

Prescribing Framework for Dexamfetamine for Attention Deficit Hyperactive Disorder and Narcolepsy

Patient's Name:..... NHS Number:

Patient's Address:.....(Use addressograph sticker)

GP's Name:.....

Communication

We agree to treat this patient within this Prescribing Framework

Specialist Prescriber's Name..... Prof Reg. No.

Specialist Prescriber's Signature..... Date:.....
Where prescriber is not a consultant:

Consultant's Name: GMC No

Consultant's Signature Date:.....

GP's Signature:..... Date:.....

GP's Name (if different from listed above).....

The front page of this form should be completed by the specialist and the form sent to the patient's general practitioner.

The patient's GP should sign and **send back to specialist**, to confirm agreement to enter into shared care arrangement. If the General Practitioner is **unwilling** to accept prescribing responsibility for the above patient the specialist should be informed within two weeks of receipt of this framework and specialist's letter.

Full copy of framework can also be found at: <https://www.hey.nhs.uk/herpc/amber/>

1. Background

ADHD

Attention-Deficit Hyperactivity Disorder (ADHD) is diagnosed if the three clinical features - inattention, over-activity and impulsiveness - have been present from an early age, persist in more than one situation (e.g. at home and in school) and impair function. The diagnosis must be made following a comprehensive assessment by an appropriate child psychiatrist and/or a paediatrician with special interest and training in this field. Drug therapy with dexamfetamine is only one part of the package of care for children with ADHD which typically includes social, psychological, behavioural and educational interventions.

In later adolescence and adult life, the range of possible impairment extends to educational and occupational underachievement, dangerous driving, difficulties in carrying out daily activities such as shopping and organising household tasks, in making and keeping friends, in intimate relationships (for example, excessive disagreement) and with childcare.

Treatment aims in ADHD are to reduce hyperactive behaviour, detect and treat any co-existing disorders, promote academic and social function and learning, improve emotional adjustment and self-esteem, and to relieve family distress.

Treatment of ADHD often needs to be continued into adolescence, and may need to be continued into adulthood. Initiating treatment in adulthood is unlicensed. Adults who present with symptoms of ADHD for the first time in primary care or general adult psychiatric services who do not have a childhood diagnosis of ADHD, should be referred for assessment by a mental health specialist trained in the diagnosis and treatment of ADHD.

These guidelines aim to provide a framework for the prescribing of dexamfetamine by GPs and to set out the associated responsibilities of GPs and hospital specialists who enter into the shared care arrangements.

Dexamfetamine is a Schedule 2 Controlled Drug (CD). Prescription requirements for prescribing CDs should therefore be observed.

The guidelines should be read in conjunction with

- The general guidance on prescribing matters given in EL (91) 127 "Responsibility for prescribing between hospitals and GPs".
- NICE Clinical Guideline 87 (NG 87) *Attention deficit hyperactivity disorder: Diagnosis and management* (Published March 2018)
- NICE Guideline 5 *Medicines optimisation: the safe and effective use of medicines to enable the best possible outcomes* 2015

Narcolepsy

Narcolepsy is a rare, disabling long-term brain disorder that can result in excessive daytime sleepiness, sleep attacks, cataplexy, sleep paralysis, excessive dreaming and disturbed nocturnal sleep. Men and women are thought to be affected equally by narcolepsy, although some studies have suggested the condition may be more common in men.

The symptoms often begin during adolescence, although the condition is usually diagnosed between the ages of 20 and 40. Treatment may have to be continued for life and remission is rare.

2. Medication Choice for ADHD

	Medication choice – children aged 5 years and over and young people	Medication choice – adults
Atomoxetine	FOURTH LINE <ul style="list-style-type: none"> For patients intolerant of methylphenidate or lisdexamfetamine OR After inadequate response to separate 6-week trials of lisdexamfetamine* AND methylphenidate* 	FOURTH LINE <ul style="list-style-type: none"> For patients intolerant of methylphenidate or lisdexamfetamine OR After inadequate response to separate 6-week trials of lisdexamfetamine* AND methylphenidate*
Dexamfetamine	THIRD LINE <ul style="list-style-type: none"> For patients responding to but intolerant of lisdexamfetamine 	THIRD LINE <ul style="list-style-type: none"> For patients responding to but intolerant of lisdexamfetamine
Guanfacine	FOURTH LINE <ul style="list-style-type: none"> For patients intolerant of methylphenidate or lisdexamfetamine OR After inadequate response to separate 6-week trials of lisdexamfetamine* AND methylphenidate* 	ONLY ON ADVICE OF TERTIARY SERVICES
Lisdexamfetamine	SECOND LINE <ul style="list-style-type: none"> After inadequate response to 6-week trial of methylphenidate* 	FIRST LINE OR SECOND LINE <ul style="list-style-type: none"> After inadequate response to trial of methylphenidate*
Methylphenidate	FIRST LINE	FIRST LINE OR SECOND LINE <ul style="list-style-type: none"> After inadequate response to trial of lisdexamfetamine*
* AT ADEQUATE DOSE		

3. Indication

ADHD:

Dexamfetamine is indicated for the treatment of Attention- Deficit/Hyperactivity Disorder (ADHD) in children of 6 years and older and in adolescents as part of a comprehensive treatment programme. Treatment must be initiated by a specialist in the treatment of ADHD. Diagnosis should be made according to DSM-IV criteria or the guidelines in ICD10

This shared care protocol applies to children 6 years and above, and adults. The drug is not licensed for children less than six years of age. Initiating treatment in adulthood is unlicensed.

Narcolepsy:

Dexamfetamine is indicated for the treatment of adults with Narcolepsy

4. Dose

ADHD:

CHILDREN AND YOUNG PEOPLE:

- **CHILD 6–18 years** 2.5mg 2–3 times daily, increased if necessary at weekly intervals by 5mg daily, usual max. 1mg/kg (up to 20mg) daily in 2 to 4 divided doses (40mg daily has been required in some children)
- **Note any children under 6 years requiring treatment will be prescribed by specialist.**
- **ADULTS over 18 years:** [unlicensed use], 5 mg twice daily, increased according to response; max. 60 mg daily; maintenance dose given in 2 to 4 divided doses

Once the patient has been stabilised a further 4-week supply will be prescribed by the psychiatrist/paediatrician to allow adequate time for information to be passed to their General Practitioner.

Narcolepsy:

- **ADULTS:** Initially 10mg daily in divided doses, increased in steps of 10mg every week, maintenance dose to be given in 2-4 divided doses; maximum 60mg per day
- **ELDERLY:** Initially 5mg daily in divided doses, increased in steps of 5mg every week, maintenance dose to be given in 2-4 divided doses; maximum 60mg per day

5. Duration of treatment

Advice will be given to the GP by the secondary care Specialist on duration of treatment and dose changes for each individual patient.

