PAEDIATRICS

A NATIONAL MODEL OF CARE FOR PAEDIATRIC HEALTHCARE SERVICES IN IRELAND

CHAPTER 30: PAEDIATRIC LABORATORY MEDICINE

Feidhmeannacht na Seirbhíse Sláinte
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ROYAL COLLEGE OF PHYSICIANS OF IRELAND

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30.0 INTRODUCTION

The vast majority of paediatric healthcare decisions are informed by diagnostic services, particularly radiology and laboratory results. A robust and responsive paediatric laboratory service is therefore vital to the provision of paediatric care. At present, these paediatric laboratory services are provided in laboratories throughout Ireland, reflecting the attendance of children across the full spectrum of primary, secondary and tertiary care paediatric services. In the majority of these laboratories, the samples from paediatric patients are managed within the same workflow as the samples from adult patients, which are also processed in these facilities. Such processing is readily achievable, given the small number of samples from paediatric patients relative to the number of samples from adults, and also given the low complexity of testing required for most primary and secondary care paediatrics.

Specialist paediatric laboratory services are restricted to a small number of units, most notably the standalone paediatric laboratories in Temple Street Children's University Hospital (Temple Street) and Our Lady's Children's Hospital Crumlin (Crumlin). However, it is also recognised that many hospitals with maternity units manage significant volumes of laboratory tests on neonates, and that some specialised neonatal laboratory testing is also provided in these settings. In addition, it is acknowledged that a proportion of specialist paediatric laboratory testing is exported from these laboratories to large reference laboratories that provide testing for adult patients in Ireland, or to paediatric reference laboratories in the United Kingdom (UK) and elsewhere.

It should also be acknowledged that the definition of specialist tests changes over time, both as a result of technological advances and evolving clinical need. For example, many tests performed routinely in a paediatric laboratory setting would be regarded as specialist testing in other institutions. Examples of this include the estimation of glomerular filtration rate (GFR) using Cr51 EDTA and acylcarnitine profiling in the paediatric clinical biochemistry laboratories, extended coagulation factor assays and flow cytometry in haematology, and pertussis polymerase chain reaction (PCR) in microbiology.

Paediatric laboratory medicine is an umbrella term that incorporates several laboratory disciplines, including haematology (and comprising routine and special haematology, blood transfusion, coagulation and stem cell processing), microbiology (including environmental screening), clinical biochemistry (including newborn screening) and histopathology. The model of care for immunology is described elsewhere within this model of care document. Paediatric laboratory medicine services are delivered by a combination of staff from different professional backgrounds. They include medical graduates who have postgraduate training in a laboratory medicine discipline, graduates of medical laboratory science programmes, and science graduates who may have specialised in biochemistry or have subsequently trained and qualified in a laboratory medicine discipline. These professionals are supported by laboratory aides and administrative staff as well as information technology and quality specialists. Some of the laboratory medicine disciplines have a substantial clinical component, and therefore work very closely with nursing and other medical and health and social care professionals, e.g. infection control staff, haemovigilance staff and others.

Histopathology

Paediatric histopathology is a laboratory specialty that provides processing and diagnostic interpretation of tissue and cellular samples from living children. This is sometimes referred to as 'surgical pathology', although it obviously encompasses tissue and cellular samples obtained through non-surgical biopsy techniques. The same professionals also provide post-mortem examinations on children who have died, a service referred to in this document as 'autopsy pathology'. The placenta is an organ that crosses this divide, as it may be examined after the delivery of a live born infant or as part of the post-mortem evaluation of a baby who has died before or shortly after birth. Because of this unique position, it is referred to in this chapter its own category as 'placental pathology'.

The techniques and skills employed by the scientific and medical staff in paediatric histopathology overlap with those in adult histopathology laboratories, but the different illnesses that afflict children mean that specialist experience is required for some areas.

Surgical Pathology

Specialist paediatric surgical pathology includes the management and diagnosis of biopsies from suspected malignant disease, gastrointestinal and liver disease and skin diseases in children, with many of the conditions affecting children rarely seen in adults and therefore unfamiliar to adult pathologists.

Placental Pathology

The examination of the placenta is a specialist area in its own right. The examination can explain the death of a child, or shed light on an illness or an adverse outcome in a newborn infant. The placenta has an increasing medico-legal importance, as it can provide important evidence in a dispute between parties in the event of a child apparently injured in the peri-partum period.

Autopsy Pathology

- Fetal, perinatal and infant pathology incorporates the post-mortem examination of these tiny children and examination of the associated placenta, as detailed above. The information provided about the baby who has died often also provides information of great importance for parents' decision-making and for medical care in a future pregnancy or for medical care of subsequent children. These examinations are fundamentally different from adult post-mortems, and require the specialist skills and knowledge of a perinatal pathologist.
- Post-mortem examinations in older children also seek to establish the cause of death and may therefore have further implications for the wider family. While some of these post-mortem examinations share features with adult post-mortems and are more accessible to adult pathologists, this cohort also includes conditions that should fall within the remit of specialist paediatric pathologists; such conditions include sudden infant death syndrome, congenital heart disease and other conditions rarely seen by adult histopathologists.

Haematology

Haematology is the discipline of laboratory medicine that is responsible for the processing and interpretation of blood and bone marrow samples from patients. It includes diagnostic services in routine haematology, flow cytometry, coagulation disorders and red blood cell disorders including haemoglobinopathies, among other areas, as well as the primarily therapeutic laboratory disciplines of blood transfusion and stem cell processing. Although some of these services are only appropriate in an intensive inpatient setting, many others are available on an outpatient basis or to the community through general practitioners (GPs). Consequently, the discipline provides services to patients across the full range of medical acuity.

In many hospital laboratories, these individual diagnostic and therapeutic disciplines are sufficiently large to have become independent laboratory departments, whereas in other smaller hospitals they operate as a single laboratory department. Haematology departments receive medical direction from consultant haematologists whose practice typically encompasses both clinical and laboratory responsibilities. The content of this document is restricted to the laboratory. Issues in relation to clinical haematology services are dealt with elsewhere.

Chemical Pathology/Clinical Biochemistry

Chemical pathology is another laboratory medicine discipline that is responsible for the diagnosis and monitoring of a variety of disparate conditions; it involves measuring and interpreting metabolite levels in different biological fluids, including blood, urine and cerebrospinal fluid. In paediatrics, the discipline covers a number of specialist areas, including 'routine' clinical biochemistry, biochemical genetics (diagnosis and monitoring of inherited metabolic disorders), newborn bloodspot screening and paediatric endocrinology. A key element of the specialty is an understanding of how age from birth through childhood into adolescence and adulthood affects metabolite concentrations in these biological fluids, and the vast array of rare inherited conditions that may present during this time period. Point-of-care testing is becoming an important element of the specialty, providing rapid analysis by the bedside while adhering to the same quality management systems as those within the laboratory setting.

Clinical Microbiology

Clinical microbiology is a specialty which traverses the spectrum of paediatric disease; from prevention to diagnosis to clinical management, and from patient level to a national overview. Uniquely, however, it also offers a hospital-wide and community-wide approach to managing infection. This chapter relates to the provision of clinical microbiology as part of the national model of care proposed by the National Clinical Programme for Paediatrics and Neonatology. It does not propose to resolve issues relating to laboratory services as a whole across Ireland; neither does it propose to examine the area of clinical microbiology services to standalone maternity hospitals that have neonatal units.

The role of clinical microbiology is integral to the successful implementation of the paediatric model of care through:

- delivering diagnostics in a timely and cost-effective manner, which improves the management of individual children and the overall quality of paediatric services
- providing expert advice on the management of complex infections in partnership with paediatric infectious diseases consultants on a 24/7 basis. For many patients, a multidisciplinary approach is required, in order to ensure that they are managed appropriately.
- providing 24/7 infection prevention and control (IPC) advice, in order to benefit all patients and ensure that care can be delivered in a safe way, in line with Health and Quality Information Authority (HIQA) standards
- ensuring that prevention of infection is embedded as a core component of quality and patient safety
- guarantee the safe and effective use of antibiotics, through an antimicrobial stewardship programme, and expand the role of outpatient parenteral antimicrobial therapy (OPAT)
- drive clinical research in paediatric infection, via high-quality diagnostic laboratory services and national reference laboratory services (such as the Irish Meningococcal and Meningitis Reference Laboratory), in addition to supporting other colleagues

A high-quality paediatric clinical microbiology service is required in the new children's hospital, and also in order to support national aspects of the overall paediatric model of care.

The rationale for this includes the following:

Clinical Management of Paediatric Laboratory Medicine

Clinical decision-making in paediatrics is heavily dependent on laboratory diagnostics, and the role of diagnostics in the management of paediatric patients is steadily increasing. On the one hand, children are presenting with more complex medical conditions; on the other hand, parents expect a high level of care and are less tolerant of

clinical uncertainty. Clinical microbiologists, with the support of an on-site paediatric-focused laboratory, can ensure that clinicians have access to the key investigations in a timely manner, and thus enable rapid assessment and management of the patient's clinical condition. The benefits for the patient are clear in terms of more rapid diagnosis and speedier access to appropriate antimicrobials. Rapid diagnostics and more timely clinical decision-making also contribute to improved patient flow. Moreover, clinical microbiologists can also ensure that financial resources are targeted in the appropriate manner and are not wasted on unnecessary testing. This demand management process is integral to ensuring that appropriate novel technologies are introduced as they become available, but in a way that supports the overall paediatric model of care.

