RCPCH Progress+

Paediatric training for excellence

Paediatric Oncology

Sub-specialty Syllabus

Version 4
Approved by the GMC for implementation from 1 August 2023

RCPCH
Royal College of Paediatrics and Child Health
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This document outlines the syllabus to be used by doctors completing Paediatric Oncology training in the United Kingdom (UK). It accompanies the RCPCH Progress+ curriculum and Assessment Strategy.

This is Version 4. 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
Version 2	September 2021	Document reviewed as part of the Shape of Paediatrics Training review. 'Using the Syllabus with ePortfolio' (page 5) updated.
Version 3	August 2023	Updated from Progress to Progress+. Using the syllabus (page 3) updated: reference to Level 1, 2 and 3 removed and replaced with Core and Specialty training.
Version 4	October 2024	Update to illustrations only.

Introduction

This syllabus supports the completion of the RCPCH Progress+ curriculum and should be used with the curriculum document and Assessment Strategy.

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, through 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 Learning Outcomes specifying the standard trainees must demonstrate to progress in training and attain a Certificate of Completion of Training (CCT). The syllabi supports the curriculum by providing further instructions and guidance on how the Learning Outcomes can be achieved and demonstrated.

In the context of clinical training or service the term “babies, children and young people” is a common term used by those working in paediatric and child health areas to mean any of those instances in context with clinical training or service. Therefore, in relation to the assessment, the trainee needs to achieve the capabilities for either a baby, child or young person.

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 core trainees (ST1 – 4), there are 11 generic paediatric Learning Outcomes. For specialty training (ST5 – 7), there are a further 11 generic paediatric Learning Outcomes and several additional Learning Outcomes in either General Paediatrics or the sub-specialty to which the trainee has been appointed.

This syllabus contains five 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 doctor.

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.

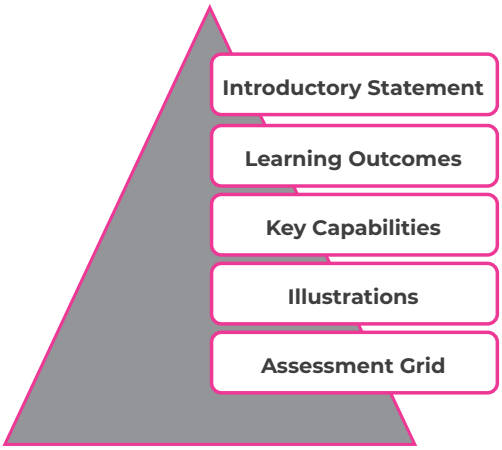

Figure 1: The five elements of the syllabus

Using the Syllabus with ePortfolio

The ePortfolio is used to demonstrate a trainee's progression using assessments, development logs and reflections. Events should be linked to the Progress+ curriculum specifically against the key capabilities at the appropriate level.

Further guidance on using the ePortfolio is available on our website: https://www.rcpch.ac.uk/resources/rcpch-eportfolio-guidance-doctors

Paediatric Oncology Introductory Statement

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

	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 as well as the cornerstones that they maintain in the field of paediatric oncology.	GPC 6, 9

Sub-specialty Learning Outcome 1

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

Key Capabilities

Demonstrates proficiency in recognising and managing all paediatric cancers at presentation, 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 many 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:** • Identifies 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 • Demonstrates knowledge of physical and psychosocial impact of cancer predisposition diagnosis and how to facilitate appropriate screening programmes
2.	**Cytogenic and molecular biology techniques:** • Recognises 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 • understand the role of WGS and GTAB in management of primary and relapsed disease

3.	**Radiotherapy:** • Understands the indications for radiotherapy for each paediatric malignancy • Recognises 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 • Recognises gross tumour target volume, clinical target volume and planning target volume • Recognises the principles of conformal therapy, arc and rotational therapy, non-coplanar planning, stereotactic localisation, intensity-modulated radiotherapy and proton-beam radiotherapy • Recognises normal tissue damage (early and late) and the clinical manifestations and management of such sequelae • Recognises the concept of normal tissue tolerance • Discusses the factors influencing tolerance and recognises the range of tolerance levels for different tissues and organs; which organs risk may be dose-limiting, such as the spinal cord, optic chiasm, lung and heart • Recognises 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 131I-MIBG and 177-Lutetium-Dotatate, and 131-I for thyroid carcinoma • Identifies 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 making use of their expertise • Understand the application process for NHS proton beam radiotherapy