6. Contraindications

- Patients with advanced arteriosclerosis
- Agitated states
- Cardiovascular disease
- History of drug or alcohol abuse
- Hyperexcitability
- Hyperthyroidism
- Moderate or severe hypertension
- Structural cardiac abnormalities
- Hypersensitivity to dexamfetamine or other amphetamine derivatives or any of the excipients.

7. Cautions

- Anorexia
- Bipolar disorder
- History of epilepsy (discontinue if seizures occur)
- Mild hypertension
- Psychosis
- Susceptibility to angle-closure glaucoma
- Tourette syndrome, Tics

- Renal impairment
- Avoid in pregnancy and lactation

8. Adverse effects

The following have been reported:

<ul style="list-style-type: none"> • Nausea, diarrhoea, abdominal cramps, anorexia (increased appetite also reported), weight loss • Dry mouth, taste disturbance, ischaemic colitis • Palpitations, tachycardia, chest pain, hypertension, hypotension, cardiomyopathy, myocardial infarction, cardiovascular collapse • Cerebral vasculitis, stroke, headache • Restlessness, depression, anhedonia, impaired concentration, ataxia, anxiety, aggression, dizziness, confusion, sleep disturbances • Hyperactivity, dysphoria, euphoria, irritability, nervousness, malaise, obsessive- compulsive behaviour, paranoia, psychosis, panic attack, tremor • Hyperreflexia • Seizures • Neuroleptic malignant syndrome 	<ul style="list-style-type: none"> • Growth restriction in children • Pyrexia (in adults) • Hyperpyrexia (in children) • Renal impairment • Sexual dysfunction • Acidosis • Rhabdomyolysis • Mydriasis • Visual disturbances • <i>Very rarely</i> angle-closure glaucoma • Alopecia • Rash • Sweating • Urticaria • Choreoathetoid movements • Dyskinesia • Tics and Tourette syndrome in predisposed individuals
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9. Interactions

Dexamfetamine has been reported to interact with the following:

- Adrenoreceptor blocking agents (e.g.propranolol) and lithium may antagonise the effects of dexamfetamine.
- Disulfiram may inhibit metabolism and excretion.
- The concurrent use of tricyclic antidepressants may increase the risk of cardiovascular side effects.
- Concurrent use of MAOI's or use within the preceding 14 days may precipitate a hypertensive crisis.
- Concurrent use of beta-blockers may result in severe hypertension and dexamfetamine may result in diminished effect of other anti-hypertensives such as guanethidine.
- Phenothiazines may inhibit the actions of dexamfetamine.
- Amfetamines may delay the absorption of ethosuximide, phenobarbital and phenytoin.
- Acute dystonia has been noted with concurrent administration of haloperidol.
- The analgesic effect of morphine may be increased and its respiratory depressant effects decreased with concurrent use of morphine and dexamfetamine.
- Amfetamines potentiate the analgesic effects of pethidine.
- Gastrointestinal acidifying agents and urinary acidifying agents lower blood levels and efficacy of dexamfetamine.
- Gastrointestinal alkalizing agents and urinary alkalizing agents increase blood levels and efficacy of amfetamines.

The effects of alcohol can be unpredictable. It is therefore advisable for patients to abstain from alcohol during treatment.

There are no known interactions with antibiotics, simple analgesics and antihistamines commonly prescribed for children

Details of contraindications, cautions, drug interactions and adverse effects listed above are not exhaustive. For further information always check with BNF www.bnf.org.uk or SPC (www.medicines.org.uk).

10. Monitoring

Pre-treatment evaluation in ADHD

Before starting medication for ADHD, people with ADHD should have a full assessment, which should include:

- A review to confirm they continue to meet the criteria for ADHD and need treatment
- A review of mental health and social circumstances, including:
 - Presence of coexisting mental health and neurodevelopmental conditions
 - Current educational or employment circumstances
 - Risk assessment for substance misuse and drug diversion
 - Care needs
- A review of physical health, including:
 - A medical history, taking into account conditions that may be contraindications for specific medicines
 - Current medication
 - Height and weight (measured and recorded against the normal range for age, height and sex)
 - Baseline pulse and blood pressure (measured with an appropriately sized cuff and compared with the normal range for age)
 - A cardiovascular assessment

Refer for a cardiology opinion before starting medication for ADHD if any of the following apply:

- History of congenital heart disease or previous cardiac surgery
- History of sudden death in a first-degree relative under 40 years suggesting a cardiac disease
- Shortness of breath on exertion compared with peers
- Fainting on exertion or in response to fright or noise
- Palpitations that are rapid, regular and start and stop suddenly (fleeting occasional bumps are usually ectopic and do not need investigation)
- Chest pain suggesting cardiac origin
- Signs of heart failure
- A murmur heard on cardiac examination
- Blood pressure that is classified as hypertensive for adults

Refer to a paediatric hypertension specialist before starting medication for ADHD if blood pressure is consistently above the 95th centile for age and height for children and young people

Ongoing monitoring in ADHD

- Measure height every 6 months in children and young people
- Measure weight every 3 months in children 10 years and under
- Measure weight at 3 and 6 months after starting treatment in children over 10 years and young people, and every 6 months thereafter, or more often if concerns arise
- Measure weight every 6 months in adults
- Plot height and weight of children and young people on a growth chart and ensure review by

the healthcare professional responsible for treatment

- Monitor heart rate and blood pressure and compare with the normal range for age before and after each dose change and every 6 months.
- Do not offer routine blood tests (including liver function tests) or ECGs to people taking medication for ADHD unless there is a clinical indication.
- If a person taking ADHD medication has sustained resting tachycardia (more than 120 beats per minute), arrhythmia or systolic blood pressure greater than the 95th percentile (or a clinically significant increase) measured on 2 occasions, reduce their dose and refer them to a paediatric hypertension specialist or adult physician
- A healthcare professional with training and expertise in managing ADHD should review ADHD medication at least once a year and discuss with the person with ADHD (and their families and carers as appropriate) whether medication should be continued.

Patients requiring long-term therapy should be carefully monitored. The patient's response to the drug should be assessed by the prescriber at each clinical meeting. Parent and teacher reports on levels of activity, concentration, and other factors, are compared before and after treatment and facilitate the decision to increase the dose or stop treatment.

A young person with ADHD receiving treatment and care from Child and Adolescent Mental Health Services (CAMHS) or paediatric services should be reassessed at school-leaving age to establish the need for continuing treatment into adulthood.

During the transition to adult services, a formal meeting involving CAMHS and/or paediatrics and adult psychiatric services should be considered, and full information provided to the young person about adult services. For young people aged 16 years and older, the care programme approach (CPA) should be used as an aid to transfer between services. The young person, and when appropriate the parent or carer, should be involved in the planning.

