

# Paediatric Oncology

Level 3

Paediatrics Sub-specialty Syllabus

**Version 2**

Approved by the GMC for implementation from 1st August 2018

This document outlines the syllabus to be used by doctors completing completing Level 3 Paediatric Oncology training in the United Kingdom training in the United Kingdom (UK). It accompanies the RCPCH Progress curriculum and assessment strategy.

This is Version 2.0. As the document is updated, version numbers will be changed, and content changes noted in the table below.

Version number	Date issued	Summary of changes
2.0	July 2018	Amendment to section 16

# Introduction



This syllabus supports the completion of the RCPCH Progress curriculum, and should be used in conjunction with the curriculum document.

The purpose of the curriculum is to train doctors to acquire a detailed knowledge and understanding of health and illness in babies, children and young people. The curriculum provides a framework for training, articulating the standard required to work at Consultant level, and at key progression points during their training, as well as encouraging the pursuit of excellence in all aspects of clinical and wider practice.

The curriculum comprises of Learning Outcomes which specify the standard that trainees must demonstrate as they progress through training and ultimately attain a Certificate of Completion of Training (CCT). The syllabi support the curriculum by providing further instructions and guidance as to how the Learning Outcomes can be achieved and demonstrated.

## Using the Syllabus

Paediatric trainees are required to demonstrate achievement of generic and sub-specialty or General Paediatric Learning Outcomes throughout their training period.

For all level 1 and level 2 trainees, there are 11 generic paediatric Learning Outcomes for each level. At level 3, there are a further 11 generic paediatric Learning Outcomes for all trainees, and several additional Learning Outcomes in either General Paediatrics or the GRID sub-specialty the trainee has been appointed into.

This syllabus contains 5 interlinked elements, as outlined in Figure 1 which illustrates how each element elaborates on the previous one.

## Elements of the Syllabus

The **Introductory Statement** sets the scene for what makes a Paediatric Oncologist.

The **Learning Outcomes** are stated at the beginning of each section. These are the outcomes which the trainee must demonstrate they have met to be awarded their Certificate of Completion of Training (CCT) in Paediatrics. Progress towards achievement of the Learning Outcomes is reviewed annually at the Annual Review of Competence Progression (ARCP).

Each Learning Outcome is mapped to the General Medical Council (GMC) Generic Professional Capabilities framework. Each trainee must achieve all the Generic Professional Capabilities to meet the minimum regulatory standards for satisfactory completion of training.

The **Key Capabilities** are mandatory capabilities which must be evidenced by the trainee, in their ePortfolio, to meet the Learning Outcome. Key Capabilities are therefore also mapped to the GMC Generic Professional Capabilities framework.

The **Illustrations** are examples of evidence and give the range of clinical contexts that the trainee may use to support their achievement of the Key Capabilities. These are intended to provide a prompt to the trainee and trainer as to how the overall outcomes might be achieved. They are not intended to be exhaustive, and excellent trainees may produce a broader portfolio or include evidence that demonstrates deeper learning. It is not expected that trainees provide ePortfolio evidence against every individual illustration (or a set quota); the aim of assessment is to provide evidence against every Key Capability.

The **Assessment Grid** indicates suggested assessment methods, which may be used to demonstrate the Key Capabilities. Trainees may use differing assessment methods to demonstrate each capability (as indicated in each Assessment Grid), but there must be evidence of the trainee having achieved all Key Capabilities.

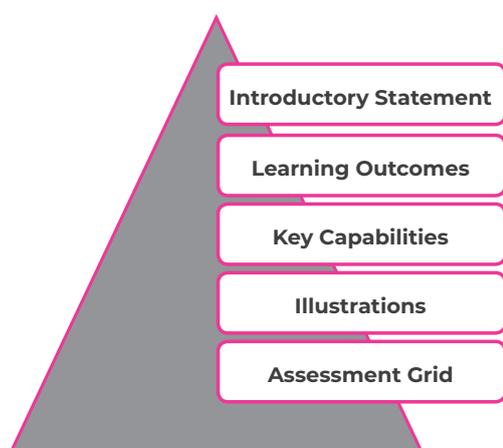


Figure 1: The 5 elements of the syllabus

## Using the Syllabus with ePortfolio

Recording evidence in the ePortfolio to demonstrate progression against the learning outcomes and key capabilities can be done from any assessment or event in the ePortfolio.

At the end of any event or assessment, there is an opportunity to add tags, documents and comments. Expanding this by clicking “show more” will enable you to link your assessment to the curriculum items, where you will find the learning outcomes for each domain, key capabilities and example illustrations.

Trainees will therefore be able to track their progress in fulfilling the mandatory learning outcomes and key capabilities.



# Paediatric Oncology Introductory Statement



## **Introductory Statement**

A Paediatric Oncologist is a doctor with specialist expertise in managing children with cancer. The cancer may be in any location or system, including the blood (leukaemia), brain or body. They care for children and young people and their families at all stages of treatment, from diagnosis to long-term follow-up or palliative care, and often maintain support for many years.

Paediatric Oncologists work closely with haematologists, surgeons, radiation oncologists, pathologists, radiologists, endocrinologists, and other oncologists, nationally and internationally, to ensure therapies are appropriate and effective. They work locally with psychologists, social workers and teachers to support patients and their families, ensuring that the burden of treatment is contained and that the long-term effects of treatment are minimised.

Evidence-based medicine is at its core, and oncology is characterised by the expectation that patients will be treated according to clinical trials whenever possible.