Clinical Support for Management of Children with Infection

Clinical microbiologists, in partnership with infectious diseases consultants, have a role in the clinical management of patients. They perform daily paediatric intensive care unit (PICU) ward rounds, an activity that has been shown to improve outcomes for children in PICU; clinical microbiologists also provide specialist advice to many subspecialists and general paediatricians with regard to complex cases. Each day, children with meningitis and positive blood cultures are reviewed and discussed with the clinicians involved. At present, the low number of consultants, relative to the paediatric catchment population and national specialist services, means that this role is under-resourced compared with international norms. As the new children's hospital moves to become a major subspecialist hospital, there is a fundamental need to have access to paediatric clinical microbiologists who can assist in patient management in this hospital, and also provide support for the management of paediatric infections to colleagues in satellite centres and elsewhere.

Infection Prevention and Control

Infection is the most common non-scheduled reason for children to be admitted to hospital, and hospital-acquired infections are recognised as one of the most important causes of patient harm. Prevention of avoidable healthcare-associated infections is thus a major component of ensuring that paediatric care is delivered in a safe and effective manner. Healthcare-associated infections can be fatal, can lead to permanent sequelae, and may also erode the confidence of parents and patients in the service provided.

Infection outbreaks can have a significant impact on patient services. Robust surveillance systems are critical for ensuring safe and effective care, particularly in relation to avoidable infections (such as central venous catheter-related infections, PICU-associated infections, surgical site infections). Surveillance data relating to preventable infections are recognised as a key requirement for ensuring patient safety. Such systems are the norm across paediatric services in the United Kingdom and North America, and it is essential that they are also in place for paediatric services in Ireland.

Antimicrobial Stewardship

Safe and effective use of antibiotics, and other antimicrobial drugs, is an increasingly important aspect of safe patient care, particularly in relation to appropriate management of sepsis and tackling the rising level of antimicrobial resistance. Having an effective antimicrobial stewardship programme is a requirement for compliance with HIQA standards. Clinical microbiologists support antimicrobial stewardship at the patient level, but also take a hospital-wide approach in order to improve prescribing across the hospital. This includes ensuring that children with infections receive the right antibiotic at the right time, while reducing unnecessary antibiotic use that exposes children to risks of adverse drug reactions and infection with antibiotic-resistant pathogens. Clinical guidelines designed to assist junior staff in choosing the appropriate antimicrobial are produced in conjunction with infectious diseases consultants and specialists in individual hospital pharmacy departments. These guidelines also have the potential to become the national paediatric prescribing formulary.

Reference Laboratory Services and Research

As a major European hospital, the new children's hospital must have a strong patient-focused research framework that aims to better understand how disease occurs and how best to manage children. The Irish Meningococcal and Meningitis Reference Laboratory (IMMRL) is based in Temple Street and for over 20 years it has been the sole centre providing molecular diagnostics for bacterial meningitis and septicaemia. Without this service, hundreds of children would have been managed in a void of uncertainty with respect to their diagnosis. The IMMRL has a strong track record in publications and also works closely with the Health Protection and Surveillance Centre and the European Centre for Disease Control in monitoring disease trends and responding to public health emergencies. This service is likely to expand greatly in the next few years as the IMMRL merges with the Epidemiology and Molecular Biology Unit (EMBU), which is also based in Temple Street. Similarly, the National Pertussis Reference Laboratory in Crumlin provides national molecular diagnostic services and epidemiological typing, supporting the clinical and public health management of pertussis. The merger of the molecular microbiology and reference laboratory services on a single site at the new children's hospital will result in a flagship national reference laboratory. This will provide advanced diagnostics, public health epidemiology support, and support for child health research across Ireland.

30.1 CURRENT SERVICE PROVISION

30.1.1 Histopathology

Establishing the existing consultant resource in paediatric and perinatal pathology is quite a challenge because many of the staff delivering significant services do so in positions where they also carry responsibility for adult services, in particular gynaecological pathology in the three Dublin maternity hospitals. In many units, general pathology staff take on significant paediatric work without a formal paediatric pathology sessional commitment. The figures below therefore carry a health warning, as official sessional commitments do not always reflect work patterns, and this makes direct comparison between units very difficult.

Hospital	Consultant WTE	NCHD WTE
Temple Street	0.6	1
Crumlin	1.7	1
Tallaght	0.3	–
NMH Holles Street	1.4*	1
Rotunda (Dublin North East)	0.9* (Plus one WTE approved but not recruited for hospital group)	1 (Plus one approved, but not recruited for hospital group)
Coombe	1.2* (combined with gynaecology)	1
Cork University Hospital	0.5	
Other locations	No dedicated positions with service provided through existing adult appointments.	

* Perinatal

Surgical Pathology

At present, tissue samples from children can ensue from medical and surgical procedures in any of the hospitals that offer paediatric care in Ireland. The bulk of specialist paediatric surgical pathology, with the exception of placental pathology, takes place in the three Dublin children's hospitals, as the majority of children requiring tissue sampling as part of the evaluation of their disease are referred to the centres prior to those investigations

taking place. While tissue samples from Tallaght are processed in that hospital, the interpretation is undertaken by consultant pathology staff in Crumlin; thus, the consultant sessions nominally based in Tallaght are in effect delivered on the ground in Crumlin through this mechanism.

Tissue samples from children suffering from one or more of a range of conditions are readily managed within local adult pathology services, especially in larger units that have subspecialty expertise in diverse areas of surgical pathology, e.g. dermatopathology and gastrointestinal pathology. These tissue samples may be taken during either elective or emergency procedures. Ideally, however, tissue samples from children with serious and especially malignant disease should be taken in a tertiary centre, where the presence of specialist pathology services would facilitate the optimum disposition and utilisation of the sample. Fresh samples collected from theatre by a pathologist allows preparation for, and initiation of, specialised testing such as fluorescence in situ hybridization (FISH), cytogenetics, molecular diagnostics, metabolic and mitochondrial interrogation as well as routine processing. Indeed, many international trials require this range of testing, which may be impossible when material has been handled in a more conventional way, i.e. by placing it directly in formalin. On occasion, a repeat biopsy is required.

While referral of the child prior to biopsy is preferred, exceptions do occur where a significant illness is detected unexpectedly on a sample taken from a child about whom there was little pre-operative suspicion, or where the clinical instability of the child precludes transfer and demands an early surgical intervention. Where a biopsy is being entertained away from a tertiary paediatric centre, consultation with the specialist paediatric pathology service may facilitate appropriate management of the sample in order to ensure that all the necessary information is harvested. In such circumstances, the tissue samples can always be forwarded to a tertiary centre in order to continue the work-up where necessary.

Placental Pathology

Placental examinations are carried out in laboratories connected to existing maternity services. Dedicated paediatric pathology appointments are limited to the three Dublin maternity hospitals and Cork University Hospital, but there are other histopathologists with experience and an interest in paediatric pathology who provide placental interpretation in other parts of Ireland. This service is incomplete, however, and does not meet the needs of its users; neither is it in line with published guidelines.

Autopsy Pathology

The paediatric autopsy service is significantly underdeveloped, especially in the area of fetal and perinatal deaths. This deficit has been the subject of a dedicated document produced by the Faculty of Pathology of the Royal College of Physicians of Ireland in 2009, and revised in the 2014 Model of Care for Perinatal and Paediatric Pathology Services. In short, while specialist perinatal autopsies are accessible in the three Dublin maternity units and a limited specialist perinatal/paediatric resource is available in Cork, there is a substantial deficit and an unmet need for fetal and perinatal autopsies in many of the other maternity units throughout Ireland where there are currently no formally appointed specialist paediatric pathologists and no established referral pathway to access such a service. Indeed, at present, many of the fetal and perinatal autopsies undertaken outside of institutions with formal paediatric pathology appointments are undertaken by retired paediatric pathologists on an ad hoc basis. This is an entirely unsatisfactory and ultimately unsustainable situation. The absence of a robust perinatal service is a clinical and medico-legal risk that cannot be allowed to continue, especially in view of the high public profile of recent adverse events in maternity hospitals.

However, a service development initially proposed some years ago, but now funded and beginning to be rolled out in Dublin North East, will see The Rotunda Hospital become a perinatal hub for the entire RCSI Hospitals Group. This has required investment in mortuary facilities (under construction), the appointment of staff in administration and medical laboratory science, as well as the appointment of an anatomic pathology technician and a consultant pathologist. It provides a clear template for the development of formal referral pathways for the other fledgling hospital groups.

The situation for specialist autopsies in older children is a little better. Existing services in Temple Street and Crumlin provide regional cover to north and south Leinster respectively. They are also available to undertake autopsies on children who have previously attended the respective hospitals, irrespective of their place of death. Similarly, where there is a suspicion that a child's death relates to a particular area of relevant expertise, e.g. congenital heart disease in Crumlin or inborn error of metabolism in Temple Street, a referral can be made. However, there is no clear referral pathway for children who fall outside these defined areas.

In the absence of established pathways, clinical staff and coroners find themselves telephoning a number of hospitals in an effort to find a pathologist who is in a position to take on a case. This results in delays and frustration for all concerned. Inquests add an additional burden to the limited number of pathologists undertaking this work. Having performed an autopsy on a child dying in a centre remote from their normal workplace, either as a result of the child being referred or as a result of the pathologist having travelled to the local hospital, they may subsequently be obliged to attend a coroner's court in that jurisdiction for protracted periods of time to the detriment of the clinical service they are primarily responsible for.

30.1.2 Haematology

Paediatric laboratory services for haematology are currently provided in laboratories across Ireland. However, specialist paediatric haematology consultant appointments are limited to a small number of Dublin hospitals, principally Temple Street and Crumlin, along with an appointment in Cork. This consultant distribution also reflects the distribution of specialist paediatric haematology testing, with most specialist testing based in Crumlin. The hours of service commitment presented below include clinical and laboratory commitments.