4.	**Supportive care:** • Recognises the predictable and unpredictable side effects of anti-cancer therapies and their management • Manages 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 • Advises on and manages problems associated with indwelling metal limb prostheses and VP shunts • Assesses strategies to reduce the risk of infection during treatment • Explains the importance of nutrition in the care of children and young people with cancer and how to optimise nutrition • Understands the importance of physical activity in children and young people with cancer • Understand the importance and strategies for mouth care • Explains the management of skin problems • Awareness of the common side effects of novel targeted agents, including MEK inhibitors' • Prescribes anti-emetic therapy based on risk stratification • Recognises mobility impairment secondary to anti-cancer therapies and offers appropriate management recommendations, including referral to other MDT members • Recognises common subacute side effects of cancer and its treatment, as well as manages or refers as appropriate • Recognises the risk factors for acute drug-specific side effects of therapy and strategies to prevent and manage these • Safely prescribes complex chemotherapy • Recognises the short- and medium-term psychological impacts of a diagnosis of cancer on a child, young person and their family, as well as appropriate management decisions and referrals

5.	**Long-term effects:** • 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 • Refers patients appropriately for fertility preservation • Assesses the psychological impact of cancer and its treatment and refers for appropriate support, eg for issues such as body image and alopecia • Assesses the impact of cancer and its treatment on education and aspirations • Advises on risk-stratified post-treatment immunisation • Plans surveillance for the above toxicities and demonstrates knowledge of national screening strategies, eg for breast cancer • Manages common toxicities and recognises when to escalate care • Identifies the late toxicities of radiotherapy, including local tissue damage and second malignancy • Recognises the late complications of bone and soft tissue tumours and their initial management • Manages late psychological morbidities seen in children and young people treated for cancer and explains current models of follow-up care and NHS strategy
6.	**Management of emergencies:** • Manages serious problems at presentation of acute leukaemia/lymphoma, including tumour lysis syndrome, hyperviscosity, coagulopathy, superior mediastinal syndrome and neutropenic sepsis • Manages patients with fever and neutropenia and explains the rationale for the early administration of intravenous antibiotics • Identifies and manages, alongside neurosurgical colleagues, acute neurosurgical problems, including spinal cord compression, raised intracranial pressure and shunt blockage • Manages problems associated with solid tumours, including thrombosis, paraneoplastic phenomena and compression of critical structures
7.	**Palliative care:** • Leads a multi-disciplinary team (MDT) in arranging palliative care for a child and young person • Differentiates between the various medical treatment options that are available for a child and young person who is palliative and remembers that team members may also be suffering when a child and young person becomes palliative • Discusses the strengths and limitations of “self-help” strategies • Demonstrates a holistic approach to end of life care, including the importance of considering the needs of siblings and other family members whilst keeping the child or young person at the centre • Ability to have open and honest conversations with children, young people and their families about death and dying • Acknowledges that parents, children and young people may still want to participate in clinical trials despite the fact their treatment is now palliative

8.	**Pharmacology and therapeutics:** • Prescribes safely and supervises the prescription of drugs for children of all ages with cancer • Advises and supervises safe prescription of intravenous fluids to complex oncology patients • Explains relevant adverse side effects of commonly used drugs in oncology patients • Understands the importance of incident reporting and Duty of Candour in cases of prescribing or administration errors, and fosters a no-blame culture to allow learning from mistakes
9.	**Pharmacokinetics:** • Safely prescribes chemotherapy in this age group
10.	**Pharmacodynamics and pharmacogenetics:** • 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) • Recognises the major metabolic pathways, including P450 enzyme activity, glucuronidation and sulphation • Recognises the effect of pathological states on drug disposition and in particular liver dysfunction, malnutrition and renal impairment • Recognises dose–response and exposure–response relationships
11.	**Toxicity:** • Responds to cases of overdose or poisoning with anti-cancer therapy • Recognises the difference between an adverse event and an adverse drug reaction (ADR), (hyperimmunoglobulinemia D [HIDS] and cryopyrin-associated periodic fever syndromes [CAPS]) • Manages the common clinical presentations of ADRs in children and young people • Recognises teratogenicity in the developing fetus and the importance of contraception in sexually active young people receiving chemotherapy

