensive care: A national multicenter study' by Gemke, R.J.B.J. et al. (1995)



## Why should specialist retrieval teams be used to recover critically ill children?

**Figure 2** - Chart comparing the actual and expected numbers of deaths calculated using the PRISM score. A - F are tertiary centres and dedicated PICUs, G is a non-tertiary PICU facility, H - J are non-tertiary centres caring for children in adult ICUs (23).

Pollack observed that despite tertiary facilities having a transport rate double that of non-tertiary hospitals the associated increased risk was not found to be significant (25). However the transport process is potentially hazardous; a dedicated team with transport experience and refined protocols should in theory provide the safest option.

There are two ways of transporting a child from a receiving hospital to the regional PICU. The first is one-way transport; the patient is taken by staff from the referring hospital to the PICU. A second option would be to send a team from the tertiary centre to collect the child - this is termed two-way transport (26). The only advantage of one-way transport is that it should get the child to the tertiary centre faster. However in practice that may not be the case because a dedicated team is well rehearsed at assembling, has all the equipment prepared and transport pre-arranged. Non-specialised teams failed to depart within the first hour of deciding to transfer a child in 93% of cases (27). Response times of specialist teams vary significantly but an average time is about 100 to 120 minutes from the PICU receiving the call (28). On their arrival they usually spend an average of 70 minutes (29) stabilising the patient and it is unusual for the return journey to be under blue-light conditions (30) as this increases the risk of accidents and the chances of the patient deteriorating due to adverse transport physiology (31). While speed is important during a retrieval, for the majority of cases stabilising and establishing monitoring of the patient are more important determinants of a successful outcome. There are certainly cases of children dying before the retrieval team arrives, there were 4 deaths reported by the South Wales service of children dying before the team arrived in 2005 (32) and the South Thames service reported 5 in 2000 (33). Whether a faster response by the retrieval team would have altered the outcome is impossible to tell but the implementation of centralised care has been proven to decrease patient mortality.

While escorting staff from a referral hospital may be sufficiently able to deal with physiological deteriorations of the patient, it is the actual experience of transporting the patient that helps to avoid such complications. A study by Edge compared specialised and non-specialised transport teams, the results showed that while the occurrence of physiological deterioration was similar between the two groups, 11%, the rate of intensive care-related adverse events occurring was ten times less in the specialised teams. The data therefore suggests that a specialised team's value is in their experience in preparing the patient for transfer, they were better at sedating the patients and securing and intravenous lines and ventilating tubes. Also for the children with the highest morbidity there is an indication that specialised teams contribute to a decrease in the likelihood of an adverse event of any kind (34).

**Summary of 'Reduction of morbidity in interhospital transport by specialised pediatric staff' by Edge, W.E. et al. (1994)**

| Percentage of transports with adverse physiological events |               |
|--|---------------|
| <i>Specialised Team</i>                                    | M<br>sp<br>Te |
| 11%  | 12            |

**Table 4** - Data from Edge et al. (34) demonstrating differences in morbidity between specialised and non-specialised transport staff.