Hospital	Consultant WTE
Temple Street	Dr Melanie Cotter: 0.6
Crumlin	Haematology: Dr Melanie Cotter 0.2 Malignant Haematology: 1.5 Professor Owen Smith Dr Aengus O'Marcaigh Coagulation Dr Beatrice Nolan: 0.8 Red Cell Disorders: 0.8 Dr Corrina McMahon
Tallaght	0*
NMH Holles Street	0*
Rotunda	Dr Melanie Cotter: 0.2
Coombe	0*
Cork University Hospital	Dr Clodagh Ryan: 1
Other locations	

* No formal sessions. Cover provided from Crumlin as required

Malignant Disease

The work-up of malignant haematological conditions in children is confined to Crumlin, although children presenting to Cork University Hospital may also have initial flow cytometry undertaken there. The complex initial work-up involves flow cytometry, cytogenetic analysis, staging assessments including cerebrospinal fluid (CSF) and the entry of patients into European cancer trials, and is centralised in Crumlin as is their initial clinical care. Aspects of the patients' subsequent care is shared between Crumlin and regional centres in a formal shared care agreement which will include some basic blood samples, but ongoing clinical and laboratory assessment of the malignant disease remains in Crumlin.

Coagulation

Routine coagulation testing is available in laboratories throughout Ireland. The initial diagnostic work-up of children with suspected disorders of coagulation is largely confined to large centres such as Galway, Cork and Dublin. A full range of specialised testing for coagulation disorders is available in the paediatric coagulation centre in Crumlin, a children's counterpart to the service for adults based in St James's Hospital. Some specialised testing is time-dependent and has to be performed adjacent to a specialised coagulation laboratory, in order to ensure accurate interpretation. Patients in whom a moderate or severe disorder is confirmed are all referred for management to the clinical service in Crumlin, but some milder disorders are managed locally. Shared care arrangements with local hospitals can reduce the number of trips to Dublin, with local laboratories undertaking some routine testing.

Red Cell Disorders

Red cell disorders are a group of illnesses caused by abnormalities of red cell membranes, red cell enzymes or the red cells principal oxygen-carrying molecule, haemoglobin. The recent history of immigration in Ireland has resulted in the establishment of a large clinical need for haemoglobinopathy services, especially sickle cell disease. Work-up involves screening by HPLC and then confirmation by multiple electrophoresis methodologies. The overwhelming majority of the screening is undertaken in Crumlin, but the Rotunda also offers a screening service to its patients. All of the confirmatory electrophoresis is undertaken in Crumlin. Coombe Hospital patients have their analysis referred to St James's Hospital. There is anecdotal evidence that some patients have initial screening for haemoglobinopathies in hospitals elsewhere in Ireland without referral for formal confirmation. Shared care arrangements with local hospitals can reduce the number of trips to Dublin, with local laboratories undertaking some routine testing.

Blood Transfusion

Blood product support services to children are available in a large number of laboratories throughout Ireland. The largest service is based in Crumlin, where it is needed to support the cardiac surgical service and the clinical haematology/oncology service in addition to supporting the management of many children with disorders of coagulation.

Stem Cell Processing

Stem cell processing is undertaken in a dedicated facility in Crumlin, the hospital where the only paediatric bone marrow and stem cell transplants in Ireland are undertaken. At present, the conditions treated in this fashion in the Crumlin facility are leukaemia, myelodysplasia and aplastic anaemia as well as autologous transplants as part of the management of solid tumours such as neuroblastoma. Since the retirement of Dr Anne O'Meara, transplants for Irish children with Hurler's syndrome, which historically were carried out in Dublin, are now carried out in Manchester. Transplants for Irish children with primary immunodeficiency are carried out in Newcastle.

30.1.3 Chemical Pathology/Clinical Biochemistry

Chemical pathology/clinical biochemistry services are provided in all HSE and private hospitals throughout Ireland, most of which have been accredited primarily to ISO 15189 by the Irish National Accreditation Board (INAB). Many of these laboratories are headed up by consultant chemical pathologists and/or consultant biochemists and are staffed by medical scientists, clinical biochemists and laboratory aides. These laboratories receive samples mainly from adult patients but also from infants and children. The laboratories – particularly those attached to hospitals with midwifery services – generally provide an excellent, day-to-day, routine service. There is, however, a requirement for a geographically isolated country such as the Ireland to have one national resource that specialises in the diagnosis and monitoring of rare, complex disorders in infants and children. Such expertise could provide leadership in framing national policies and developing the paediatric service nationally. In addition, specialist knowledge and international personal contacts are essential in order to obtain the very best advice and service to diagnose some extremely rare disorders. This aspect of the service is constantly overlooked, but is a very important part of paediatric clinical biochemistry. The current medical consultant staff complement in paediatric chemical pathology is presented below:

	Consultant WTE	NCHD WTE
Temple Street	0.80	1.00
Crumlin	0.20*	
Tallaght Hospital		
Rotunda	0.20	
NMH, Holles Street		
Coombe		
Cork University Maternity Hospital		

** Following the untimely death in 2006 of the consultant biochemist in Crumlin, the consultant biochemist post was frozen. A replacement consultant post was not advertised; neither was such an appointment made subsequently.*

The Departments of Clinical Biochemistry on the Temple Street and Crumlin sites are recognised as the reference paediatric clinical biochemistry laboratories in Ireland, dedicated solely to the provision of routine and specialist paediatric clinical biochemistry. The two laboratories work closely together under the leadership of a single consultant paediatric chemical pathologist. The laboratories provide support and advice to other laboratories, clinicians and GPs who seek a specialist paediatric clinical biochemistry opinion. The combined laboratories offer a comprehensive and specialised laboratory service, including such national specialties as newborn bloodspot screening, biochemical genetics and specialist paediatric endocrinology, along with technical and scientific paediatric expertise. The laboratories liaise closely with colleagues in UK and European diagnostic and research laboratories for the referral of more complex and specialist paediatric investigations. While many other hospital laboratories in Ireland provide routine clinical biochemistry testing on samples from infants and children, none of these laboratories provide specialist testing, and most either refer samples to, or seek professional advice from, staff in Temple Street or Crumlin.

Molecular genetics is playing an increasing role in the diagnosis of inherited metabolic disorders. For some conditions or groups of disorders, molecular genetics will, and is, the initial diagnostic investigation, followed by monitoring outcome and treatment using biochemical genetic (clinical biochemistry) tests. The National Newborn Bloodspot Screening Laboratory already works closely with the Department of Molecular Genetics in Crumlin

to screen babies for cystic fibrosis. It is essential that this cooperation continues to develop and enhance the molecular and biochemical genetics service to infants and children in Ireland.

The biochemistry department in Crumlin has developed to meet the needs of the specialist clinical services in the hospital and provides a national service for the diagnosis and monitoring of infants and children with congenital adrenal hyperplasia. In 2014, the laboratory, having secured funding for a Tandem Mass Spectrometer, embarked on an ambitious plan to develop a specialised paediatric laboratory endocrinology service, thus repatriating a number of endocrine investigations and developing others. In addition, the laboratory is developing an assay to replace the Chromium-labelled EDTA clearance test, which is currently used to perform renal clearance studies in children. Long term, the intention is to provide this service nationally.

Crucially, as well as providing a full routine service, the laboratories tailor their services to the particular needs of the paediatric patient and the requirements of the clinicians delivering the many national clinical specialties provided on the Temple Street and Crumlin hospital sites. This requires sample handling procedures which are very different from those employed in laboratories serving a predominantly adult population. It also requires knowledge of the changing reference ranges encountered in developing babies and children, the different disease patterns encountered, and the flexibility to respond to unexpected requirements on an almost daily basis.

Service Provision

Temple Street	'Routine' paediatric clinical biochemistry Point-of-care testing Specialist services: • National Newborn Bloodspot Screening Laboratory • tertiary referral laboratory service for the diagnosis and monitoring of inborn errors of metabolism, including hypoglycaemia work-up for infants and children • sweat testing for cystic fibrosis • expertise in the use of dynamic function tests in endocrine diagnosis
Our Lady's Children's Hospital Crumlin	Routine' paediatric clinical biochemistry Specialist services: • tertiary referral laboratory for the diagnosis and home-monitoring of individuals with congenital adrenal hyperplasia • chromium-labelled EDTA clearance studies • sweat testing for cystic fibrosis • expertise in the use of dynamic function tests in endocrine diagnosis In development – specialist paediatric laboratory endocrine service
Both	Advice on the diagnosis of complex paediatric disorders. Paediatric assay finder service in the UK and Europe for complex and rare disorders in infants and children. Paediatric reference ranges.

The joint clinical biochemistry department has earned an international reputation for excellence. Its consultants and medical scientists work closely with colleagues in the UK and in Europe, seeking out the very best diagnostic services for infants and children presenting with very rare, complex metabolic and paediatric-related disorders – if the requisite tests cannot be provided on site. The joint clinical biochemistry department is a national resource. Its laboratories are equipped with a range of complex diagnostic instrumentation, and its medical scientists are

trained to the highest standards – training that is achieved by attending international meetings and training academies. When possible, staff attend multidisciplinary team meetings in Crumlin and Temple Street.

30.1.4 Clinical Microbiology

Details of current staffing levels for the clinical microbiology service in Temple Street and Crumlin are presented in Appendix 1. At present, there are 1.7 WTE consultant clinical microbiologists, divided across three functions; diagnostics, infection prevention and control, and clinical management/antibiotic stewardship. One of the weaknesses in this arrangement is that all consultants are cross-appointed with other hospitals in Dublin. Two of the three consultants also work single-handed in their other roles and, as a consequence, this represents a major clinical issue. Furthermore, it has resulted in a split paediatric service being provided by three microbiologists across five different sites. Two of the consultants also provide cover to the IMMRL and the EMBU reference laboratories in Temple Street. The current roles of the consultant microbiologists are summarised in Appendix 2.