After transition to adult services, adult healthcare professionals should carry out a comprehensive assessment of the person with ADHD that includes personal, educational, occupational and social functioning, and assessment of any coexisting conditions, especially drug misuse, personality disorders, emotional problems and learning difficulties.

Monitoring in Narcolepsy

- Monitor for aggressive behavior or hostility during initial treatment.
- Prior to prescribing, it is necessary to conduct a baseline evaluation of a patient's cardiovascular status including blood pressure and heart rate. A comprehensive history should document concomitant medications, past and present co-morbid medical and psychiatric disorders or symptoms and family history of sudden cardiac/unexplained death.
- Pulse, blood pressure, psychiatric symptoms, appetite and weight should be recorded at initiation of therapy, following each dose adjustment, and at least every 6 months thereafter
- A risk assessment for substance misuse and diversion should be completed

12. Information to patient

- Reporting of side-effects and adverse events to GP or Specialist
- Ensure a clear understanding of the treatment

This medicine can impair cognitive function and can affect a patient's ability to drive safely. This class of medicine is in the list of drugs included in regulations under 5a of the Road Traffic Act 1988. When prescribing this medicine, patients should be told:

- The medicine is likely to affect their ability to drive
- Not to drive until they know how they are affected by the medication
- It is an offence to drive while under the influence of this medicine

However, patients would not be committing an offence (called 'statutory defence') if:

- The medicine has been prescribed to treat a medical or dental problem **and**
- They have taken it according to the instructions given by the prescriber and in the information provided with the medicine **and**
- It was not affecting their ability to drive safely

A diagnosis of Narcolepsy must be reported to the DVLA

12. Responsibilities of clinicians involved

ADHD:

Stage of Treatment	Specialist	General Practitioner
Initiation	<ul style="list-style-type: none"> Assessment and diagnosis of ADHD Initiation of Dexamfetamine therapy Provision of written guidance and questionnaires for parents and teachers regarding drug treatment, at the specialists discretion Reporting adverse events to the CHM Monitor height, weight, blood pressure and heart rate as indicated. 	<ul style="list-style-type: none"> Liaise and seek advice from the specialist team, when appropriate Take over prescribing of medication 4 weeks after the patient has been stabilised on treatment and provide on- going clinical care
Maintenance	<ul style="list-style-type: none"> Monitor height, weight and blood pressure as indicated until the patient is stabilised Assess continued need for treatment annually including dose and appropriate interruption of medication Review treatment as requested by the GP For young people, if Dexamfetamine is to be continued beyond age 18 years then care should be transferred to adult psychiatric services as appropriate Reporting of adverse events to CHM Advising the GP when Dexamfetamine should be discontinued Providing necessary supervision and support during the discontinuation phase 	<ul style="list-style-type: none"> Prescribing Dexamfetamine once the patient is stabilised Liaising with the specialist regarding any complications of treatment Reporting adverse events to the specialist and the CHM Review treatment every 6 months Monitor blood pressure and pulse every 6 months For children under 10 years monitor weight every 3 months For children over 10 years and adults monitor weight every 6 months Reporting to and seeking advice from the specialist on any aspect of patient care which is of concern to the GP and may affect treatment Co-operating with the specialist during the discontinuation phase

Narcolepsy:

Stage of Treatment	Specialist	General Practitioner
Initiation	<ul style="list-style-type: none"> Assessment and diagnosis of Narcolepsy Initiation of Dexamfetamine therapy Report adverse events to CHM Monitor weight, blood pressure and heart rate until the patient is stabilised 	<ul style="list-style-type: none"> Liaise and take advice from the specialist team when appropriate Take over prescribing of medication 4 weeks after the patient has been stabilized on treatment and provide ongoing clinical care
Maintenance	<ul style="list-style-type: none"> Review treatment as requested by GP. Review the need for continued treatment Reporting adverse events to CHM Advising the GP when dexamfetamine should be discontinued for patients receiving the drug long-term. Provide necessary supervision and support during discontinuation phase 	<ul style="list-style-type: none"> Prescribing dexamfetamine once the patient is stabilised Liaison with the Specialist regarding any complications of treatment. Reporting of adverse events to Specialist and CHM Review treatment every 6 months Monitor weight, blood pressure and pulse 6 monthly Reporting to and seeking advice from the Specialists on any aspect of patient care which is of concern to the GP and may affect treatment Co-operating with the Specialist during the discontinuation phase

Contact Details:

HTFT

During Office hours: Medicines Management Pharmacist Humber Teaching NHS Foundation Trust

Head Quarters Willerby Hill (01482 301724) or contact specialist as per clinic letter

Out of hours: In emergency contact Victoria House and ask for on-call CAMHS consultant 01482 223191

Community Paediatrics (CHCP)

During Office hours: Contact specialist (as per clinic letter) or secretaries on 01482 221261

Sleep Disorder Service

APPROVAL PROCESS

Written by:	Melissa Turner, Specialist Clinical Pharmacist Jackie Stark, Principal Pharmacist, HTFT
Consultation process:	HTFT Drugs and Therapeutics Group, Community Paediatrics
Approved by:	Include MMIG, LMC, HFT DTC
Ratified by:	HERPC Sept 2018
Review date:	Sept 2021

Appendix 1:

Blood Pressure Levels for Boys by Age and Height Percentile

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	80	81	83	85	87	88	89	34	35	36	37	38	39	39
	90th	94	95	97	99	100	102	103	49	50	51	52	53	53	54
	95th	98	99	101	103	104	106	106	54	54	55	56	57	58	58
	99th	105	106	108	110	112	113	114	61	62	63	64	65	66	66
2	50th	84	85	87	88	90	92	92	39	40	41	42	43	44	44
	90th	97	99	100	102	104	105	106	54	55	56	57	58	58	59
	95th	101	102	104	106	108	109	110	59	59	60	61	62	63	63
	99th	109	110	111	113	115	117	117	66	67	68	69	70	71	71
3	50th	86	87	89	91	93	94	95	44	44	45	46	47	48	48
	90th	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	95th	104	105	107	109	110	112	113	63	63	64	65	66	67	67
	99th	111	112	114	116	118	119	120	71	71	72	73	74	75	75
4	50th	88	89	91	93	95	96	97	47	48	49	50	51	51	52
	90th	102	103	105	107	109	110	111	62	63	64	65	66	66	67
	95th	106	107	109	111	112	114	115	66	67	68	69	70	71	71
	99th	113	114	116	118	120	121	122	74	75	76	77	78	78	79
5	50th	90	91	93	95	96	98	98	50	51	52	53	54	55	55
	90th	104	105	106	108	110	111	112	65	66	67	68	69	69	70
	95th	108	109	110	112	114	115	116	69	70	71	72	73	74	74
	99th	115	116	118	120	121	123	123	77	78	79	80	81	81	82
6	50th	91	92	94	96	98	99	100	53	53	54	55	56	57	57
	90th	105	106	108	110	111	113	113	68	68	69	70	71	72	72
	95th	109	110	112	114	115	117	117	72	72	73	74	75	76	76
	99th	116	117	119	121	123	124	125	80	80	81	82	83	84	84
7	50th	92	94	95	97	99	100	101	55	55	56	57	58	59	59
	90th	106	107	109	111	113	114	115	70	70	71	72	73	74	74
	95th	110	111	113	115	117	118	119	74	74	75	76	77	78	78
	99th	117	118	120	122	124	125	126	82	82	83	84	85	86	86
8	50th	94	95	97	99	100	102	102	56	57	58	59	60	60	61
	90th	107	109	110	112	114	115	116	71	72	72	73	74	75	76
	95th	111	112	114	116	118	119	120	75	76	77	78	79	79	80
	99th	119	120	122	123	125	127	127	83	84	85	86	87	87	88
9	50th	95	96	98	100	102	103	104	57	58	59	60	61	61	62
	90th	109	110	112	114	115	117	118	72	73	74	75	76	76	77
	95th	113	114	116	118	119	121	121	76	77	78	79	80	81	81
	99th	120	121	123	125	127	128	129	84	85	86	87	88	88	89
10	50th	97	98	100	102	103	105	106	58	59	60	61	61	62	63
	90th	111	112	114	115	117	119	119	73	73	74	75	76	77	78
	95th	115	116	117	119	121	122	123	77	78	79	80	81	81	82
	99th	122	123	125	127	128	130	130	85	86	86	88	88	89	90

Blood Pressure Levels for Boys by Age and Height Percentile (Continued)

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
11	50th	99	100	102	104	105	107	107	59	59	60	61	62	63	63
	90th	113	114	115	117	119	120	121	74	74	75	76	77	78	78
	95th	117	118	119	121	123	124	125	78	78	79	80	81	82	82
	99th	124	125	127	129	130	132	132	86	86	87	88	89	90	90
12	50th	101	102	104	106	108	109	110	59	60	61	62	63	63	64
	90th	115	116	118	120	121	123	123	74	75	75	76	77	78	79
	95th	119	120	122	123	125	127	127	78	79	80	81	82	82	83
	99th	126	127	129	131	133	134	135	86	87	88	89	90	90	91
13	50th	104	105	106	108	110	111	112	60	60	61	62	63	64	64
	90th	117	118	120	122	124	125	126	75	75	76	77	78	79	79
	95th	121	122	124	126	128	129	130	79	79	80	81	82	83	83
	99th	128	130	131	133	135	136	137	87	87	88	89	90	91	91
14	50th	106	107	109	111	113	114	115	60	61	62	63	64	65	65
	90th	120	121	123	125	126	128	128	75	76	77	78	79	79	80
	95th	124	125	127	128	130	132	132	80	80	81	82	83	84	84
	99th	131	132	134	136	138	139	140	87	88	89	90	91	92	92
15	50th	109	110	112	113	115	117	117	61	62	63	64	65	66	66
	90th	122	124	125	127	129	130	131	76	77	78	79	80	80	81
	95th	126	127	129	131	133	134	135	81	81	82	83	84	85	85
	99th	134	135	136	138	140	142	142	88	89	90	91	92	93	93
16	50th	111	112	114	116	118	119	120	63	63	64	65	66	67	67
	90th	125	126	128	130	131	133	134	78	78	79	80	81	82	82
	95th	129	130	132	134	135	137	137	82	83	83	84	85	86	87
	99th	136	137	139	141	143	144	145	90	90	91	92	93	94	94
17	50th	114	115	116	118	120	121	122	65	66	66	67	68	69	70
	90th	127	128	130	132	134	135	136	80	80	81	82	83	84	84
	95th	131	132	134	136	138	139	140	84	85	86	87	87	88	89
	99th	139	140	141	143	145	146	147	92	93	93	94	95	96	97

BP, blood pressure

* The 90th percentile is 1.28 SD, 95th percentile is 1.645 SD, and the 99th percentile is 2.326 SD over the mean.

For research purposes, the standard deviations in Appendix Table B-1 allow one to compute BP Z-scores and percentiles for boys with height percentiles given in Table 3 (i.e., the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles). These height percentiles must be converted to height Z-scores given by (5% = -1.645; 10% = -1.28; 25% = -0.68; 50% = 0; 75% = 0.68; 90% = 1.28%; 95% = 1.645) and then computed according to the methodology in steps 2-4 described in Appendix B. For children with height percentiles other than these, follow steps 1-4 as described in Appendix B.

Blood Pressure Levels for Girls by Age and Height Percentile

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	83	84	85	86	88	89	90	38	39	39	40	41	41	42
	90th	97	97	98	100	101	102	103	52	53	53	54	55	55	56
	95th	100	101	102	104	105	106	107	56	57	57	58	59	59	60
	99th	108	108	109	111	112	113	114	64	64	65	65	66	67	67
2	50th	85	85	87	88	89	91	91	43	44	44	45	46	46	47
	90th	98	99	100	101	103	104	105	57	58	58	59	60	61	61
	95th	102	103	104	105	107	108	109	61	62	62	63	64	65	65
	99th	109	110	111	112	114	115	116	69	69	70	70	71	72	72
3	50th	86	87	88	89	91	92	93	47	48	48	49	50	50	51
	90th	100	100	102	103	104	106	106	61	62	62	63	64	64	65
	95th	104	104	105	107	108	109	110	65	66	66	67	68	68	69
	99th	111	111	113	114	115	116	117	73	73	74	74	75	76	76
4	50th	88	88	90	91	92	94	94	50	50	51	52	52	53	54
	90th	101	102	103	104	106	107	108	64	64	65	66	67	67	68
	95th	105	106	107	108	110	111	112	68	68	69	70	71	71	72
	99th	112	113	114	115	117	118	119	76	76	76	77	78	79	79
5	50th	89	90	91	93	94	95	96	52	53	53	54	55	55	56
	90th	103	103	105	106	107	109	109	66	67	67	68	69	69	70
	95th	107	107	108	110	111	112	113	70	71	71	72	73	73	74
	99th	114	114	116	117	118	120	120	78	78	79	79	80	81	81
6	50th	91	92	93	94	96	97	98	54	54	55	56	56	57	58
	90th	104	105	106	108	109	110	111	68	68	69	70	70	71	72
	95th	108	109	110	111	113	114	115	72	72	73	74	74	75	76
	99th	115	116	117	119	120	121	122	80	80	80	81	82	83	83
7	50th	93	93	95	96	97	99	99	55	56	56	57	58	58	59
	90th	106	107	108	109	111	112	113	69	70	70	71	72	72	73
	95th	110	111	112	113	115	116	116	73	74	74	75	76	76	77
	99th	117	118	119	120	122	123	124	81	81	82	82	83	84	84
8	50th	95	95	96	98	99	100	101	57	57	57	58	59	60	60
	90th	108	109	110	111	113	114	114	71	71	71	72	73	74	74
	95th	112	112	114	115	116	118	118	75	75	75	76	77	78	78
	99th	119	120	121	122	123	125	125	82	82	83	83	84	85	86
9	50th	96	97	98	100	101	102	103	58	58	58	59	60	61	61
	90th	110	110	112	113	114	116	116	72	72	72	73	74	75	75
	95th	114	114	115	117	118	119	120	76	76	76	77	78	79	79
	99th	121	121	123	124	125	127	127	83	83	84	84	85	86	87
10	50th	98	99	100	102	103	104	105	59	59	59	60	61	62	62
	90th	112	112	114	115	116	118	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
	99th	123	123	125	126	127	129	129	84	84	85	86	86	87	88