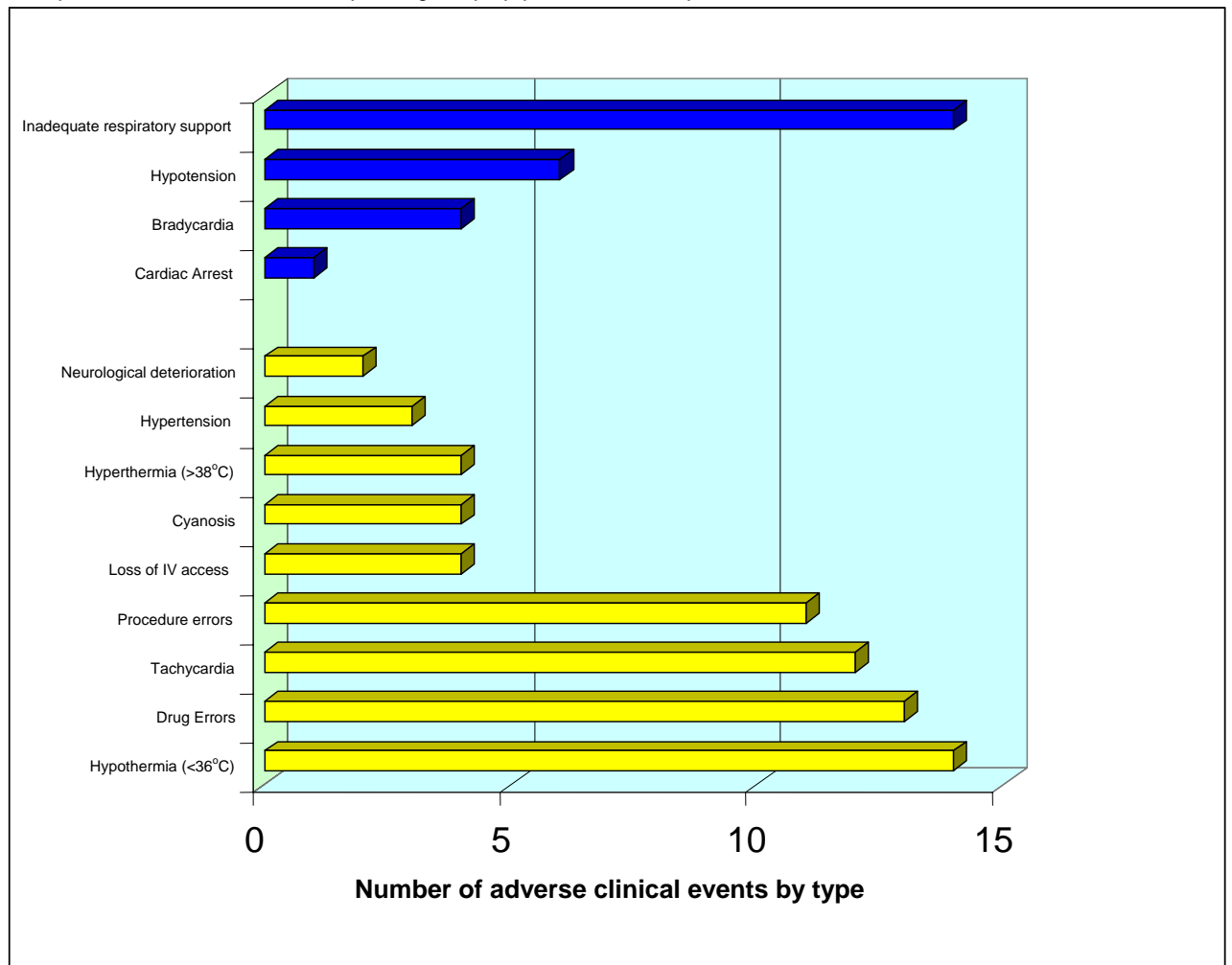
Analysis of the performance of the retrieval service operated by St. Mary's Hospital in London in 1993/1994 showed that for a specialist team on 51 retrievals there were no adverse events related to the equipment used and only 2 of the patients (4%) showed physiological deterioration (35). There is no original data in this study for a performance comparison with a non-specialised team however the criteria used to record adverse events were the same as those in Edge et al. Therefore the two studies provide evidence for the use of specialised staff in reducing the morbidity of critically ill children during inter-hospital transport.