In addition to the consultant microbiologists, the clinical microbiology service comprises a large number of other staff (also detailed in Appendix 1). These staff members include the following: laboratory scientists (who are divided between the routine diagnostic laboratories, molecular diagnostic laboratories, and national reference laboratories); infection prevention and control nurses; antimicrobial pharmacists, and administrative assistants. In addition, there is currently one microbiology specialist registrar post in Temple Street. It should be noted that staffing levels in the Crumlin and Temple Street are currently below international standards. However, the creation of economies of scale in the new children's hospital should enable a high-quality service to be delivered, assuming that current staffing levels are maintained. Diagnostic and national reference laboratory services are provided in both Crumlin and Temple Street. Both sites also have an infection prevention and control advisory service, and an antimicrobial stewardship programme in place.

30.2 PROPOSED MODEL OF CARE

30.2.1 Histopathology

Surgical Pathology

Specialist surgical pathology services for children will continue to be based in Crumlin and Temple Street until they merge as part of the development of the new children's hospital. As described above, children requiring tissue sampling as part of the evaluation of their disease are most frequently referred to the specialist services in Dublin. However, it is inevitable that there will be a continuing need for the processing and interpretation of paediatric surgical pathology material in regional units.

Because these demands are already met within existing hospital group resources, it is likely that any expansion of paediatric pathology services to meet the needs of the perinatal pathology service (see below) will comfortably ensure that any such samples are appropriately handled in the future. Referral of any resultant pathologic material should be along the same pathway that the child's clinical care dictates: for example, if a child is referred within a hospital group to a hub, the pathology material should, in the first instance, follow that same pathway, as it will facilitate the child's management. However, further expert opinion would be available, if required, through the new children's hospital pathology service and, should the child be referred to the new children's hospital, the pathology material would also follow. It is not anticipated that tissue sampling will be undertaken at the satellite centres in Blanchardstown and Tallaght.

Placental Pathology

Placental examination should be available to every obstetrician, paediatrician and family who needs, or requests, it. When not available in the unit in which the infant is delivered, it should be accessible along the referral pathways dictated by the regional hospital group structures. This will be facilitated by the developments proposed for the autopsy service outlined below. These recommendations are commensurate with the tissue pathway published by the Royal College of Pathologists in London in 2011. Dr Eoghan Mooney, National Maternity Hospital, Holles Street, has also proposed to the Faculty of Pathology and to the Health Service Executive (HSE) the establishment of a national placental referral resource where additional specialist advice could be obtained as required.

Autopsy Pathology

It is recognised that the transport of a child over great distances for the purpose of obtaining an autopsy places an additional burden on families who face the choice of being separated from their child if they choose not to accompany the remains, or of being deprived of the support of their friends and family if they choose to travel with their child. However, it is not possible to have a dedicated, specialist paediatric autopsy service in every hospital in Ireland. There is therefore an inevitable conflict between the aspiration to minimise the need for travel and the necessity to access a specialist paediatric autopsy service. Clearly, autopsy services for older children who die in circumstances where a specialist post-mortem is not indicated, e.g. road traffic accident, may be provided by local pathology services, without any need for referral.

Specialist paediatric autopsy services should be provided by a regionalised service based on the pathways associated with the new hospital group structures. This will establish separate perinatal autopsy services for the RCSI, Dublin Midlands and Ireland East hospital groups, with each service based around the relevant Dublin maternity hospital. An additional service would be based in Cork to cater for the South-South West Hospital Group. The Saolta and University of Limerick hospital groups should be able to access such a service in either Galway or Limerick, or potentially both, subject to local/regional discussion and manpower planning. This configuration should provide clarity on referral pathways, thus reducing delays and the distances travelled by families who are waiting to have a post-mortem completed prior to making funeral arrangements for their child.

Such services, while established principally to address the unmet need for perinatal autopsies, may also succeed in reducing the need for referral of older children from outside Leinster to the new children's hospital for specialist paediatric autopsies. Nonetheless, the new children's hospital should still provide a full paediatric autopsy service to the parts of Ireland that are not covered by the services in Cork, Galway and Limerick. Furthermore, the new children's hospital should be willing on occasion to manage additional paediatric cases outside this catchment area by agreement with families, coroners and the regional paediatric pathology service in whose catchment area the death of the child has occurred.

There is currently no clarity about the mortuary facilities in the new children's hospital and no certainty as to whether one or other of the maternity hospitals will move to the St James's Hospital campus. There is a possibility that any such move might enable one or more of the Dublin-based regional perinatal services to physically merge with the new children's hospital autopsy service. At one stage, consideration was given to establishing a single paediatric autopsy suite for the Dublin region, although this would involve substantial additional transport of children from maternity units. However, given the proposal to develop perinatal pathology services on the basis of hospital groups, it seems more likely and more appropriate that perinatal autopsies will remain the responsibility of the individual maternity units that host the referral pathway for their own hospital group.

Even in the absence of a physical merger, it is anticipated that greater collaboration between the maternity units will reflect a functional merger that has the potential to improve quality, education and research.

30.2.2 Haematology

The establishment of the new children's hospital will amalgamate the Temple Street and Crumlin laboratories into one of two potential configurations, as outlined in the introduction to this document. Either way, specialist paediatric haematology laboratory services will be based predominantly on the St James's Hospital campus. The configuration preferred by the consultant haematologists with primary responsibility for coagulation disorders and red cell disorders is that there should not be duplication of the specialist laboratory services for these cohorts of patients. As a result, some of the specialist laboratory work-up of coagulation and red cell disorders will be located within a single facility, even if a separate paediatric laboratory is constructed within the new children's hospital. It is yet to be determined with certainty whether that would be located in the St James's Hospital Central Pathology Laboratory or within any new children's hospital paediatric laboratory, but it is possible that these specialist clusters may be shared – with some going to St James's Hospital and others going to the new children's hospital.

Even so, a significant volume of routine haematology testing will continue to be carried out in laboratories across Ireland, and will also continue to be carried out within individual hospital networks. Indeed, there is likely to be very little additional change in the referral pattern for the majority of these specimens – although an argument could be made for the centralisation of some of the limited special haematology done outside of the current footprint of the new children's hospital constituent hospitals, e.g. HPLC screening of haemoglobinopathy in The Rotunda Hospital.

The establishment of two satellite centres in Blanchardstown and Tallaght will require some hot laboratory supports for the minor injuries unit. These centres would be best supported by the existing adult laboratories on the host adult hospital campus, which are best placed to provide the immediate quality assurance and back-up to a service that is designed to influence real-time decisions in the injury unit. In circumstances where samples are taken from children attending outpatient clinics in the satellite centre, they could be:

a) transported to the new children's hospital for processing within the new children's hospital laboratory facility. This could be achieved with a regular transport service, which would ensure sample delivery within approximately four hours of the sample being taken.
b) managed in the host hospital, with referral of queries or specialist testing to the new children's hospital, as required. This would mirror the existing management of laboratory samples from children attending outpatients in paediatric facilities elsewhere in Ireland.

It is unlikely that specialty clinics will take place in satellite centres. However, were such clinics proposed, access to specialty laboratory testing (e.g. coagulation) might be one factor that would preclude such implementation. The clinical haematology/oncology service plans to repatriate both metabolic and immunodeficiency transplants from the UK – a move that would deliver clinical, logistical and financial benefits, and would also be much less disruptive for children and their families. In order to achieve this outcome, the service is seeking the appointment of a dedicated transplant physician to take a lead on the transplant service.

30.2.3 Chemical Pathology/Clinical Biochemistry

The establishment of the new children's hospital will result in the amalgamation of the laboratories on the Temple Street and Crumlin sites into a single entity serving the needs of the complex paediatric tertiary care services in hospital. Irrespective of where the laboratory is sited, i.e. either within the new children's hospital or on the St James's Hospital campus, it is essential that the specialty is recognised and preserved, as it will be the only paediatric chemical pathology service on the island of Ireland. The knowledge and expertise is currently embedded within all senior members of the department, and this knowledge and expertise must be fostered and further developed.

Ireland has a population of 4.83 million, approximately 22% of whom are aged under 14 years. It also has an annual birth rate of approximately 68,000; as such, it needs to have a minimum of two paediatric consultant chemical pathologists/consultant biochemists available 24/7. These two consultants would provide national leadership in the specialty, and they should be located on the St James's Hospital campus – preferably in the new children's hospital and sharing sessional commitments with the three Dublin maternity hospitals. The laboratory needs to be appropriately staffed and equipped to meet the requirements and challenges of paediatric chemical pathology/clinical biochemistry, in order to provide the best possible diagnostic services to the infants and children of Ireland in a timely and economic manner. Current governance arrangements with respect to the National Newborn Bloodspot Screening Laboratory should continue. However, the importance of the close working relationship between newborn bloodspot screening and diagnostic services with the clinical services must be recognised and maintained.

30.2.4 Clinical Microbiology

The proposed model of care for paediatric clinical microbiology will be based on a three-tier system: regional services, new children's hospital clinical microbiology services and, finally, national paediatric clinical microbiology services and representation. Integration with infectious diseases is also critical to successful management of infection in the new children's hospital.

Regional Services

The majority of paediatric samples will be processed in local and regional microbiology laboratories. The microbiologists in the hospitals where these laboratories are located provide advice and clinical input as required. Ideally, at least one microbiologist in these local/regional centres should have had some experience of working in a paediatric hospital and should be able to provide advice on the management of illnesses such as meningitis, pneumonia and neonatal sepsis. They should also provide infection prevention and control advice relating to the paediatric infections that are likely most to occur in a regional centre.

Clinical Microbiology in the New Children's Hospital and Satellite Centre

The professional standards expected from a clinical microbiology service have previously been outlined at a European level (Humphreys et al., 2010). The clinical microbiologists will have roles in the diagnosis and management of clinical infection, as well as supporting the implementation of a robust infection control programme that includes antimicrobial stewardship and disease surveillance. There is a need to ensure that the processing of samples through the satellite centres is carried out under the governance of an INAB-accredited laboratory system. These roles are outlined in Appendix 2.