Blood Pressure Levels for Girls by Age and Height Percentile (Continued)

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
11	50th	100	101	102	103	105	106	107	60	60	60	61	62	63	63
	90th	114	114	116	117	118	119	120	74	74	74	75	76	77	77
	95th	118	118	119	121	122	123	124	78	78	78	79	80	81	81
	99th	125	125	126	128	129	130	131	85	85	86	87	87	88	89
12	50th	102	103	104	105	107	108	109	61	61	61	62	63	64	64
	90th	116	116	117	119	120	121	122	75	75	75	76	77	78	78
	95th	119	120	121	123	124	125	126	79	79	79	80	81	82	82
	99th	127	127	128	130	131	132	133	86	86	87	88	88	89	90
13	50th	104	105	106	107	109	110	110	62	62	62	63	64	65	65
	90th	117	118	119	121	122	123	124	76	76	76	77	78	79	79
	95th	121	122	123	124	126	127	128	80	80	80	81	82	83	83
	99th	128	129	130	132	133	134	135	87	87	88	89	89	90	91
14	50th	106	106	107	109	110	111	112	63	63	63	64	65	66	66
	90th	119	120	121	122	124	125	125	77	77	77	78	79	80	80
	95th	123	123	125	126	127	129	129	81	81	81	82	83	84	84
	99th	130	131	132	133	135	136	136	88	88	89	90	90	91	92
15	50th	107	108	109	110	111	113	113	64	64	64	65	66	67	67
	90th	120	121	122	123	125	126	127	78	78	78	79	80	81	81
	95th	124	125	126	127	129	130	131	82	82	82	83	84	85	85
	99th	131	132	133	134	136	137	138	89	89	90	91	91	92	93
16	50th	108	108	110	111	112	114	114	64	64	65	66	66	67	68
	90th	121	122	123	124	126	127	128	78	78	79	80	81	81	82
	95th	125	126	127	128	130	131	132	82	82	83	84	85	85	86
	99th	132	133	134	135	137	138	139	90	90	90	91	92	93	93
17	50th	108	109	110	111	113	114	115	64	65	65	66	67	67	68
	90th	122	122	123	125	126	127	128	78	79	79	80	81	81	82
	95th	125	126	127	129	130	131	132	82	83	83	84	85	85	86
	99th	133	133	134	136	137	138	139	90	90	91	91	92	93	93

BP, blood pressure

* The 90th percentile is 1.28 SD, 95th percentile is 1.645 SD, and the 99th percentile is 2.326 SD over the mean.

For research purposes, the standard deviations in Appendix Table B-1 allow one to compute BP Z-scores and percentiles for girls with height percentiles given in Table 4 (i.e., the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles). These height percentiles must be converted to height Z-scores given by (5% = -1.645; 10% = -1.28; 25% = -0.68; 50% = 0; 75% = 0.68; 90% = 1.28%; 95% = 1.645) and then computed according to the methodology in steps 2-4 described in Appendix B. For children with height percentiles other than these, follow steps 1-4 as described in Appendix B.