Specific disease management:	
1.	**Leukaemias:** • Disease management: » Manages the various clinical presentations of children and young people 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 and people 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 » Recognises 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: » Recognises what is known of the epidemiology of infant and childhood leukaemias and MDS, including the aetiology and genetic associations » Recognises the constitutional and genetic conditions that predispose to the development of leukaemia » Recognises 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 » Recognises 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 » Understands the role of molecular techniques in risk stratification and treatment planning » Considers approaches to adult patients with leukaemia and recognises how these differ from paediatrics » Applies knowledge of teenage and young adult (TYA) considerations, eg the therapeutic differences and disease variants with age (young and old) » Discusses new modalities for the treatment of leukaemias including CAR-T • Supportive care: » Manages the complications of leukaemia treatment, including tumour lysis, coagulopathy, infections, mediastinal obstruction, pancreatitis, thrombosis, PRES, 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 sarcoma malignant bone tumour » Recognises and requests appropriate radiological and laboratory investigations to diagnose, stage and measure response in osteosarcoma and Ewing's sarcoma » Recognises the clinical presentation of sarcoma malignant bone tumour » Applies the staging system for osteosarcoma and Ewing's sarcoma » Prescribes current treatment strategies for osteosarcoma and Ewing's sarcoma as well as 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 » Demonstrates an understanding of important considerations for local control, including balancing morbidity of surgery and radiotherapy with potentially compromising survival outcomes • 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 » Explains 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 » Recognises and requests 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 and young person » Explains the principles of managing relapsed soft tissue sarcoma » Identifies 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 » Identifies 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.	**Rhabdomyosarcoma:** • Disease management: » Recognises the clinical presentations of rhabdomyosarcoma (RMS) affecting the head and neck (parameningeal versus non-parameningeal), nasopharynx, orbit and pelvis and extremities » Explains the different approaches to treatment according to the anatomical site of the tumour and age of the child and young person » Understands and is able to explain options for local control and the need to balance morbidity of surgery and radiotherapy with potentially compromising survival outcomes » Explains the principles of managing relapsed RMS » Identifies the current clinical trials available for treatment of RMS • Principles: » Recognises the genetic variables which have significance for the prognosis of RMS » 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
5.	**Retinoblastoma:** • Disease management: » Recognises the clinical presentations and clinical features of unilateral and bilateral retinoblastoma » Recognises the clinical manifestations of trilateral retinoblastoma » Applies staging of retinoblastoma, according to the intraocular extent of the tumour » Explains the role of surgery, irradiation, chemotherapy and photocoagulation in the treatment of retinoblastoma • Principles: » Explains the epidemiology and inheritance pattern of bilateral retinoblastoma » Applies the principles of screening and follow-up for children who are siblings of a patient with retinoblastoma » Discusses the prognostic features and prognosis of retinoblastoma according to stage and histology • Late effects: » Recognises the complications and late effects of retinoblastoma, including the risk of secondary malignancy in unilateral or bilateral retinoblastoma » Develops follow-up strategies for survivors and identifies late effects of therapy, counselling accordingly