The model of delivery of paediatric microbiology services in the new children's hospital will need to take into account national requirements, particularly in relation to laboratory diagnostics and the prevention of healthcare-associated infection.

Laboratory Modernisation Programme

The HSE Laboratory Modernisation Programme will result in significant changes to the way in which diagnostic laboratories operate in Ireland.

Provision of National Specialist Diagnostics

Regardless of the changes resulting from the Laboratory Modernisation Programme, the paediatric microbiology service in the new children's hospital will continue to provide specialist national diagnostic and reference laboratory services for a range of paediatric pathogens (i.e. in the same way as these services are currently provided in Temple Street and Crumlin).

HSE HCAI/AMR Clinical Programme

The HCAI National Clinical Programme has targeted three key priority areas relating to healthcare-associated infection (HCAI) and antimicrobial resistance (AMR), namely:

- hand hygiene
- device-related infections
- antimicrobial stewardship

The paediatric microbiology service in the new children's hospital will need to provide diagnostic support and expertise in relation to infection prevention and control (IPC), and antimicrobial stewardship, in order to deliver the required continuous quality improvement in these areas. It is likely that the experience of the paediatric microbiology service in delivering on these areas in the new children's hospital will be used as a model for delivering improvement in paediatric services throughout Ireland.

HIQA Standards

The new children's hospital will be required to meet standards set by HIQA in relation to Safer, Better Healthcare and HCAI. The latter standards require 24-hour access to an accredited microbiology laboratory, as well as support for IPC and antimicrobial stewardship programmes. Again, the way in which this is delivered at the new children's hospital may be used as a model for meeting HIQA standards for paediatric services elsewhere.

Quality Assurance and Hospital Licensing

At present, hospitals are required to provide a range of surveillance and indicator data that are used for national quality assurance purposes. Many of these data are based on laboratory-generated data and data gathered by IPC teams. Data requirements are likely to increase, as hospital licensing comes into effect. The experience from other countries has been that microbiological and IPC indicator data are core requirements for hospital licensing. A robust, and appropriately resourced, surveillance and audit system will need to be incorporated into the paediatric microbiology service (which will also serve to support internal continuous quality improvement programmes in the new children's hospital).

National Advice and Representation

There is a need to have available a small number of paediatric microbiologists who can provide support to regional microbiologists in the management of paediatric patients with complex conditions – i.e. microbiologists who provide specialist referral diagnostic services and advise on complex infection control issues. This system may be implemented at an individual level or by way of sharing clinical pathways and guidelines. Alternatively, it may be implemented using clinical advice provided at the IMMRL as part of the clinical interpretation of specimen results.

Paediatric clinical microbiologists also provide representation for paediatrics services on numerous national and international committees. These roles are essential in order to ensure that the voice of children can be heard at national meetings, and also to ensure that paediatric services are not forgotten.

At present, these roles include, but are not limited, to:

- National Immunisation Advisory Committee
- Royal College of Physicians of Ireland (RCPI) Hand Hygiene Committee
- Health Protection Surveillance Centre (HPSC) Scientific Advisory Committees (relating to paediatric infection)
- HIQA advisory committees
- National Pneumococcal Surveillance Committee
- Control of aspergillus during construction work
- HCAI/AMR Advisory Group to the RCPI
- Steering Group NIMT Maternity Report Committee
- Hepatitis C Screening Committee
- European Invasive Bacterial Disease Surveillance Network (IBD-Net)
- HIQA advisory groups

With strengthening of paediatric microbiology services, appropriate representation could also be achieved on other national committees, such as:

- Irish National Accreditation Board (INAB) Clinical Advisory Committee
- Irish External Quality Assessment Scheme Advisory Board
- National Clinical Effectiveness Committee

The new children's hospital can also become a training centre for national and international trainees seeking to gain additional training in paediatric microbiology. It will be possible to provide expert rotations, and thus ensure that trainees receive a broad base of training in paediatric microbiology.

Paediatric microbiology is an integral part of the overall model of care for delivering paediatric services in Ireland, and it supports the achievement of the goals of the paediatric clinical programme as follows:

i) Keeping Children out of Hospital

- The development and appropriate application of rapid diagnostics has been shown to help avoid hospital admissions for children with infection. For example, in a number of centres in the United States, local availability of rapid viral diagnostics has been used to identify enteroviral infection in children suffering from meningitis or possible sepsis, thus allowing many such children to be managed as outpatients.
- Liaison with GPs, through electronic reporting of laboratory results, provision of clinical interpretation of laboratory reports, and support for community-based quality improvement projects can help to avoid hospital admissions for children with infections. This can be achieved by ensuring the selection of appropriate antibiotic choice and dose, so that uncomplicated infections can be effectively treated in the community.
- Involvement in national committees and quality improvement programmes aimed at providing high-quality care in the community, e.g. primary care antibiotic guidelines, primary care infection control guidelines, national childhood vaccination programmes, etc.

ii) Reducing Length of Hospital Stay

- Improving patient flow through hospitals by providing rapid, timely laboratory results (tailoring of laboratory testing to clinical needs)
- Development of a strong outpatient parenteral antimicrobial therapy (OPAT) programme
- Driving programmes to reduce the incidence of healthcare-associated infection (which, on average, doubles the length of hospital stay)
- Provision of key audit and surveillance data to monitor hospital activity and flow

iii) Reducing Harm, and Improving Safety, for Paediatric Patients

- Reducing healthcare-associated infection, which is recognised as one of the most important forms of preventable harm to patients
- Provision of audit and surveillance data to support patient safety programmes
- Reducing harm from inappropriate antimicrobial therapy through antimicrobial stewardship programmes, e.g. inadequate or delayed antibiotic therapy (in cases of sepsis), adverse drug reactions, drug-drug interactions, secondary infections, antimicrobial resistance

30.2.5 The New Children's Hospital, and Associated Impact on the Model of Care

The establishment of a new national children's hospital, in addition to the physical merger of the three Dublin facilities for children, represents an important opportunity for paediatric healthcare. It is clear that the new national children's hospital will require a substantial, accessible and flexible paediatric laboratory service if it is to meet its stated goal of providing world-class care for children and their families.

Two models are currently under consideration:

1. A separate paediatric laboratory embedded within the new children's hospital, largely based on a merger of the Temple Street and Crumlin facilities. This was the configuration proposed in the previous iteration of the new children's hospital, and is the configuration that best preserves paediatric laboratory expertise into the future.
2. The establishment of a new campus laboratory where the paediatric laboratory service is accommodated in a newly built facility that would provide adult services to St James's Hospital, and, potentially, to the wider Dublin Midlands Hospital Group. This premise is based on the observation that the existing Central Pathology Laboratory in St James's Hospital is now in need of significant refurbishment and expansion, in order to meet the needs of its own hospital, and could not plausibly absorb the additional activity of the new children's hospital. In any such configuration, there would have to be robust structural, operational and governance arrangements in order to preserve paediatric laboratory expertise into the future.

Coherent arguments can be made for both configurations. Indeed, the configurations could be characterised as physical manifestations of the two opposing forces that are competing to shape the future of laboratory services nationally. The first is a drive to integrate laboratory testing into the facilities they serve, bringing the tests and the staff who interpret them closer to the patient and their doctors, thereby improving the pattern of testing, providing a flexible and responsive service, as well as maximising their influence on healthcare decisions. The second is a drive to consolidate laboratory testing, thus providing more tests in fewer larger laboratories. This offers potential opportunities to make laboratory testing less costly, although it inevitably involves separating the laboratory from the staff who are ordering the tests.

Preliminary discussions with the laboratory services personnel in St James's Hospital established agreement on a number of principles that would govern laboratory practice on the campus, irrespective of the ultimate configuration selected. These principles were submitted as part of the work of the Shared Services Subcommittee who examined the issue in 2013. One of these principles is that the new children's hospital would not seek to develop an additional repertoire of testing in circumstances where a test was already available in the Central Pathology Laboratory. While some testing that is applicable to immunology is undertaken in the existing children's laboratories, immunology is not an accredited specialty in either Crumlin or Temple Street. At this juncture, it is not anticipated that additional testing will be included in the children's laboratory, as the immunology department in the Central Pathology Laboratory is likely to provide laboratory support for such a service.

Two consultant paediatric immunologists have been appointed in the past two years. Dr Aideen Byrne has a special interest in allergy, while her colleague, Dr Ronan Leahy, has a special interest in immunodeficiency. These two consultants provide diagnostic and interpretative support to the immunology and allergy components of laboratory practice in children, wherever the sample is processed, and this support will continue after the move to the new campus.

Satellite Centres

The new children's hospital programme includes a proposal to develop two satellite centres on the campuses of the existing adult hospitals in Tallaght and Blanchardstown. The laboratory services that will be required to support these centres are obviously critically dependent on the model of care chosen for the sites. However, while the model of care for these two facilities is not yet entirely clear, it is understood that it will feature an urgent care centre as well as non-specialist outpatient services. Under such circumstances, a range of laboratory tests will be required in order to support immediate decision-making in the urgent care centre; such testing will therefore necessitate short turnaround times. Other laboratory results for outpatients not needed as rapidly could potentially be referred to the main new children's hospital laboratory facility. The balance between these two approaches will be determined by the model of care and the capacity of the existing host laboratory.

It will be critical to ensure that there is clarity regarding the governance of laboratory tests, and also to ensure that there is visibility of tests between the children's units and the new children's hospital. While the new national laboratory information management system (LIMS) provides a ready basis for same, the current roll-out schedule may lead to the satellite centres opening well in advance of the provision of LIMS to any of the children's hospitals that will support and interact with these centres.