Appendix 2

Online Resources

1- Heart Rate Centile Calculator

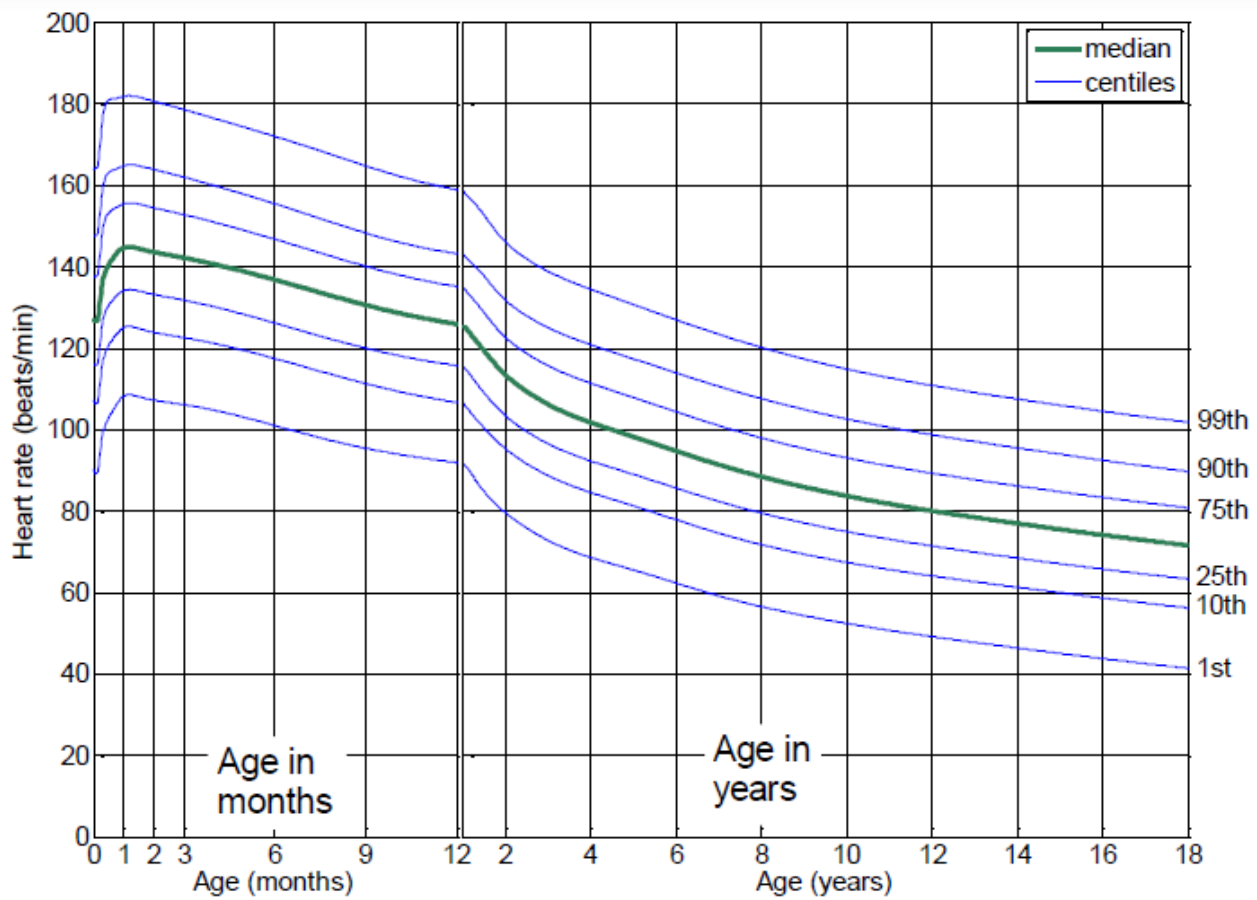
<http://madox.org/webapp/184>

2- Blood Pressure Centile Calculator

<https://www.bcm.edu/bodycomplab/Flashapps/BPVAgeChartpage.html>

Appendix 3

Heart Rate Centile Charts From Birth to 18 years:



Appendix 4

Data Recording

Measurement 1
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 2
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 3
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 4
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 5
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 6
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 7
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 8
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 9
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

Measurement 10
 Recording Date: _____
 Weight: _____
 Length/Height: _____
 Location: _____
 Health worker name: _____

BOYS

UK Growth chart

2-18 years

RCPCH **Department of Health** **Healthier Scotland**

Anyone who measures a child, plots or interprets charts should be suitably trained or supervised. For further information and training materials see fact sheet and presentation on www.growthcharts.rpch.ac.uk

This chart is mainly intended to assess the growth of school age boys. It combines data from the UK 1990 growth reference for children at birth and from 4-18 years, with the WHO growth standard for children aged 2 years to 4 years. The growth of children under 2 years of age should be plotted on the more detailed UK-WHO 0-4 years growth charts.

As well as simply using this chart for plotting growth data, it also includes a number of new features which you may wish to use to help interpret the growth data.

- birth centile plotting scale
- BMI look-up and plotting grid
- scales to estimate adult height and mid-parental centile
- guide to assessing puberty

Measurement procedure
Accurate measurement is essential and shoes must be removed for all measurements

Height:
Measure height recorded to the last millimetre. A correctly installed stadiometer or approved portable measuring device is the only equipment that can be reliably used (see illustration). If a child cannot stand, measure lying down, using an approved length measuring device and plot as for height.

Weight:
Remove heavy clothing and shoes and weigh using class II clinical electronic scales in metric setting.

Plotting
Plot each measurement by placing a small dot where a vertical line through the child's age crosses a horizontal line through the measured value.

The lettering on the charts ('weight', 'length' etc.) sits on the 50th centile to provide orientation.

Birth centile plotting scale
The chart starts at age 2 years, but there is a plotting scale on the left of the chart where for term infants, birth weight (and if measured, length) can be plotted to allow comparison of the birth centile with later growth.

Please place sticker (if available) otherwise write in space provided

Name: _____

NHS/CHI No: _____

Hospital No: _____

Date of Birth: ____/____/____

When is further assessment required? If any of the following:

- Where weight or height or BMI is below the 0.4th centile, unless already fully investigated at an earlier age.
- If the height centile is more than 3 centile spaces below the mid-parental centile.
- A drop in height centile position of more than 2 centile spaces, as long as measurement error has been excluded.
- Smaller centile falls or discrepancies between child's and mid-parental centile, if seen in combination, or if associated with possible underlying disease.
- If there are any other concerns about the child's growth.

Adult Height Predictor
This allows you to predict the child's adult height based on their current height, but with a regression adjustment to allow for the tendency of very tall and short children to be less extreme in height as adults. Four boys out of five will have an adult height within ± 6 cm of the predicted adult height.

Instructions for use
Plot the most recent height centile on the centile line on the Adult Height Predictor (on the flap to the right of the height centile chart) and read off the predicted adult height for this centile.

Mid-Parental Centile
The 'mid-parental centile' is the average adult height centile to be expected for all children of these parents. It incorporates a regression adjustment to allow for the tendency of very tall and short parents to have children with less extreme heights. Comparing this to the child's current height centile can help assess whether the child's growth is proceeding as expected. The larger the discrepancy between the two, the more likely it is that the child has some sort of growth disorder. Most children's height centiles (nine out of ten) are within almost centile spaces of the mid-parental centile, and only 1 percent will be more than three centile spaces below.

Instructions for use
The Mid-parental Centile Comparator is on the flap to the right of the height centile chart. If possible measure both parents' heights, or else use reported heights. Plot their heights on the Mother's and Father's height scales. Join the two points with a line between them. The mid-parental centile is where this line crosses the centile line in the middle. Compare the mid-parental centile to the child's current height centile, plotted on the adult height predictor centile scale.

Mid-parental target height
This can be obtained by plotting the mid-parental centile on the main chart at age 18 and reading off the corresponding height. Four boys out of five will have an adult height within ± 7 cm of this target height. However the predicted adult height (above) is usually closer than mid-parental target height to the child's final height.

Pubertal Assessment
The puberty 'phase' may be ascertained through simple questions about the appearance of secondary sexual characteristics as well as by clinical examination.

By history from parents, carers or young person

Pre-puberty (Tanner stage 1)	In Puberty (Tanner stages 2-3)	Completing Puberty (Tanner stages 4-5)
If both of the following: • High voice • No signs of pubertal development	If any of the following: • Slight deepening of the voice • Early pubic or axillary hair growth • Enlargement of testes or penis	If any of the following: • Voice fully broken • Moustache and early facial hair growth • Adult size of penis with pubic and axillary hair

Is the timing of puberty normal?
The three vertical black lines (puberty lines) on the right hand page (9-18 years) of the chart indicate the normal age limits for the phases of puberty described above.

- Boys with measurements plotted on the left page will usually be in the 'Pre-puberty' phase. Puberty before 9 years in boys is likely to be precocious and further assessment is necessary.
- Between 9-14 years most boys will be either 'Pre-puberty' or 'In puberty'. If there are no signs of puberty by 14 years, then puberty is delayed and further assessment is indicated.
- From 14-17 years most boys will be either 'In puberty' or 'Completing puberty'.
- After 17 years boys will usually be 'Completing puberty'. If this is not the case, maturation is delayed and further assessment may be needed.