# Sub-specialty Learning Outcomes

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Sub-specialty Learning Outcomes		GMC Generic Professional Capabilities
1.	Recognises, assesses and manages the full range of paediatric oncology conditions.	GPC 3, 5, 6, 7
2.	Assumes the role of oncology team leader and takes responsibility for this area of service, effectively managing and coordinating patient flow, staffing, safety and quality in the context of a paediatric oncology department.	GPC 1, 5, 6
3.	Builds robust relationships with parents or carers and patients that will be sustainable for both parties throughout the cancer journey.	GPC 1, 3, 7
4.	Understands the concepts of evidence-based medicine and clinical trials, and the cornerstones that they maintain in the field of paediatric oncology.	GPC 6, 9

# Sub-specialty Learning Outcome 1

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Recognises, assesses and manages the full range of paediatric oncology conditions.	GPC 3, 5, 6, 7
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## Key Capabilities

Demonstrates proficiency in recognising and managing all paediatric cancers, at presentation, at relapse and during palliative and terminal care.	GPC 3
Demonstrates proficiency in professionally engaging with each and every new patient and their families to guide them through their cancer journey, which may last for a considerable number of years.	GPC 3

## Illustrations

Applies specialist knowledge to investigate, diagnose and manage the following within their specialisation, recognising some areas of overlap between paediatric oncology training strands:

1. **Genetics and molecular biology:**

- Describes features of syndromes associated with an increased cancer risk, including ataxia telangiectasia, xeroderma pigmentosa, Li–Fraumeni syndrome, inherited breast cancer syndromes, PTEN hamartoma syndrome, Fanconi anaemia, Lynch syndrome, familial adenomatous polyposis, neurofibromatosis type I and II, Gorlin syndrome, Wiskott–Aldrich syndrome, Wilms tumour predisposition syndrome, and rhabdoid tumour predisposition syndrome
- Identifies the types of tumour associated with each condition
- Establishes the importance of identifying cancer predisposition syndromes and the ethical considerations involved in genetic counselling, and applies this to practice

2. **Cytogenetic and molecular biology techniques:**

- Describes the main molecular biological techniques in current use for diagnosis, monitoring and disease stratification in current oncology practice; this is likely to include karyotype analysis, fluorescence in situ hybridisation (FISH), reverse transcription polymerase chain reaction (rtPCR) and gene sequencing techniques including next generation sequencing, gene expression analysis and methylation analysis

3.

**Radiotherapy:**

- Recognises the indications for radiotherapy for each paediatric tumour
- Describes the basic principles of radiotherapy and the planning and treatment methods for children at different ages, including immobilisation methods, steps in planning, and recognition of the key aspects of a radiotherapy plan
- Describes gross tumour target volume, clinical target volume and planning target volume
- Describes the principles of conformal therapy, arc and rotational therapy, non-coplanar planning, stereotactic localisation and intensity-modulated radiotherapy
- Describes normal tissue damage (early and late)
- Describes the concept of normal tissue tolerance
- Discusses the factors influencing tolerance and knows the range of tolerance levels for different tissues and organs; knows for which organs risk may be dose-limiting, such as the spinal cord, optic chiasm, lung and heart
- Describes the relevance of linear energy transfer (LET) to cellular damage
- Explains the relative biological effect (RBE) and discusses its relationship to LET
- Explains commonly encountered dose fractionation regimes (hyperfractionation, accelerated fractionation and hypofractionation) and their radiobiological rationale
- Explains the influence of gaps in radiotherapy
- Explains the influence of oxygen on radiosensitivity
- Manages the interactions of chemotherapy agents with radiotherapy
- Explains the difference between x-rays (photons) and protons, and the potential advantage of these in the paediatric setting
- Explains the principles of brachytherapy and the potential benefit in terms of local radiation dose
- Explains the principles of molecular radiotherapy, such as <sup>131</sup>I-MIBG and <sup>177</sup>Lutetium-Dotatate, and <sup>131</sup>I for thyroid carcinoma
- Names and describes inherited syndromes associated with increased sensitivity to radiation and those with increased risk of malignancy following radiotherapy
- Appreciates the role of the play therapist and the specialist paediatric radiographer
- Demonstrates awareness of the National Health Service (NHS) Proton Overseas Programme and how it works

4.

**Supportive care:**

- Demonstrates knowledge of the common side effects of anti-cancer therapies and their management
- Demonstrates the ability to manage fever and infection, including the diagnosis, treatment and prevention of bacterial, fungal, viral and parasitic infections in patients receiving systemic anti-cancer therapy
- Advises on and manages problems associated with vascular access, including management of line-associated sepsis, line malfunction and line-associated thrombosis and extravasation
- Assesses strategies to reduce the risk of infection during treatment
- Explains the importance of nutrition in the care of children with cancer and how to optimise nutrition
- Demonstrates understanding of the management of mouth care
- Demonstrates understanding of the management of skin problems
- Prescribes anti-emetic therapy based on risk stratification
- Recognises mobility impairment secondary to anti-cancer therapies and makes appropriate management recommendations, including referral to other MDT members
- Recognises common subacute side effects of cancer and its treatment, and manages or refers as appropriate
- Knows the risk factors for acute drug-specific side effects of therapy and strategies to prevent and manage these
- Demonstrates the ability to safely prescribe complex chemotherapy
- Demonstrates an understanding of the short- and medium-term psychological impacts of a diagnosis of cancer on a child, young person and their family, and makes appropriate management decisions and referrals