30.2.6 Laboratory Modernisation Programme

The Health Service Executive (HSE) has established a laboratory modernisation group to review the existing configuration of laboratory services. This group has recommended the establishment of a hub-and-spoke model for laboratories based around the recently defined hospital groups. This would place the laboratory hubs in a major academic hospital with a university affiliation. It is envisaged that the process would see the transfer of some cold laboratory testing, including GP work from the smaller 'spoke' hospitals to the 'hub' facilities. The smaller laboratories would, therefore, have a reduced range and volume of testing, and may also have restricted hours of operation designed to reflect the needs of the institution they support. Any reconfiguration of paediatric laboratory services will have to be cognisant of, and compatible with, this hospital group-based hub-and-spoke approach.

To this end, the laboratory modernisation group met the Children's Hospital Group management to review proposals for paediatric laboratory medicine services in the new children's hospital. On foot of these discussions, the Children's Hospital Group believe that a merged St James's Hospital campus laboratory is the configuration that is most compatible with the overall thrust of the national laboratory modernisation programme. However, the cost of such a facility is significant, and is not within the budget for the new children's hospital. A business case submitted to the HSE was initially unsuccessful, but it is likely that further revisions of this business case will follow. In the meantime, the default position is the creation of a separate, standalone paediatric laboratory within the new children's hospital. In any event, some transfer of specialist services from the paediatric laboratories to the existing St James's Hospital campus laboratories is possible. Discussions continue regarding a number of areas of possible collaboration, with specialist coagulation a particular target, due to the need to replace the existing St James's Hospital coagulation laboratory facility as part of the new children's hospital development.

Conclusion

Whatever the ultimate configuration of laboratories on the St James's Hospital campus, it is vital that the proposals provide a sustainable, identifiable and accessible resource of paediatric laboratory expertise for all paediatric healthcare professionals and general laboratories in Ireland providing paediatric services. It is therefore essential that the existing paediatric knowledge base in laboratory medicine, built up over many years in Crumlin and Temple Street, is protected, maintained and nurtured for both medical and scientific staff. In the opinion of the majority of paediatric laboratory professionals, this would be best achieved by the establishment of a separate paediatric laboratory integrated within the new children's hospital. However, given the overall laboratory reform agenda, an alternative merged configuration may be imposed. Such a proposal would essentially result in the demise of the last Irish specialist paediatric laboratory. As a consequence, this decision would have would have to take account of the appropriate internal laboratory configuration and robust governance arrangements, in order to prevent the gradual dissolution of a specialist expertise built up over many generations, and upon which tertiary paediatric clinical services depend.

It is not anticipated that the establishment of a paediatric laboratory on the St James's Hospital campus, either separate or merged with the adult facility, will significantly alter the existing national landscape of paediatric laboratory samples. Most hospitals will continue to offer their existing range of testing to children who are being treated there, although there may be some regionalisation of testing with the hospital groups as part of the national modernisation agenda. The only major change that can be anticipated is the possible repatriation of some testing from abroad, because both the size of the new facility and the critical mass of scientists located there would make such an initiative both possible and economically advantageous. As a result, samples which currently travel from a wide range of Irish hospitals to specialist paediatric laboratories in Manchester, Sheffield and other cities, might now be processed in the new national paediatric laboratory facility.

30.3 REQUIREMENTS FOR SUCCESSFUL IMPLEMENTATION OF THE MODEL OF CARE

30.3.1 Staffing

General

As outlined in the introduction to this document, paediatric laboratory medicine services are delivered by a combination of different professional groups working together. The merger of Temple Street and Crumlin laboratories will provide opportunities for efficiencies in the management of routine workload. However, the retention of the existing scientific staff is critical to the continued provision of the many roles fulfilled by the DPLM; it is also critical to the potential repatriation of laboratory samples currently sent abroad at considerable cost, and with the inevitable delays that ensue. The scientific staff in the existing paediatric laboratories constitute the core of the specialist expertise in children's laboratory medicine that has been built up over time. While the staffing discussions below deal principally with consultant staff, the authors strongly advocate the retention of the existing scientific staff complement in whatever paediatric laboratory configuration is delivered in the new children's hospital.

Histopathology

Various models of workload measurement can be used to assess demands on a consultant pathologist's time. Indeed, a new draft proposal for paediatric pathology has recently been discussed by the Royal College of Pathologists. However, no tool is foolproof and the geographic spread of Ireland's population is such that it will make some of the comparisons meaningless. In addition, historical arrangements with consultants in Ireland hamper direct comparisons with other jurisdictions: for example, consultant pathologists in Ireland's maternity units support adult gynaecological pathology as well as perinatal services, thus reducing the time available to support perinatal services. Furthermore, there is an enormous unmet need for perinatal autopsy services in particular, and this makes calculations difficult. Where no local figures for demand were available, the Faculty of Pathology, RCPI Sub-committee extrapolated from figures in the maternity hospitals that do have an existing on-site perinatal autopsy service.

It is accepted that no specialist unit can function with a single consultant if service in that unit is to be robustly supported throughout the year. A single-handed consultant will find it difficult to obtain second opinions and share case material – a process that is an important feature of quality control. Indeed, this case-sharing measure is built into the RCPI Faculty of Pathology's Quality Improvement Programme. These factors have helped to inform the recommendations below, which are taken from the Faculty of Pathology Model of Care for Perinatal and Paediatric Pathology Services. The development of larger groups or networks of diagnosticians should have the additional spin-off benefit of permitting a degree of subspecialisation and of allowing for development of protected research time.

Operation of the proposed model of care requires a significant expansion of existing paediatric pathology consultant resources. As follows:

- An additional one WTE consultant paediatric pathologist is required in each of the Dublin maternity hospitals.
- In Cork, a single consultant pathologist has a half-time commitment to perinatal services for the South/Southwest Hospital Group. Additional 1.5 WTE consultant appointments are necessary in order to bring this up to required levels.

- The service to be located in Galway/Limerick required two WTE consultant appointments. These may be based in one or other location, or split between the two. However, if a two-site model is selected, close cooperation and cross-cover would be a requirement if the sites are to avoid the pitfalls associated with a single-handed consultant position, as described above.

These appointments will place additional challenges on other services in the hospital groups. The various challenges are outlined in detail in the Faculty of Pathology document and are not expanded on here. However, full delivery of the programme will necessitate additional appointments in medical laboratory science, as well as the appointment of an anatomic pathology technician; it will also necessitate the provision of bereavement support and, potentially, radiography and radiology services, as well as administrative services to facilitate the operation of the referral pathways. By way of providing a concrete example, the resource package assembled to meet the expanded hospital group-wide remit of The Rotunda Hospital includes a number of new staff appointments in addition to infrastructural investment.

Hospital	Consultant Existing WTE	Consultant Proposed WTE	NCHD Existing WTE	NCHD Proposed WTE
Temple Street	0.6	Combined in new children's hospital	1	2
Crumlin	1.7		1	
Tallaght	0.3		–	
NMH Holles Street	1.4	Minimum 2	1	2
Rotunda	1.9	2	2	2
Coombe	1.2	Minimum 2	1	2
Cork University Hospital	0.5 WTEs	Minimum 2	–	–
Other locations	No dedicated positions, with service provided through existing adult appointments	2 WTEs between Galway/Limerick in configuration to be discussed	–	–

Haematology

The existing clinical haematology appointments will continue to provide the bulk of laboratory medical direction in the new children's hospital. The laboratory supports the appointment of a designated transplant physician to supervise this complex, heavily regulated and expensive area of laboratory practice.

Chemical Pathology/Clinical Biochemistry

For over 20 years, the joint department of Chemical Pathology/Clinical Biochemistry has been headed up by a single consultant paediatric chemical pathologist working a 1:1 rota 24/7. In addition, this consultant is Director of the National Newborn Bloodspot Screening Laboratory and consultant chemical pathologist to The Rotunda Hospital. A minimum of two WTE consultants, giving full cross-cover to each other, are required in the new children's hospital, in order to provide a national service. Furthermore, joint appointments are required in at least one of the two proposed outreach paediatric sites in Connolly Hospital Blanchardstown (paediatric and maternity). Connolly and Tallaght hospitals are currently served by adult chemical pathologists, and it is assumed that these consultants will provide support for the limited testing proposed on these sites. Additional advice from the new children's hospital will be available, if required.

The merger of the two departments in the new children's hospital should allow for the development of the paediatric clinical biochemistry service, with repatriation of investigations and greater participation in multidisciplinary teams. It will remain the only paediatric clinical biochemistry department in Ireland supporting national clinical services in the new children's hospital, as well as housing the National Newborn Bloodspot Screening Laboratory and providing a valuable resource to other hospitals, and clinicians in Ireland.

As we move into the genomic era in medicine, it is essential that the Department of Clinical Biochemistry (biochemical genetics) continues to foster close working links with the Department of Molecular Genetics, in order to provide best international practice for the diagnosis and monitoring of infants and children living in Ireland who have rare inherited metabolic disorders; these have an overall incidence of up to one in 500.

Microbiology

Based on the paediatric catchment population, specialist services and other factors, there is a requirement for an additional 2.9 WTE consultant paediatric clinical microbiologists over the existing number, in order to deliver the paediatric model of care. This calculation is based on the RCPath formula, and is detailed in Appendix 4. The increase in consultant numbers will allow for a significant expansion of the service, which will in turn improve patient care and result in the development of a better laboratory for the new children's hospital. Current staffing levels for laboratory scientists, infection prevention and control nurses, antimicrobial pharmacists and administrative assistants need to be maintained, to ensure delivery of a high-quality service.