Growth patterns before and during puberty
Successive height measurements can show wide variation, because it is difficult to measure height accurately. If there are concerns it is useful to measure on a few occasions over time. Assessing growth during puberty is complex because the age when puberty starts varies.

What does a height in the shaded area below the 0.4th centile mean?
This chart provides some extra guidance about the lower limit (0.4th centile) for height in boys 9-14 years. If a plot falls within the shaded area on the height chart between 9 and 14 years, pubertal assessment will be required and mid-parental centile should be assessed.

If they are **In puberty** or **Completing puberty**, they are below the 0.4th centile and should be referred. In most instances a **Pre-pubertal** boy plotted in this area is growing normally, but comparison with the mid-parental centile and growth trajectory will assist the assessment of whether further investigation is needed.

Centile terminology
If the point is within 1/4 of a space of the line they are on the centile: e.g. 91st.
If not they should be described as being between the two centiles: e.g. 75th-91st.
A centile space is the distance between two of the centile lines, or equivalent distance if midway between centiles.

Body Mass Index (BMI) centile look-up
If weight is above the 75th centile or if weight and height centiles differ, the BMI centile should be calculated, as the BMI centile is the best indicator of thinness and fatness. The BMI look-up allows you to read off the BMI centile, accurate to a quarter of a centile space. There is a BMI centile grid at the top of the growth chart where the centiles for children with high or low values can be plotted.

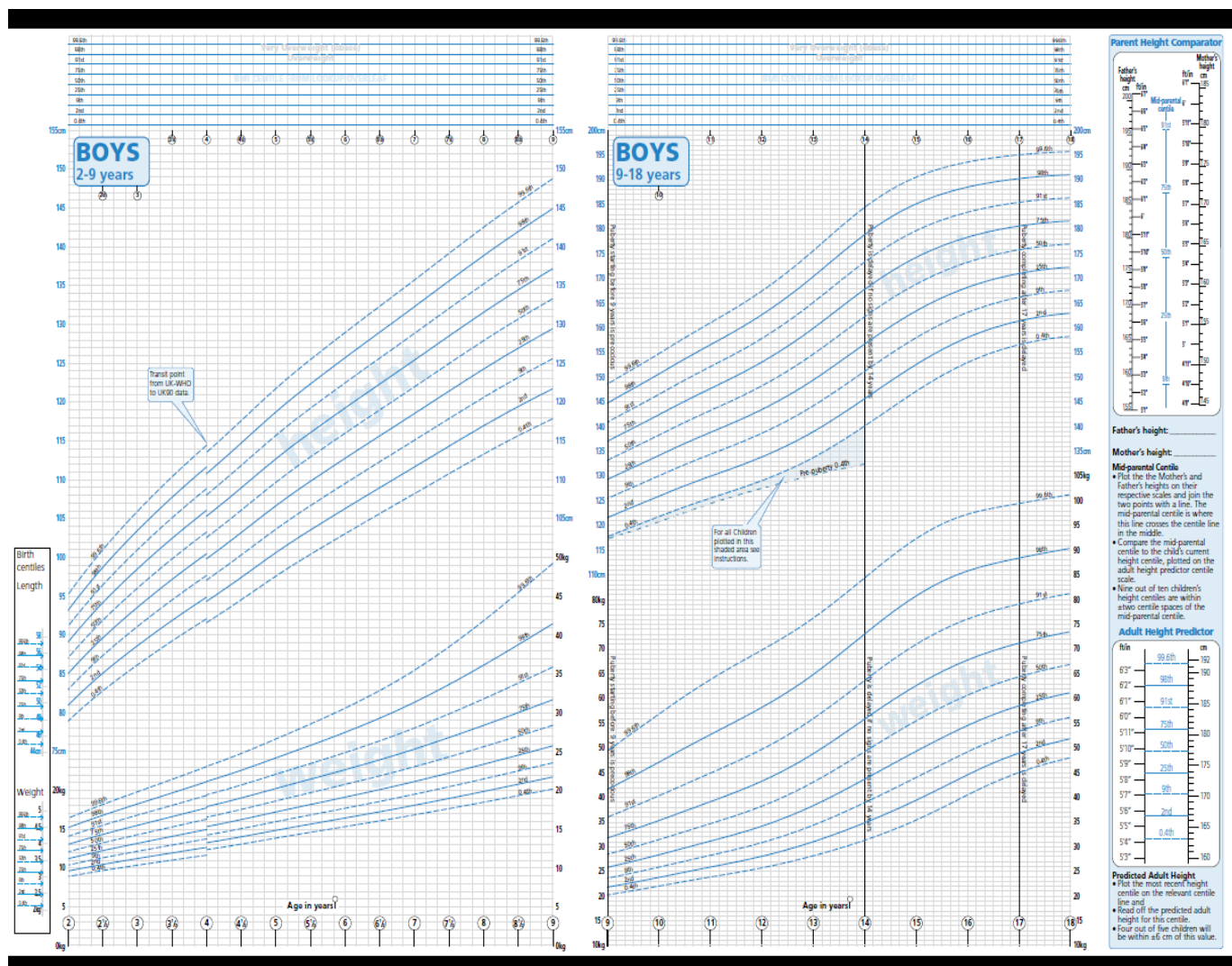
Instructions for use

1. Note the weight and height centiles from the growth chart.
2. Plot the weight centile against the height centile on the BMI look-up.
3. If between centiles, read across in this position.
4. Read off the corresponding BMI centile from the blue slanting lines.
5. Plot the centile in the BMI grid at the top of the growth chart at the appropriate age.

What does a high or low BMI mean?
A BMI above the 91st centile suggests overweight. A child above the 98th centile is very overweight (clinically obese). BMI below the 2nd centile is unusual and may reflect undernutrition, but may simply reflect a small build.

References
1. Freeman AJ, Cole TJ, Chinn S, Jones PRM, White EM, Preuss MA. Cross sectional stature and weight reference curves for the UK, 1990. Arch Dis Child 1995; 73:17-24.
2. www.nhs.uk/childgrowth
For further relevant references see fact sheet downloadable from www.growthcharts.rpch.ac.uk

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Appendix 5:

GIRLS UK Growth chart 2-18 years

RCPCH Department of Health **healthier scotland**

Anyone who measures a child, plots or interprets charts should be suitably trained or supervised. For further information and training materials see fact sheet and presentation on www.growthcharts.rpch.ac.uk

This chart is mainly intended to assess the growth of school age girls. It combines data from the UK 1990 growth reference for children at birth and from 4-18 years¹, with the WHO growth standard for children aged 2 years to 4 years². The growth of children under 2 years of age should be plotted on the more detailed UK-WHO 0-4 years growth charts.