5.	<p><b>Long-term effects:</b></p> <ul style="list-style-type: none"> <li>• Explains the aetiology of late systemic toxicities of chemotherapy including cardiac, renal, respiratory, central nervous system (CNS), endocrine and bone effects, as well as second malignancy</li> <li>• Refers patients appropriately for fertility preservation</li> <li>• Assesses the psychological impact of cancer and its treatment, and refers for appropriate support, e.g. for issues such as body image and alopecia</li> <li>• Assesses the impact of cancer and its treatment on education and aspirations,</li> <li>• Advises on risk-stratified post-treatment immunisation</li> <li>• Plans surveillance for the above toxicities and has knowledge of national screening strategies, e.g. for breast cancer</li> <li>• Manages common toxicities and knows when to escalate care</li> <li>• Describes the late toxicities of radiotherapy, including local tissue damage and second malignancy</li> <li>• Describes the late complications of bone and soft tissue tumours and their initial management</li> <li>• Manages late psychological morbidities seen in children and young people treated for cancer and explains current models of follow-up care and NHS strategy</li> </ul>
6.	<p><b>Management of emergencies:</b></p> <ul style="list-style-type: none"> <li>• Manages serious problems at presentation of acute leukaemia/lymphoma including tumour lysis syndrome, hyperviscosity, coagulopathy, superior mediastinal syndrome and neutropenic sepsis</li> <li>• Manages any patient with fever and neutropenia, and can explain the rationale for the early administration of intravenous antibiotics</li> <li>• Identifies and manages, alongside neurosurgical colleagues, acute neurosurgical problems including spinal cord compression, raised intracranial pressure and shunt blockage</li> <li>• Manages problems associated with solid tumours including thrombosis, paraneoplastic phenomena and compression of critical structures</li> </ul>
7.	<p><b>Palliative care:</b></p> <ul style="list-style-type: none"> <li>• Leads a multidisciplinary team (MDT) in arranging palliative care for a child</li> <li>• Differentiates between the various medical treatment options that are available for a child who is palliative and remembers that team members may also be suffering when a child becomes palliative</li> <li>• Discusses the strengths and limitations of “self-help” strategies</li> <li>• Acknowledges that parents and children may still want to participate in clinical trials despite the fact their treatment is now palliative</li> </ul>

8.	<p><b>Pharmacology and therapeutics:</b></p> <ul style="list-style-type: none"> <li>• Prescribes safely and supervises the prescription of drugs for children of all ages with cancer</li> <li>• Advises and supervises safe prescription of intravenous fluids to complex oncology patients</li> <li>• Explains relevant adverse side effects of commonly used drugs in oncology patients</li> </ul>
9.	<p><b>Pharmacokinetics:</b></p> <ul style="list-style-type: none"> <li>• Safely prescribes chemotherapy in this age group</li> </ul>
10.	<p><b>Pharmacodynamics and pharmacogenetics:</b></p> <ul style="list-style-type: none"> <li>• Optimises drug therapy, and in particular understands the meaning of drug half-life, peak and trough levels, volume of distribution, clearance and area under the concentration-time curve (AUC)</li> <li>• Describes the major metabolic pathways, including P450 enzyme activity, glucuronidation and sulphation</li> <li>• Describes the effect of pathological states on drug disposition, and in particular liver dysfunction, malnutrition and renal impairment</li> <li>• Describes dose–response and exposure–response relationships</li> </ul>
11.	<p><b>Toxicity:</b></p> <ul style="list-style-type: none"> <li>• Responds to cases of overdose or poisoning with anti-cancer therapy</li> <li>• Describes the difference between an adverse event and an adverse drug reaction (ADR) (hyperimmunoglobulinemia D [HIDS] and cryopyrin-associated periodic fever syndromes [CAPS])</li> <li>• Manages the common clinical presentations of ADRs in children</li> <li>• Describes teratogenicity in the developing fetus and recognises the importance of contraception in sexually active young people receiving chemotherapy</li> </ul>

## Specific disease management:

1.

### **Leukaemias:**

• Disease management:

- » Manages the various clinical presentations of children with leukaemia and myelodysplastic syndrome (MDS)
- » Applies the current treatment protocols and clinical trials for childhood and infant acute leukaemias, both acute lymphoblastic leukaemia (ALL) and acute myeloid leukaemia (AML)
- » Applies the current treatment protocols and clinical trials for refractory and relapsed leukaemia
- » Applies the appropriate diagnostic investigations in children with leukaemia and MDS
- » Confidently discusses the prognostic factors in childhood leukaemia and their implications for risk stratification
- » Explains the role of, and indications for bone marrow transplant in infant and childhood leukaemias
- » Explains the current role of radiotherapy in leukaemia treatment and the complications associated with it
- » Recognises the developing role for immunotherapy in the management of leukaemia
- » Describes the management of rarer forms of childhood leukaemia
- » Manages testicular, CNS and bone marrow relapse of leukaemia
- » Explains the clinical, laboratory and prognostic features of chronic myeloid leukaemia and juvenile myelomonocytic leukaemia
- » Recognises the clinical presentation, laboratory features and prognosis of myelodysplasias
- » Explains the role of bone marrow transplant in the treatment of myelodysplasia and chronic myeloid leukaemia in childhood
- » Explains the prognostic factors associated with relapsed leukaemia
- » Explains the management of ALL and AML in patients with Down syndrome

- Principles:
  - » Describes what is known of the epidemiology of infant and childhood leukaemias and MDS, including the aetiology and genetic associations
  - » Describes the constitutional and genetic conditions that predispose to the development of leukaemia
  - » Describes the incidence of ALL and AML and the peak age at which they occur
  - » Discusses the historical perspective on the evolution of trials for the treatment of leukaemias
  - » Describes the cytogenetic and molecular abnormalities associated with infant leukaemias
  - » Monitors the response to treatment including minimal residual disease (MRD), with a recognition of its limitations
  - » Considers approaches to adult patients with leukaemia and recognises how these differ from paediatrics
  - » Applies knowledge of teenage and young adult (TYA) considerations e.g. the therapeutic differences and disease variants with age (young and old)
  - » Discusses new modalities for the treatment of leukaemias
- Supportive care:
  - » Manages the complications of leukaemia treatment including tumour lysis, coagulopathy, infections, mediastinal obstruction, pancreatitis, thrombosis, steroid-related diabetes and hypertension
- Late effects:
  - » Develops follow-up strategies for leukaemia survivors, identifies late effects of therapy and counsels accordingly

2.