30.3.2 Infrastructure

It is essential that clinical microbiologists have access to an on-site clinical INAB-accredited laboratory, in order to provide the clinical service that is expected for a national children's hospital. By having control over the laboratory, it will be possible for the microbiologists to ensure that the service can be responsive to the needs of both the user and the patient. The focus of the laboratory can be directed at paediatrics and kept relevant. Moreover, it also ensures that during periods of high activity it can respond quickly to the needs of the hospital. The laboratory in the new children's hospital must also have good connectivity with the satellite centres, so that clinicians can have access to historical patient results, as necessary. Appropriate information technology support is required for the generation, analysis and reporting of surveillance and audit data, and for the analysis and reporting of laboratory bioinformatics data and epidemiological data from reference laboratories.

30.3.3 Education

Histopathology

The existing paediatric and perinatal pathology resources play an important role in undergraduate and postgraduate medical, nursing and paramedical education in hospitals and affiliated academic institutions. This contributes to the training of current and future paediatric healthcare professionals, and also encourages potential pathology trainees to pursue career opportunities in this specialty. This education role will inevitably continue, irrespective of changes in hospital groups and the establishment of the new children's hospital. Obviously, adequate resources are needed in order to achieve the full potential of the role. The establishment of a unified tertiary paediatric service creates the opportunity to explore the possibility of extending training of pathology NCHDs. At present, this is limited to a three-month rotation as part of the basic training programme for general histopathology MRCPath. However, there is a dedicated paediatric pathology MRCPath and the new children's hospital would provide comprehensive exposure to paediatric pathology which, in conjunction with specialist perinatal pathology services in the maternity units, might permit completion of a formal paediatric pathology training programme – a programme which currently requires people to leave Ireland in order to obtain such training.

Haematology

The existing haematology resources play an important role in undergraduate and postgraduate medical, nursing and paramedical education in hospitals and affiliated academic institutions. This contributes to the training of current and future paediatric healthcare professionals, and also plays an important role in the training of adult haematologists who may practise in areas where they may encounter disease in the paediatric age group. This role will inevitably continue, irrespective of changes in hospital groups and the establishment of the new children's hospital. Obviously, adequate resources are needed in order to achieve the full potential of the role.

Chemical Pathology/Clinical Biochemistry

All staff, both scientific and medical, participate in continuing professional development as laid down by their respective professional bodies. Medical scientists are encouraged to enrol in a variety of MSc courses in clinical biochemistry, including courses run by Dublin City University and the University of Ulster. Each student undertakes a research project of at least six weeks' duration, related to an area of special interest to the respective laboratory. In-house training and education is provided for all scientific staff through regular meetings, i.e. five slide weekly meetings on the Temple Street site and monthly meetings on the Crumlin site. Both sites participate in the United Kingdom National External Quality Assessment Service (UKNEQAS) bi-weekly interpretative comment programme. Staff on the Temple Street site organise and participate in a three-week module of the Dublin City University MSc in Clinical Biochemistry. The topics, 'Paediatric Clinical Biochemistry' and 'Screening and Diagnosis of Inborn Errors of Metabolism' alternate each year. Lectures and workshops relevant to newborn screening are organised on a regular basis for public health nurses and midwives; lectures are also organised in Trinity College Dublin (TCD), University College Dublin (UCD) and the Royal College of Surgeons in Ireland (RCSI).

Microbiology

Clinical microbiology plays a role in the undergraduate and postgraduate curriculum in the education of all staff on the area of infection prevention and control, the utility of laboratory testing, and also around the area of patient management with respect to antimicrobials. Undergraduate teaching support is provided through lectures and tutorials in RCSI. Education sessions are also provided for paediatricians through Grand Rounds and journal clubs. Specialist registrars in microbiology are also trained in the department, and receive specialist training in all areas of paediatric infection by liaising closely with colleagues working in the infectious diseases area and in academic research.

30.3.4 Research

Histopathology

The existing paediatric and perinatal pathology resources play an active role in research, both in supporting research output undertaken by clinical staff and in initiating independent research activity. If the appropriate resources were to be put in place, there would be an opportunity to build on existing expertise to further develop the worldwide reputation of Irish-based researchers in this area. The concentration of clinical facilities and research facilities in close proximity would generate additional benefits and should be pursued wherever possible. Geographical separation of clinician-researchers from a research facility would be extremely detrimental for clinician-scientists who, hard-pressed for time due to their clinical commitments, would find themselves unable to respond adequately to the needs of their research groups optimally as a result of time lost travelling from location to location. Furthermore, the proximity of all branches of research, including wet-laboratory research, to the clinical-teaching campus is essential for exposure of the entire medical community, trainees and fully fledged professionals to the research.

Haematology

The existing haematology resources play an active role in research, both supporting research output undertaken by clinical staff and initiating independent research activity. If the appropriate resources were to be put in place, there would be an opportunity to build on existing expertise in order to further develop the worldwide reputation of Irish-based researchers in the haematology area.

Chemical Pathology/ Clinical Biochemistry

The existing departments are active in independent laboratory research, some of which is linked to the attainment of higher professional degrees for laboratory scientists working within the specialty. The laboratories also provide a critical service in supporting much of the clinical research undertaken in paediatrics.

Microbiology

The paediatric microbiology service has a strong research record, encompassing research activities generated within the diagnostic, infection prevention and control, and antimicrobial stewardship components of the service, as well as providing support for clinical audit and research carried out by other teams. Research is a key component of the work carried out by the national microbiology reference laboratory services, which are currently based in Temple Street and Crumlin. Formal links to paediatric research programmes should be maintained and strengthened.

30.4 GOVERNANCE

30.4.1 Overall Governance Arrangements

External

While the existing Crumlin and Temple Street departments are standalone paediatric services, the remaining paediatric services are components of combined adult/children's laboratories. That situation notwithstanding, the governance of each paediatric laboratory service will lie within the hospital group structure. Undoubtedly, there will be benefits from having a professional relationship between units.

The governance arrangements for the new children's hospital laboratory service will depend on the ultimate configuration chosen by the Children's Hospital Group. If, as is currently envisaged, the departments of Paediatric Laboratory Medicine are housed in a separate laboratory within the new children's hospital, then the governance arrangement will be straightforward and will be directly to the Clinical Director and CEO of the Children's Hospital Group. If a combined campus laboratory is built, and if the DPLM is housed there, the governance arrangements will be more complex. However, a clear governance relationship with the new children's hospital would be necessary if the DPLM were to remain responsive to the needs of the children, their families and clinical staff working in the facility.

Internal

Internally, the DPLM will continue to have a pathology board or management committee who will be responsible for the laboratory service. Whereas a clinical lead will be appointed from the consultant group, each department will also have a medical lead or director selected from one of the consultants who has sessional commitments to that department. In practice, as is currently the case, individual laboratory departments will probably operate with joint leads drawn from both medical and scientific staff. Medically qualified staff will provide the clinical lead and scientific staff will provide the technical and scientific leads as components of a joint leadership team.

Chemical Pathology/Clinical Biochemistry

The governance and the corporate governance structure of both laboratories is laid down in the respective Quality Management documents, which have been approved and adopted by the respective pathology boards. The consultant chemical pathologist is responsible for strategic planning and implementation of service delivery, as well as for developments in partnership with the laboratory managers and chief medical scientists, in consultation with the respective paediatric clinical teams on both sites. The consultant chemical pathologist will report to the Director of Pathology in the individual hospitals.

With respect to the National Newborn Bloodspot Screening Laboratory, the Director of the laboratory (consultant chemical pathologist) is responsible for the day-to-day management of the screening programme, and reports to the HSE's National Newborn Bloodspot Screening Governance Group. Temple Street has a service level agreement with the HSE to provide the service on behalf of the HSE and to act as data controllers, in addition to acting as data processors for the programme.

Clinical Microbiology

The governance of clinical microbiology services in the new children's hospital will be done through the laboratory management board. This will ensure that the department comes under the INAB accreditation process and that the services provided are reliable and quality assured. The reference laboratory services will also operate under this framework. Infection control services are reviewed through the infection control committee of the hospital, who report to the chief executive officer, as per guidance from HIQA. Paediatric microbiology should be embedded within both a hospital-wide and country-wide programme, in order to improve the quality and safety of paediatric care.

30.5 PROGRAMME METRICS AND EVALUATION

Histopathology

Paediatric histopathology is a component of the Faculty of Pathology Quality Improvement Programme, with specific metrics designed to capture performance and quality in paediatric autopsy services as well as other metrics shared with adult practice describing surgical pathology.

The percentage of fetal and perinatal deaths in a maternity unit that are subject to investigation by autopsy is a further metric that will allow comparison between units across Ireland, and should provide a clear indication of the ability of disparate units to access perinatal services.

Laboratory Accreditation to ISO 15189

Haematology

Accreditation to ISO 15189
Accreditation of transfusion by Health Product Regulatory Authority
Accreditation of stem cell transplants by Joint Accreditation Committee-ISCT & EBMT (JACIE)

Chemical Pathology/Clinical Biochemistry

The programme metrics, including performance, efficiency and service development, are assessed by using a variety of measures. The laboratory service on both sites is accredited annually by INAB to ISO 15189 standards.

The laboratories participate in a number of national and international qualitative and quantitative quality assurance programmes, and regularly monitor agreed key performance indicators (KPIs). The departments of Paediatric Laboratory Medicine on both sites organise annual user meetings and user surveys to obtain feedback from users.

Regular audit and management review is also a key metric of the programme. This monitors the response to user requests and complaints, the quality of results, the continuous improvement process, quality objectives and developing needs of the service, among a range of other issues. The programme is evaluated against best international practice through research and attendance at specialist international meetings, such as the International Congress of Paediatric Laboratory Medicine, the annual symposium of the Society for the Study on Inborn Errors of Metabolism (SSIEM), the International Society for Newborn Screening (ISNS), the European Conference on Cystic Fibrosis and the European Society of Paediatric Endocrinology (ESPE).