As well as simply using this chart for plotting growth data, it also includes a number of new features which you may wish to use to help interpret the growth data.

- birth centile plotting scale
- BMI look-up and plotting grid
- scales to estimate adult height and mid-parental centile
- guide to assessing puberty

Measurement procedure
Accurate measurement is essential and shoes must be removed for all measurements

Height: Measure height recorded to the last millimetre. A correctly installed stadiometer or approved portable measuring device is the only equipment that can be reliably used (see illustration). If a child cannot stand, measure lying down, using an approved length measuring device and plot as for height.

Weight: Remove heavy clothing and shoes and weigh using class II clinical electronic scales in metric setting.

Plotting
Plot each measurement by placing a small dot where a vertical line through the child's age crosses a horizontal line through the measured value.
The lettering on the charts ('weight', 'length' etc.) sits on the 50th centile to provide orientation.

Birth centile plotting scale
The chart starts at age 2 years, but there is a plotting scale on the left of the chart where for term infants, birth weight (and if measured, length) can be plotted to allow comparison of the birth centile with later growth.

Please place sticker (if available) otherwise write in space provided

Name: _____

NHS/CHI No: _____

Hospital No: _____

Date of Birth: ____/____/____

When is further assessment required? If any of the following:

- Where weight or height or BMI is below the 0.4th centile, unless already fully investigated at an earlier age.
- If the height centile is more than 3 centile spaces below the mid-parental centile.
- A drop in height centile position of more than 2 centile spaces, as long as measurement error has been excluded.
- Smaller centile falls or discrepancies between child's and mid-parental centile, if seen in combination, or if associated with possible underlying disease.
- If there are any other concerns about the child's growth.

Adult Height Predictor
This allows you to predict the child's adult height based on their current height, but with a regression adjustment to allow for the tendency of very tall and short children to be less extreme in height as adults. Four girls out of five will have an adult height within 4.6 cm of the predicted adult height.

Instructions for use
Plot the most recent height centile on the centile line on the Adult Height Predictor (on the flap to the right of the height centile chart) and read off the predicted adult height for this centile.

Mid-Parental Centile
The mid-parental centile is the average adult height centile to be expected for all children of these parents. It incorporates a regression adjustment to allow for the tendency of very tall and short parents to have children with less extreme heights. Comparing this to the child's current height centile can help assess whether the child's growth is proceeding as expected. The larger the discrepancy between the two, the more likely it is that the child has some sort of growth disorder. Most children's height centiles (nine out of ten) are within \pm two centile spaces of the mid-parental centile, and only 1 percent will be more than three centile spaces below.

Instructions for use
The Mid-parental Centile Comparator is on the flap to the right of the height centile chart. If possible measure both parents' heights, or else use reported heights. Plot their heights on the Mother's and Father's height scales. Join the two points with a line between them. The mid-parental centile is where this line crosses the centile line in the middle. Compare the mid-parental centile to the child's current height centile, plotted on the adult height predictor centile scale.

Mid-parental target height
This can be obtained by plotting the mid-parental centile on the main chart at age 18 and reading off the corresponding height. Four girls out of five will have an adult height within \pm 7 cm of this target height, however the predicted adult height (above) is usually closer than mid-parental target height to the child's final height.

Pubertal Assessment
The puberty 'phase' may be ascertained through simple questions about the appearance of secondary sexual characteristics as well as by clinical examination.

By history from parents, carers or young person

Pre-puberty (Onset stage 1)	In Puberty (Onset stage 2-3)	Completing Puberty (Onset stage 4-5)
No signs of pubertal development	Any breast enlargement, pubic or axillary hair	Started periods with signs of pubertal development

Is the timing of puberty normal?
The three vertical black lines (puberty lines) on the right hand page (8-18 years) of the chart indicate the normal age limits for the phases of puberty described above.

- Girls with measurements plotted on the left page will usually be in the 'Pre-puberty' phase. Puberty before 8 years in girls is likely to be precocious and further assessment is necessary.
- Between 8-13 years most girls will be either 'Pre-puberty' or 'in puberty'. If there are no signs of puberty by 13 years, then puberty is delayed and further assessment is indicated.
- From 13-16 years most girls will be either 'in puberty' or 'Completing puberty'.
- After 16 years girls will usually be 'Completing puberty'. If this is not the case, maturation is delayed and further assessment may be needed.

Growth patterns before and during puberty
Successive height measurements can show wide variation, because it is difficult to measure height accurately. If there are concerns it is useful to measure on a few occasions over time. Assessing growth during puberty is complex because the age when puberty starts varies.

What does a height in the shaded area below the 0.4th centile mean?
This chart provides some extra guidance about the lower limit (0.4th centile) for height in girls 8-13 years. If a plot falls within the shaded area on the height chart between 8 and 13 years, pubertal assessment will be required and mid-parental centile should be assessed.

If they are **In puberty** or **Completing** puberty, they are below the 0.4th centile and should be referred. In most instances a **Pre-pubertal** girl plotted in this area is growing normally, but comparison with the mid-parental centile and growth trajectory will assist the assessment of whether further investigation is needed.

Centile terminology
If the point is within 1/4 of a space of the line they are on the centile e.g. 91st.
If not they should be described as being between the two centiles e.g. 75th-91st.
A centile space is the distance between two of the centile lines, or equivalent distance if midway between centiles.

Body Mass Index (BMI) centile look-up

If weight is above the 75th centile or if weight and height centiles differ, the BMI centile should be calculated, as the BMI centile is the best indicator of thinness and fatness. The BMI look-up allows you to read off the BMI centile, accurate to a quarter of a centile space. There is a BMI centile grid at the top of the growth chart where the centiles for children with high or low values can be plotted.

Instructions for use

1. Note the weight and height centiles from the growth chart.
2. Plot the weight centile against the height centile on the BMI look-up.
3. If between centiles, read across in this position.
4. Read off the corresponding BMI centile from the pink slanting lines.
5. Plot the centile in the BMI grid at the top of the growth chart at the appropriate age.

What does a high or low BMI mean?
A BMI above the 91st centile suggests overweight. A child above the 98th centile is very overweight (clinically obese). BMI below the 2nd centile is unusual and may reflect undernutrition, but may simply reflect a small build.

References
1. Freeman JV, Cole TJ, Chen S, Jones PRM, White BM, Preece MA. Cross sectional stature and weight reference curves for the UK, 1990. Arch Dis Child 1995; 73:17-24.
2. www.who.int/childgrowth
For further relevant references see fact sheet downloadable from www.growthcharts.rpch.ac.uk

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