**Bone tumours in children and young people:**

- Disease management:
  - » Recognises the differential diagnoses for the appearances of a suspected bone tumour on plain x-rays, including osteosarcoma, Ewing's sarcoma, osteoblastoma, Langerhans cell histiocytosis, and benign lesions
  - » Recognises the clinical presentation of osteosarcoma and Ewing's sarcoma
  - » Uses appropriate radiological and laboratory investigations to diagnose, stage and measure response in osteosarcoma and Ewing's sarcoma
  - » Recognises the clinical presentation and pattern of spread of osteosarcoma and Ewing's sarcoma
  - » Applies the staging system for osteosarcoma and Ewing's sarcoma
  - » Prescribes current treatment strategies for osteosarcoma and Ewing's sarcoma, and forthcoming developments
  - » Explains the role and limitations of surgery, the relevance of histological margins at resection and possible indications for further surgery or adjuvant radiotherapy for both Ewing's and osteosarcoma
  - » Explains the principles of managing relapsed osteosarcoma and Ewing's sarcoma

- Principles:
  - » Applies knowledge of the epidemiology, predisposing factors and genetic predispositions associated with osteosarcoma and Ewing's tumours
  - » Applies the clinical, radiological and laboratory features of osteosarcoma and Ewing's sarcoma
  - » Explains the relevant prognostic indicators in different bone tumours, including the site, tumour volume and histopathological response to treatment
  - » Discusses the different molecular subtypes of the Ewing's family of tumours and their effects on prognosis
  - » Upholds the value of a site-specialised sarcoma orthopaedic oncologic service
- Supportive care:
  - » Manages the clinical problems associated with osteosarcoma and Ewing's sarcoma
  - » Manages the side effects of chemotherapy and radiotherapy
- Late effects:
  - » Recognises the late effects of bone tumour therapy, including second malignancy and orthopaedic limitations
  - » Explains the rehabilitation requirements for limb sparing, joint-sparing surgery and massive resections, including amputation
  - » Explains the psychological effects of limb surgery for children and young adults
  - » Describes growth requirements and the post-operative management of prosthetic insertions
  - » Explains the principles of rehabilitation after limb surgery

3.

**Non-rhabdomyosarcomatous soft tissue sarcoma in children and adolescents:**

- Disease management:
  - » Explains the epidemiology, pathology and biology of soft tissue sarcoma in children and adolescents
  - » Recognises the clinical presentation of soft tissue sarcoma by age, by anatomic site and with and without metastases
  - » Uses appropriate radiological and laboratory investigations to diagnose and stage soft tissue sarcoma
  - » Recognises the cytogenetic and molecular genetic abnormalities associated with soft tissue sarcoma
  - » Applies the current national and European strategies for treatment of soft tissue sarcoma
  - » Explains the different approaches to treatment according to the anatomical site of the tumour and age of the child
  - » Explains the principles of managing relapsed soft tissue sarcoma
  - » Describes the current clinical trials available for treatment of soft tissue sarcoma
  - » Explains the roles of surgery, chemotherapy and radiotherapy in the treatment of soft tissue sarcomas and current European treatment strategies
  - » Manages infantile fibrosarcoma, infantile/aggressive/desmoid fibromatosis, malignant rhabdoid tumours, synovial sarcoma, malignant peripheral nerve sheath tumours and desmoplastic small round cell tumours
  - » Describes new therapeutic approaches in non-rhabdomyosarcomatous soft tissue sarcoma (NRSTS)
- Principles:
  - » Discusses the prognostic factors and the prognosis according to age and stage
  - » Discusses the genetic variables which have significance for the prognosis of soft tissue sarcoma
  - » Discusses the histological subtypes of soft tissue sarcomas relative to the prognosis and patterns of presentation and spread

4.	<p><b>Rhabdomyosarcoma:</b></p> <ul style="list-style-type: none"> <li>• Disease management: <ul style="list-style-type: none"> <li>» Recognises the clinical presentations of rhabdomyosarcoma (RMS) affecting the head and neck (parameningeal versus non-parameningeal), nasopharynx, orbit and pelvis and extremities</li> <li>» Explains the different approaches to treatment according to the anatomical site of the tumour and age of the child</li> <li>» Explains the principles of managing relapsed RMS</li> <li>» Describes the current clinical trials available for treatment of RMS</li> </ul> </li> <li>• Principles: <ul style="list-style-type: none"> <li>» Describes the genetic variables which have significance for the prognosis of RMS</li> <li>» Explains treatment stratification according to age, clinical presentation, molecular and cytogenetics, Intergroup Rhabdomyosarcoma Studies (IRS) grouping and sub-grouping according to the current national protocol</li> </ul> </li> </ul>
5.	<p><b>Retinoblastoma:</b></p> <ul style="list-style-type: none"> <li>• Disease management: <ul style="list-style-type: none"> <li>» Describes the clinical presentations and clinical features of unilateral and bilateral retinoblastoma</li> <li>» Recognises the clinical manifestations of trilateral retinoblastoma</li> <li>» Applies staging of retinoblastoma according to the intraocular extent of the tumour</li> <li>» Explains the role of surgery, irradiation, chemotherapy and photocoagulation in the treatment of retinoblastoma</li> </ul> </li> <li>• Principles: <ul style="list-style-type: none"> <li>» Explains the epidemiology and inheritance pattern of bilateral retinoblastoma</li> <li>» Applies the principles of screening and follow-up for children who are siblings of a patient with retinoblastoma</li> <li>» Discusses the prognostic features and prognosis of retinoblastoma according to stage and histology</li> </ul> </li> <li>• Late effects: <ul style="list-style-type: none"> <li>» Recognises the complications and late effects of retinoblastoma, including the risk of secondary malignancy in unilateral or bilateral retinoblastoma</li> <li>» Develops follow-up strategies for survivors and identifies late effects of therapy, counselling accordingly</li> </ul> </li> </ul>

6.