**Criteria used in Edge et al. and Britto et al. in defining adverse events during transport (36)**

| Adverse physiological events  | Adverse intensive care-related events  |
|---|--|
| <ul style="list-style-type: none"> <li>▪ Respiratory arrest or cyanosis, or both</li> <li>▪ Cardiac arrest</li> <li>▪ Systolic hypotension (child &lt;65 mm Hg, infant &lt;55 mm Hg)</li> <li>▪ Cardiac arrhythmia including tachycardia (child &gt;200/min, infant &gt;220/min) or bradycardia (child &lt;40/min, infant &lt;50/min)</li> <li>▪ Loss of consciousness (Glasgow coma scale &lt;7)</li> <li>▪ Loss of brainstem reflexes</li> <li>▪ Core temperature (&lt;34°C)</li> <li>▪ Hypoglycaemia (&lt;2.5 mmol/l)</li> </ul> | <ul style="list-style-type: none"> <li>▪ Occluded endotracheal tube</li> <li>▪ Accidental tracheal extubation</li> <li>▪ Loss of intravenous access</li> <li>▪ Pulmonary aspiration</li> <li>▪ Loss of monitoring</li> <li>▪ Malfunction of ventilator</li> <li>▪ Exhaustion of oxygen supply</li> </ul> |

Further studies draw similar conclusions, demonstrating worryingly high levels of incidents occurring when transport is carried out by inexperienced teams. 32% of cases arriving at the PICU at the Royal Manchester Children's Hospital during 1995 were not monitored adequately or at all during the transfer and 'critical incidents or serious events occurred in a third of all transfers' (37). The skills of the doctors transporting the children is also questionable when the audit reported 10% of all endotracheal tubes were blocked on arrival, half of those arriving at the unit who had not been intubated had to be within four hours, and 31% had the wrong sized tube. Specialised teams possess this kind of knowledge and as they carry out transports regularly that can be audited and their practices updated and improved.

In 75% of transfers to the Birmingham Children's Hospital PICU the children being transported suffered "adverse clinical events" and 23% suffered life-threatening events (38). It found that "inadequate circulatory and ventilatory support, inadequate monitoring, equipment failures, and drug errors were common," the reason being that the transport was carried out by inexperienced doctors in poorly equipped, unadapted ambulances.



**Figure 3** - Data from Barry and Ralston (38) showing the numbers of serious (in yellow) and critical (in blue) adverse clinical events that occur in 56 transfers by non-specialist transport teams to the Birmingham Children’s Hospital.

The study also established that patients who subsequently died were more likely to have suffered transport complications. It is possible inadequate stabilization prior to and care during transport could precipitate this increased risk of mortality but the most critically ill children who died when on a PICU would also be more likely to deteriorate during transport anyway. A study from British Columbia (39) found that while the composition of the transport team had significant effects on the frequency of avoidable insults, it did appear to impact on the overall post-transport mortality rate also. The differences in severity of illness were not accounted for so it is difficult to draw firm conclusions.