6.	**Renal tumours:** • Disease management: » Recognises the clinical presentation of a renal tumour and explains the differential diagnosis of a renal mass for different age groups » Explains 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 recognises the principles of treating bilateral Wilms tumour » Discusses the prognosis for Wilms tumour and 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 » Recognises 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; recognises 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 multi-disciplinary 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 » Recognises and applies 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 » Recognises the histological subtypes of Hodgkin's lymphoma, their incidence in children and young people 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 » Recognises treatment stratification according to stage, clinical presentation and subtype » Applies the current treatment strategies for Hodgkin's lymphoma, including the role of radiotherapy and recognises the principles of managing relapsed Hodgkin's lymphoma • Principles: » Discusses the epidemiologic, clinical and laboratory features of Hodgkin's lymphoma in children and young people, 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: » Recognises 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 » Identifies 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) » Recognises 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 » Recognises the principles of managing relapsed NHL » Recognises 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 as well as anaplastic large cell lymphoma » Recognises the incidence of lymphomas in children and young people and the effect of this on their prognosis and treatment » Discusses the association of Epstein Barr virus and human immunodeficiency virus NHL » Recognises 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: » Recognises 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) » Recognises and applies the appropriate radiological and laboratory investigations to diagnose and stage NBL » Recognises treatment stratification according to age, clinical presentation and molecular and cytogenetics » Discusses the current national and European strategies for treatment of NBL » Recognises the principles of managing relapsed and refractory NBL » 'Explains the approach to the management of low and intermediate-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 » Manages the side effects of immunotherapy, including prophylactic and acute pain control' • Late effects: » Recognises 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 » Recognises the differential diagnosis of right upper quadrant masses » Recognises which congenital conditions are associated with an increased risk of hepatoblastoma and the association of hepatocellular carcinoma with inborn errors of metabolism causing cirrhosis » Recognises and applies 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: » Recognises 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 and young people 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, including 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 » Recognises the syndromes/conditions predisposing to germ cell tumours » Recognises the embryological basis of germ cell tumours and the relationship to histological classification » Recognises 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, recognising 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 and young people, including the indications for HSCT from other than a matched-sibling donor, eg 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: » Recognises the role of total body irradiation (TBI) in HSCT, including its administration and short- and the long-term side effects » Recognises 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 recognises 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: » Explains the late effects of HSCT in children and young people, including on growth and fertility and the risk of second malignancy » Understands the psychological impact of HSCT and living with lifelong complications such as GVHD • Governance: » Explains the regulatory framework, accreditation requirements and governance arrangements for stem cell transplant services
14.	**Teenage and young adult patients:** • Disease management: » Recognises 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: » Recognises the differences in the delivery of care, communication strategies and challenges involved in providing appropriate holistic care for TYA patients » Recognises psychosocial elements common to all TYA patients and those differences which arise because of the specific disease • Supportive care: » Recognises 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, eg reticulocytes, ferritin, vitamin B12 and folate » Interprets a coagulation screen and identifies which further tests may be appropriate, particularly in relation to disseminated intravascular coagulation (DIC) » Diagnoses haemophagocytic lymphohistiocytosis (HLH) » Manages a child and young person 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 » Recognises the main risk factors for thrombosis in children and young people » 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) » Conducts 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 » Recognises 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 » Recognises 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 manages according to age anatomical position and presence of raised intracranial pressure » Utilises appropriate imaging modalities (including positron emission tomography and functional imaging) to determine the extent and metastatic spread of CNS tumours » Appropriately incorporates the role of surgery, irradiation, chemotherapy and novel agents in the treatment of CNS tumours

- » Identifies chemotherapy agents and delivery techniques in relation to the blood brain barrier
- » Understands the importance of molecular diagnostics and indications for consideration of novel and targeted agents
- » 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 and young person with a CNS tumour
- » Communicates effectively within a neuro-oncology multi-disciplinary team in planning the therapy for a child and young person with a CNS tumour
- » Recognises situations in which cure is not possible and initiates discussions about palliative treatment appropriately

• 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, functional imaging and histopathological 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 and molecular subtypes and grading of brain tumours and their relation to tumour site, pattern of spread and prognosis

• Supportive Care:

- » Accesses 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

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

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

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 babies, children and adolescents.	GPC 3, 6

Illustrations

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

Sub-specialty Learning Outcome 4

Understands the concepts of evidence-based medicine and clinical trials, as well as 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 and young person with cancer.
2.	Informs and gains the consent for a child, young person and family to participate in a clinical trial. Understands the process for clinical trial set up, monitoring, SAE reporting and GCP.

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 (Mini-CEX)	Paediatric Case-based Discussion (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 (MSF)	Paediatric Carers for Children Feedback (Paed CCF)	Other
Demonstrates proficiency in recognising and managing all paediatric cancers at presentation, 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 many 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 babies, children and adolescents.	✓	✓				✓		✓	✓	
Demonstrates proficiency in understanding the importance of clinical trials and the fundamental role they play in the field of paediatric oncology.	✓	✓				✓				