**Renal tumours:**

- Disease management:
  - » Recognises the clinical presentation of a renal tumour and knows the differential diagnosis of a renal mass for different age groups
  - » Describes the cytogenetic and molecular aspects of Wilms tumour
  - » Explains the significance of nephroblastomatosis in Wilms tumour
  - » Discusses the congenital anomalies associated with Wilms tumour and the current strategies for screening
- Principles:
  - » Discusses the incidence of Wilms tumour and understands the principles of treating bilateral Wilms tumour
  - » Discusses the prognosis for Wilms tumour and is able to stage Wilms tumour pre- and post-surgery
  - » Explains the pathological subtypes of renal tumours, including Wilms tumour
  - » Explains the stratification of therapy for Wilms tumour according to histology and treatment response
  - » Explains the approach to the management of relapsed Wilms tumour
  - » Describes the principles of treatment for all stages of Wilms tumour according to the current national and European clinical trials
  - » Discusses the presentation and management of mesoblastic nephroma
  - » Discusses the presentation and management of clear cell sarcoma of the kidney and renal rhabdoid tumour
- Supportive care:
  - » Manages hypertension secondary to a renal mass
- Late effects:
  - » Explains the complications of Wilms tumour and its treatment; understands the late effects of treatment and the recommended follow-up and screening for second tumours

7.

**Rare tumours:**

- Explains the importance of wide consultation, including with colleagues in adult specialties, and multidisciplinary team working when managing “rare” tumours in childhood
- Recognises the importance of literature review and the use of established guidelines where available
- Applies the principles of treatment of:
  - » Adrenocortical tumours
  - » Malignant melanoma
  - » Nasopharyngeal carcinoma
  - » Differentiated thyroid carcinoma
  - » Colonic carcinoma
  - » Tumours of unknown primary

8.

### **Hodgkin's lymphoma:**

- Disease management:
  - » Recognises the clinical presentation of Hodgkin's lymphoma
  - » Uses the appropriate radiological and laboratory investigations (including fluorodeoxyglucose-positron emission tomography [FDG-PET]) to diagnose, stage and measure response in Hodgkin's lymphoma
  - » Discusses the clinical presentation and pattern of spread of Hodgkin's lymphoma
  - » Applies knowledge of the histological subtypes of Hodgkin's lymphoma, their incidence in children and the effect of subtype on their prognosis and treatment
  - » Recognises and understands the management of nodular lymphocyte-predominant Hodgkin's lymphoma as a separate, more indolent variant
  - » Describes treatment stratification according to stage, clinical presentation and subtype
  - » Applies the current treatment strategies for Hodgkin's lymphoma, including the role of radiotherapy, and understands the principles of managing relapsed Hodgkin's lymphoma
- Principles:
  - » Discusses the epidemiologic, clinical, and laboratory features of Hodgkin's lymphoma in children, including the prognostic factors and prognosis according to age and stage
  - » Discusses the genetic variables which have a significance for the prognosis of Hodgkin's lymphoma
  - » Applies the Ann Arbor staging system for Hodgkin's lymphoma
  - » Recognises impaired cellular immunity in a patient with Hodgkin's lymphoma
  - » Recognises the different approaches taken for paediatric, young adult and older adult Hodgkin's lymphoma
- Supportive care:
  - » Manages the clinical problems associated with Hodgkin's disease
  - » Manages the side effects of treatment
- Late effects:
  - » Describes the complications of Hodgkin's disease therapy and the long-term side effects and their management, including cardiac and lung function effects, the increased risk of breast cancer and the risk of subfertility
  - » Develops follow-up strategies for survivors and identifies late effects of therapy, counselling accordingly
  - » Describes the importance of, and methods to achieve fertility preservation

9.

**Non-Hodgkin's lymphoma:**

- Disease management:
  - » Recognises the clinical presentations and pattern of spread of non-Hodgkin's lymphoma (NHL)
  - » Describes treatment stratification according to stage, clinical presentation and subtype
  - » Discusses the current treatment strategies for NHL, including the role of radiotherapy and high-dose therapy
  - » Describes the principles of managing relapsed NHL
  - » Describes the role of immunotherapy in lymphomas
  - » Discusses the current treatment strategies according to immunophenotype and pathological subtype
  - » Discusses the prognostic features and prognosis of NHL according to stage, histology and immunophenotype
- Principles:
  - » Discusses the types of NHL, specifically Burkitt's and Burkitt-like lymphoma, diffuse large B and mediastinal large B-cell lymphoma, lymphoblastic-B and T-cell lymphoma, and anaplastic large cell lymphoma
  - » Describes the incidence of lymphomas in children and the effect of this on their prognosis and treatment
  - » Discusses the association of Epstein Barr virus and human immunodeficiency virus NHL
  - » Describes the cytogenetic and molecular genetic abnormalities associated with NHL
  - » Explains the differences in the approaches to treatment of NHL for paediatric versus adult patients
- Supportive care:
  - » Manages the acute presentations of NHL, including SVC obstruction, airway compression, spinal cord compression and tumour lysis
  - » Manages the side effects of treatment
- Late effects:
  - » Describes the complications of NHL therapy, the long-term side effects (including on cardiac function) and their management

10.