**Summary of ‘Optimal Escort for Interhospital Transport of Pediatric Emergencies’ by Macnab, A.J. (1991)**

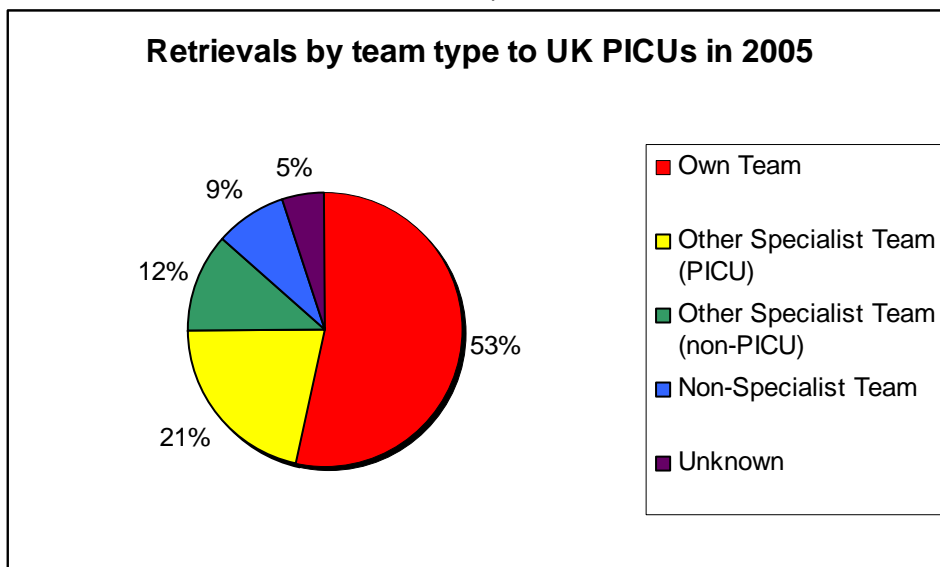
| Lead Member of Transport Team               | Failure to achieve adequate stabilisation | Average frequency of insults / hours or transport care per insult | Post-transport mortality rate |
|---|---|---|-------------------------------|
| <i>Emergency Medical Attendants (EMAs)</i>  | 62%                                       | 1.48  | 14.7%                         |
| <i>EMAs trained in paediatric transport</i> | 11%                                       | 8.24  | 6.8%                          |
| <i>Senior PICU resident or fellow</i>       | 3%  | 29.07   | 13.5%                         |

**Table 5** - Data from McNab (39). While there was a bias for specialised staff to transport the more seriously ill children there is no adjustment in the data to account for differing case mixes.

These studies all generally show that specialised transfer teams improve the outcome for the patient, if we look at the actual figures provided these do tend to vary. This may be due to the different methods used when analysing the data and the relatively small samples. The level of training among “non-

specialised" teams is will also be very variable (40) and the patients being transported were very different. The study of Birmingham Children's Hospital referred mainly to the transfer of neonates with congenital abnormalities whereas 80% of the patients dealt with by the team from St. Mary's Hospital had meningococcal disease or other infections (41). The available evidence suggests a specialised team provides a much better outcome. If only as it will reassure parents; relieve the demands on staffing in the referral hospitals and take the pressure and stress off inexperienced staff having to escort critically ill children.

As a result of this evidence specialised transport services have been established throughout England and Wales and now 75% of critically ill children are retrieved by such teams (42). It is important that staff and available beds are used efficiently so that services can remain operational even during busy periods. Reports suggest services do operate under considerable pressures at times, compounded by 'severe shortages of specialist paediatric nurses' (43). South London PICUs were full on 68 occasions and all London PICUs were full on 17 occasions between 1997 and 2000 (44). University Hospital Wales PICU only closed once, turning down two admissions, from April 2005 to March 2006 (45). In each of these circumstances any child who did ultimately need an ICU bed received it as other units retrieval teams were able to provide cover.



**Figure 4** - Data from the Paediatric Intensive Care Audit Network (PICAnet) report (42).

An argument against using retrieval teams is that it will lead to staff in local hospitals losing vital skills in stabilising critically ill children so patients presenting at these hospitals will receive poorer care (46). Fears of this are completely unfounded as staff in referral hospitals are performing more endotracheal intubations, central venous and arterial access procedures than in 1993 (47). Referring staff still need to institute therapeutic measures to stabilise the child, taking advice from the paediatric intensivists at the lead centre, before the retrieval team arrives. The establishment of a lead centre is probably

beneficial in maintaining the skill levels among staff in the local hospitals by providing initial support over the phone and through training schemes run by the lead centres where the acquired expertise in the specialist unit is a valuable teaching resource for the local hospitals. This is an important part of the remit of the staff at the lead centres (48).

## Conclusion

The introduction of centralised tertiary PICUs has improved the prognosis of children requiring intensive support. Transporting children to these units can best be achieved by sending specialised teams that can provide adequate monitoring, equipment and experience to retrieve critically ill children safely and with fewer serious incidents.

'This essay is my own work and aspects where collaboration has been involved are acknowledged, and sources are cited.'

James Davidson

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