Members of the departments, and the consultant chemical pathologist in particular, have served on a number of task forces, and have participated in a number of national and international meetings where the programme was reviewed and monitored against peers. These task forces have included the following: the UKNEQAS Clinical Chemistry Advisory Group for Paediatric Assays; the Council of the Society for the Study of Inborn Errors of Metabolism; Irish representative in the European division of the International Society of Newborn Screening Working Group; Department of Health representative on the evaluation of population newborn screening practices for rare disorders in Member States of the European Union.

Clinical Microbiology

Key metrics for the programme are:

- Number of consultant microbiologists
- Compliance with key documents regarding infection control
  - HIQA guidelines
  - MRSA guidelines
  - Hand hygiene
  - Other key Health Prevention Surveillance Centre (HPSC) documents
- Establishment of a comprehensive patient-centred surveillance programme
- Turnaround times for key laboratory investigations
- HIQA inspections

30.6 KEY RECOMMENDATIONS

- Increase consultant paediatric pathologists in the Dublin maternity hospitals, as well as in the Cork, Limerick and Galway maternity hospitals.
- A minimum of two WTE consultant chemical pathologists, giving full cross-cover to each other, are required in the new children's hospital, in order to provide a national service.
- An additional 2.9 WTE clinical microbiologists are required.
- An additional transplant physician to support the Bone Marrow Transplant programme for metabolic and malignant disease is required.
- The HSE Laboratory Modernisation Programme will result in significant changes to the way in which diagnostic laboratories operate in Ireland, following the establishment of a hub-and-spoke model whereby

regional diagnostic laboratories (based in large tertiary hospitals) will provide laboratory medicine services to other hospitals (most likely determined by hospital group configurations). The implications of this programme for the new children's hospital remain unclear, but whatever configuration is chosen for the site, a robust, flexible, accessible, identifiable, accountable and renewable paediatric laboratory medicine service must be in place, in order to support the new children's hospital and regional paediatric care units.

30.7 ABBREVIATIONS AND ACRONYMS

AMR	antimicrobial resistance
CSF	cerebrospinal fluid
CRE	Carbapenem-Resistant Enterobacteriaceae
DPLM	Departments of Paediatric Laboratory Medicine
EMBU	Epidemiology and Molecular Biology Unit
ESPE	European Society of Paediatric Endocrinology
FISH	fluorescence in situ hybridization
GFR	glomerular filtration rate
GP	general practitioner
HCAI	healthcare-associated infection
HIQA	Health and Quality Information Authority
HPSC	Health Protection Surveillance Centre
HSE	Health Service Executive
HSSD	Hospital Sterile Services Department
IMMRL	Irish Meningococcal and Meningitis Reference Laboratory
INAB	Irish National Accreditation Board
IPC	infection prevention and control
ISNS	International Society for Newborn Screening
JACIE	Joint Accreditation Committee-ISCT & EBMT
KPI	key performance indicator
LIMS	laboratory information management system
MDROs	multidrug-resistant organisms
MRCPath	Membership of Royal College of Pathology
NCHD	non-consultant hospital doctor
OPAT	outpatient parenteral antimicrobial therapy
PICU	paediatric intensive care unit
PCR	polymerase chain reaction
RCPI	Royal College of Physicians of Ireland
RCSI	Royal College of Surgeons in Ireland
SSIEM	Society for the Study on Inborn Errors of Metabolism
TCD	Trinity College Dublin
UCD	University College Dublin
UK	United Kingdom
UKNEQAS	United Kingdom National External Quality Assessment Service
WTE	whole time equivalent

30.8 REFERENCES

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30.9 APPENDICES

30.9.1 Appendix 1 Current Paediatric Clinical Microbiology Staffing in Temple Street and Crumlin

Table 1: Current clinical microbiology staffing (in whole-time equivalents)

Role	Temple Street	Crumlin	Total
Consultant microbiologist	1	0.7	1.7
Medical scientist (diagnostic laboratory)	10	24	34
Medical scientist (molecular and reference laboratories)	10	3	13
Infection prevention and control nurse	1.8	3	4.8
Antimicrobial pharmacist	0.5	1	1.5
Administrative assistant	1.8	1	2.8
Specialist registrar	1	0*	1

* One registrar assigned, but never appointed

Table 2: Current consultant microbiologist staffing arrangements in Temple Street and Crumlin

Role	Primary employer	Secondary site	Division of hours
A	Crumlin	Coombe Women & Infants University Hospital	28 hours Crumlin 11 hours Coombe
B	Temple Street	Health Protection Surveillance Centre	21 hours Temple Street 18 hours HPSC
C	Rotunda	Temple Street and Honorary Fellow at Royal College of Surgeons in Ireland	21 hours Rotunda 18 hours Temple Street

The consultant microbiologists in Tallaght will not have any hours transferred to the new children's hospital.

30.9.2 Appendix 2 Current Roles of Clinical Microbiologists in Temple Street and Crumlin

Role	Core function	Role of the Clinical Microbiologist
1.	Clinical	• Consult on difficult cases to assist with differential diagnosis, optimise laboratory requests, interpret results and advise on both empiric and rationalised antimicrobial treatment. Provide 24-hour consultation service.
2.	Antibiotic stewardship	• Observe trends in resistance, and alert clinicians to changing patterns. Selective reporting of antimicrobials to preserve reserve antimicrobials for infections with multidrug-resistant organisms (MDROs)

3.	Surveillance	• Sentinel organisms or clusters of organisms to identify possible spread of infection. Ensure early detection, in order to prevent outbreaks of infectious disease. • Management of clustering and outbreaks, as required • Surveillance of high-risk facilities • Acute compounding unit • Apheresis unit • Stem cell transplant unit • HSSD • Spirometry • Endoscopy • Liaison with personnel in relevant areas, in order to identify reasons for non-conformance of results • Reporting notifiable diseases • Reporting MDROs
4.	Patient screening	• Detection MDRO carriage and advise on management
5.	Laboratory	• Ensure that the diagnostic testing repertoire is optimised for paediatric cohorts severed. Specialised testing to be tailored for each group, such as oncology, cystic fibrosis, cardiology. • Optimise turnaround times to facilitate bed/cot management, particularly during viral gastroenteritis and respiratory season. • Introduce new technology in a cost-effective manner, in order to ensure that the tertiary referral centre can accommodate national demands, once volume of requests is sufficient. Referral of specialist requests to specialised centres abroad. • Detection of MDROs and particularly CREs is both complex and evolving. Ensure that methodology is continuously updated. • Review intra-hospital, inter-hospital, national and international antimicrobial trends regularly.
6.	Laboratory management	• Clinical and scientific staff jointly plan and prioritise laboratory developments. • Business plans to be developed, in order to ensure cost-effectiveness, or to justify need where not cost-effective. • Accreditation of laboratory tests via INAB • Staff training to ensure understanding new tests equipment. • Regular audits, including internal and external quality assessments • Ensure staff safety/liaise with occupational health
7.	Specialised 'reference' services	• IMMRL • EMBU • Pertussis • CF pseudomonas service • Aspergillus

8.	Buildings, new builds/ refurbishment	• Assist with implementation of latest design recommendations for infection control standards • Ensure patient/staff safety during these episodes • Educate builders and their subcontractors on hazards • Review builders' method statements
9.	Infection prevention and control team	• Lead IPC team to ensure that standard operating procedures/guidelines/ information leaflets are available and are up to date • Respond to epidemics, such as Ebola virus, train staff regarding personal protective equipment (PPE) and understanding of the mechanisms of spread and management isolation, infectious material and waste. • Education on continuous basis for hand hygiene, contact precautions, epidemiology of infectious diseases, isolation. • Ward surveillance rounds on a daily basis. Advice to staff parents/patients • Screening of isolation rooms post-terminal clean • Surveillance of sentinel organisms MDROs. Line infection rates, wound infection rates, positive blood culture rates. MDRO surveillance to include colonisation and infection rates.
10.	Education/ training	• All grades of staff including postgraduate trainees.
11.	Research	• Supervision of research theses • Liaison with other teams, in order to collaborate on research initiatives • Support clinical trials • Initiate laboratory-linked research projects • Publish in peer-reviewed journals • Present posters and participate in hospital, national and international conferences

30.9.3 Appendix 3 Required Consultant Paediatric Microbiologists

Criteria	WTE requirement/ weighting factor	Notes
Population served	2 WTEs	Based on serving one-third of national paediatric population
Trainees	x 1.05 multiplicative factor	Based on one paediatric microbiology SpR post
Specialist services	x 1.4 multiplicative factor	National tertiary referral services (renal transplant, paediatric haematology/oncology, neurosurgery, inherited metabolic disorders, cardiac surgery, cystic fibrosis etc.)
Teaching	x 1.05 multiplicative factor	>20 lectures/teaching sessions per year
Subtotal, based on Webb formula	**3.1 WTEs**	
Clinical direction of reference laboratories	0.5 WTE	IMMRL and National Pertussis Reference Laboratory (0.25 WTE per reference laboratory)
Support for laboratory governance and clinical issues on satellite centres	0.5 WTE	Responsibility for ensuring the clinical accreditation of rapid diagnostics performed at the clinical satellite centres, and offer clinical advice
Community paediatrics and representation on national committees	0.5 WTE	Requirement for community paediatric services (CRC, St Michael's House, Sunshine House). National Immunisation Advisory Committee. Paediatric representation on national infection committees. Remit to provide national infection control advice.
Current complement	**1.7 WTEs**	Divided between three posts, currently shared with The Rotunda Hospital, Coombe University Hospital and HPSC
Total requirement	**4.6 WTEs**	
Total requirement in addition to current complement	**2.9 WTEs**	