**Neuroblastoma:**

- Disease management:
  - » Recognises the clinical presentations of neuroblastoma (NBL) by age, by anatomic site and with and without metastases (including for stage 4S)
  - » Uses the appropriate radiological and laboratory investigations to diagnose and stage NBL
  - » Describes treatment stratification according to age, clinical presentation and molecular and cytogenetics
  - » Discusses the current national and European strategies for treatment of NBL
  - » Describes the principles of managing relapsed NBL
  - » Explains the approach to the management of low-risk disease

- Principles:
  - » Discusses the prognostic factors and prognosis according to age and stage
  - » Discusses the genetic variables which have a significance for the prognosis of NBL
  - » Explains the current International Neuroblastoma Staging System (INSS)
  - » Discusses the association of opsoclonus myoclonus with NBL, its presentation and management
- Supportive care:
  - » Manages the clinical problems associated with NBL including hypertension, spinal cord compression, Horner's syndrome and respiratory compromise from massive tumour in infancy
  - » Manages the side effects of treatment
  - » Manages the side effects of high-dose therapy, including veno-occlusive disease
- Late effects:
  - » Describes the complications of NBL therapy, the long-term side effects and their management

11.

**Hepatic tumours:**

- Disease management:
  - » Recognises the clinical presentations of liver tumours according to age at presentation
  - » Discusses the differential diagnosis of right upper quadrant masses
  - » Discusses which congenital conditions are associated with an increased risk of hepatoblastoma and the association of hepatocellular carcinoma with inborn errors of metabolism causing cirrhosis
  - » Uses the appropriate radiological and laboratory investigations to diagnose and stage hepatoblastoma
  - » Explains treatment stratification according to tumour anatomy, age and tumour markers
  - » Explains the pre-treatment staging system
  - » Recognises the clinical features and treatment options for infantile haemangioma, congenital haemangioma and arterio-venous malformation of the liver in infancy
- Principles:
  - » Discusses the prognosis of hepatoblastoma and hepatocellular carcinoma, and factors that determine it
  - » Explains the role of supra-regional centres and multi-centre communication in the care of children with hepatic tumours
  - » Explains the role of liver transplantation in the management of hepatic tumours
  - » Applies the current national and European strategies for treatment of hepatoblastoma
- Supportive care:
  - » Manages the complications of liver tumours
- Late effects:
  - » Develops follow-up strategies for survivors and identifies late effects of therapy, counselling accordingly

12.

**Germ cell tumours:**

- Disease management:
  - » Explains the approach to treatment depending on age, histology and site, and the indications for surgery, chemotherapy and radiotherapy
  - » Explains the varied clinical presentations of germ cell tumours according to age and site
  - » Refers for the required radiological investigations for diagnosis and staging
  - » Discusses the method of risk stratification of germ cell tumours
- Principles:
  - » Explains the age distribution of germ cell tumours and the relation to primary site
  - » Discusses the syndromes/conditions predisposing to germ cell tumours
  - » Describes the embryological basis of germ cell tumours and the relationship to histological classification
  - » Describes the importance of serum and cerebrospinal fluid (CSF), alpha-fetoprotein (AFP) and human chorionic gonadotrophin (hCG) as tumour markers, both in diagnosis, monitoring response and at relapse, and recognises their limitations
  - » Recognises the importance of managing germ cell tumour patients through appropriate MDTs in optimising patient outcomes
  - » Explains follow-up requirements in terms of disease surveillance and potential late effects of therapy
  - » Recognises that molecular studies may help refine clinical risk stratification systems and assist diagnosis, disease monitoring, and detection of relapse
  - » Recognises that germ cell tumours can present at intracranial and extracranial sites, and that management strategies differ accordingly
  - » Assesses the management of relapsed germ cell tumour, including high-dose therapy
- Late effects:
  - » Assesses the complications of germ cell tumour therapy, the long-term side effects and their management

13.

**Haematopoietic stem cell transplantation:**

- Disease management:
  - » Explains the role of high-dose therapy with autologous stem cell rescue in the management of malignant disorders in children and young adults
  - » Explains the role of stem cell rescue in maintaining chemotherapy dose intensity in the treatment of solid tumours and after molecular radiotherapy
  - » Discusses the indications for allogeneic haematopoietic stem cell transplantation (HSCT) in children, including the indications for HSCT from other than a matched-sibling donor, e.g. malignant disorders, bone marrow failure syndromes, haemoglobinopathies and metabolic and immunological diseases
  - » Explains the advantages of donor lymphocyte infusion in some malignant disorders and mixed donor chimerism
  - » Explains the role and timing of allogeneic HSCT in the treatment of leukaemias and lymphomas in children and young adults

- Principles:
  - » Describes the role of total body irradiation (TBI) in HSCT, including its administration and short- and the long-term side effects
  - » Describes the commonly used chemotherapy conditioning regimens used in HSCT in malignant disorders in children and young adults, and understands their short- and long-term side effects
  - » Explains the principles of immunosuppression and the types of immunosuppressive agents used in HSCT
  - » Recognises the consequences of myelosuppression and immunosuppression post-HSCT, including the need for infection prophylaxis
  - » Explains the principles of human leucocyte antigen (HLA) typing, donor selection and HSCT collection and cryopreservation, and knows the different potential sources of HSCT
  - » Explains immune reconstitution post-HSCT and its relation to stem cell source, graft-versus-host disease GVHD and the use of serotherapy
  - » Explains infection precautions during and after HSCT
  - » Explains the need for, and the specific types of vaccination that are given post-HSCT
- Supportive care:
  - » Recognises the complications of HSCT and their management, including graft-vs-host disease, viral reactivation, haemorrhagic cystitis, veno-occlusive disease and graft failure
- Late effects:
  - » Discusses the late effects of HSCT in children, including on growth and fertility and the risk of second malignancy
- Governance:
  - » Explains the regulatory framework, accreditation requirements and governance arrangements for stem cell transplant services

14. **Teenage and young adult patients:**

- Disease management:
  - » Demonstrates an understanding of the specific diseases for which the behaviour and management differs from that for younger patients, specifically germ cell tumours, acute lymphoblastic leukaemia, Hodgkin's lymphoma and brain tumours
  - » Explains the rationale for the management of diseases that are uncommon in children and more common in adults, specifically melanoma, breast cancer and colon cancer
  - » Recognises that some drugs may be metabolised differently in the teenage years

- Principles:
  - » Discusses the differences in the delivery of care, communication strategies and challenges involved in providing appropriate holistic care for TYA patients
  - » Discusses psychosocial elements common to all TYA patients and those differences which arise because of the specific disease
- Supportive care:
  - » Demonstrates an understanding of the psychosocial issues of TYA patients
  - » Demonstrates an understanding of MDT working to support TYA patients
  - » Demonstrates an awareness of the differences in tolerance of therapy between children and TYA patients
- Late effects:
  - » Recognises that late effects differ according to physical development, psychological development, disease type and modality of therapy

15.

**Non-malignant haematology:**

- Disease management:
  - » Interprets appropriate blood indices, e.g. reticulocytes, ferritin, vitamin B12 and folate
  - » Interprets a coagulation screen and knows which further tests may be appropriate, particularly in relation to disseminated intravascular coagulation (DIC)
  - » Makes a diagnosis of haemophagocytic lymphohistiocytosis (HLH)
  - » Manages a child with haemophilia or other bleeding disorders, such as Von Willibrand disease, in accordance with local protocols
  - » Promptly treats bleeding in a haemophiliac patient and closely monitors head injuries in accordance with local protocols
  - » Discusses the main risk factors for thrombosis in a child
  - » Investigates and manages thrombosis in association with intravenous catheters
  - » Explains the therapeutic options for management of thrombosis and the risks associated with anticoagulants (including novel oral anticoagulants [NOACs]) and thrombolytic therapy
  - » Manages acquired disorders of coagulation (including disseminated intravascular coagulation and thrombotic thrombocytopenic purpura) and excessive bleeding
    - » Manages therapeutic and prophylactic anticoagulation
- Consumption:
  - » Manages haemolysis, both immune and non-immune
  - » Manages haemophagocytic lymphohistiocytosis (HLH) and thrombotic thrombocytopenia (TTP)
  - » Makes a differential diagnosis and begins the initial management of acute idiopathic thrombocytopenia (ITP)

- Transfusion:
  - » Applies knowledge about the hazards of blood transfusion, including transfusion-transmitted infection and transfusion reactions
  - » Explains the reasons for the use of irradiated blood products
  - » Recognises the clinical presentation and initiates the laboratory evaluation of haemolysis
  - » Applies clinical indications for blood product support, including the choice of appropriate blood products and the indications for irradiated blood products
- Haemoglobin and red cell disorders:
  - » Manages sickle cell disease and the acute sickle bone crisis; recognises splenic sequestration and sickle chest syndrome, realising the need for prompt intervention
  - » Discusses the CNS complications of sickle cell disease
  - » Recognises the clinical presentation and laboratory features of the thalassaemias
  - » Applies knowledge about the use of transfusion programmes and the principles of iron chelation therapy
  - » Recognises the presentation and management of hereditary spherocytosis
  - » Discusses aplastic anaemia, including the use of immunosuppression and transplantation

16

**Central Nervous System Tumours:**

- With particular reference to:
  - » Low Grade Astrocytoma
  - » High Grade Astrocytoma
  - » Diffuse Intrinsic Pontine Astrocytoma
  - » Ependymoma
  - » Embryonal Brain Tumours including Medulloblastoma, pineoblastoma and supratentorial Embryonal Tumours
  - » Craniopharyngioma
  - » CNS Germ Cell tumours
  - » Atypical Teratoid Rhabdoid Tumours
  - » Manages acquired disorders of coagulation (including disseminated intravascular coagulation and thrombotic thrombocytopenic purpura) and excessive bleeding
- Disease management:
  - » Identifies the different clinical presentations of CNS tumours and is able to manage according to the age of a child, anatomical position, and presence of raised intracranial pressure
  - » Utilises appropriate imaging modalities (including positron emission tomography) to determine the extent and metastatic spread of CNS tumours
  - » Appropriately incorporates the role of surgery, irradiation and chemotherapy in the treatment of CNS tumours

- » Applies knowledge chemotherapy agents and delivery techniques in relation to the blood brain barrier
- » Monitors the response to treatment of CNS tumours using clinical, imaging, biochemical and histological markers
- » Works within the framework of a neuro-oncology multi-disciplinary team in planning an appropriate and safe initial diagnostic workup of a child with a CNS tumour
- » Communicates effectively within a neuro-oncology multi-disciplinary team in planning the therapy for a child with a CNS tumour
- » Embryonal Brain Tumours including Medulloblastoma, pineoblastoma and supratentorial Embryonal Tumour
- Principles:
  - » Initiates prompt action for any patient with suspected raised intracranial pressure, spinal cord compression reduced level of consciousness and seizures
  - » Applies the epidemiology of central nervous system (CNS) tumours
  - » Recognises the importance of staging in treatment and prognosis of CNS tumours including the use of CSF cytology, serum and CSF tumour markers and molecular findings
  - » Applies knowledge of the cytogenetic and molecular genetic abnormalities associated with CNS tumours and recognise the association between brain tumours and heritable syndromes
  - » Applies knowledge of current clinical trials which are relevant to the brain tumour in question
  - » Applies knowledge about the neuro-pathological subtypes and grading of brain tumours and their relation to tumour site, pattern of spread and prognosis
- Supportive Care:
  - » Is able to access an Ommaya or Rickham reservoir for CSF sampling or administration of antibiotics or chemotherapy
- Late Effects:
  - » Recognises the acute complications and long term effects of brain tumours arising from; tumour, surgery, radiotherapy and chemotherapy related to patient's age and stage of development
  - » Applies knowledge about the potential neurological, endocrinological, cognitive, behavioural and social sequelae of CNS tumours and their treatment
  - » Applies knowledge about which secondary malignancies are associated with treatment of CNS tumours (also management of a brain tumour as a second malignancy)

- » Develops a multi-disciplinary team approach to rehabilitation including; physical therapy, speech & language, special senses (vision and hearing impairment), education (knowledge of special educational need provision), dietetics (management of obesity and failure to thrive), endocrine (assessment and replacement) and psycho-social care

# Sub-specialty Learning Outcome 2



Assumes the role of oncology team leader and takes responsibility for this area of service, effectively managing and coordinating patient flow, staffing, safety and quality in the context of a paediatric oncology department.	GPC 1, 5, 6
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## Key Capabilities

Demonstrates proficiency in leading and working within an MDT and values the input from all team members in order to attain the best outcome for the paediatric oncology patient.	GPC 3, 5, 6
Demonstrates proficiency in communicating and liaising effectively and clearly with the MDTs within the principle treatment centre (PTC) and the shared-care hospital.	GPC 3, 5

## Illustrations

Organisation of cancer care:	
1.	Demonstrates a clear understanding of MDT operation, including knowledge of the key members of the team.
2.	Presents a concise summary of a patient's disease pathway for MDT discussion.
3.	Leads the MDT discussion.
4.	Demonstrates understanding of children's and young people's cancer networks and of how to facilitate safe shared care between PTCs and paediatric oncology shared-care units (POSCUs).

# Sub-specialty Learning Outcome 3

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Builds robust relationships with parents or carers and patients that will be sustainable for both parties throughout the cancer journey.	GPC 1, 3, 7
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## Key Capabilities

Recognises that the cancer journey extends from presentation – with planning and delivery management of the initial therapy – to recognition of relapse and subsequent agreement on second line therapy with patient and carers.	GPC 3, 6
Demonstrates proficiency in managing the palliative and subsequent terminal care of infants, children and adolescents.	GPC 3, 6

## Illustrations

1.	Manages a dying child and their family.
2.	Manages the family of a child who has relapsed.

# Sub-specialty Learning Outcome 4

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Understands the concepts of evidence-based medicine and clinical trials, and the cornerstones that they maintain in the field of paediatric oncology.

GPC 6, 9

## Key Capabilities

Demonstrates proficiency in understanding the importance of clinical trials and the fundamental role they play in the field of paediatric oncology.

GPC 6, 9

## Illustrations

1. Demonstrates knowledge of the available trials in the management of the child with cancer.
2. Informs and gains the consent for a child and family to participate in a clinical trial.

# Assessment Grid

This table suggests assessment tools which may be used to assess the Key Capabilities for these Learning Outcomes. This is not an exhaustive list, and trainees are permitted to use other methods within the RCPCH Assessment Strategy to demonstrate achievement of the Learning Outcome, where they can demonstrate these are suitable.

Key Capabilities	Assessment / Supervised Learning Event suggestions									
	Paediatric Mini Clinical Evaluation (ePaed Mini-CEX)	Paediatric Case-based Discussion (ePaed Cbd)	Directly Observed Procedure / Assessment of Performance (DOP/AoP)	Acute Care Assessment Tool (ACAT)	Discussion of Correspondence (DOC)	Clinical Leadership Assessment Skills (LEADER)	Handover Assessment Tool (HAT)	Paediatric Multi Source Feedback (ePaed MSF)	Paediatric Carers for Children Feedback (Paed CCF)	Other
Demonstrates proficiency in recognising and managing all paediatric cancers, at presentation, at relapse and during palliative and terminal care.	✓	✓				✓		✓		
Demonstrates proficiency in professionally engaging with each and every new patient and their families to guide them through their cancer journey, which may last for a considerable number of years.						✓		✓	✓	
Demonstrates proficiency in leading and working within an MDT and values the input from all team members in order to attain the best outcome for the paediatric oncology patient.						✓		✓		
Demonstrates proficiency in communicating and liaising effectively and clearly with the MDTs within the principle treatment centre (PTC) and the shared-care hospital.	✓	✓			✓	✓		✓		
Recognises that the cancer journey extends from presentation – with planning and delivery management of the initial therapy – to recognition of relapse and subsequent agreement on second line therapy with patient or carers.	✓	✓								
Demonstrates proficiency in managing the palliative and subsequent terminal care of infants, children and adolescents.	✓	✓				✓		✓	✓	
Demonstrates proficiency in understanding the importance of clinical trials and the fundamental role they play in the field of paediatric oncology	✓	✓				✓				



