CHILD DEVELOPMENT, COMMUNITY, BEHAVIOUR AND PSYCHIATRIC DISORDER

DR SAEDER AL SALMI
Children acquire functional skills throughout childhood. The term 'child development' is used to describe the skills acquired by children between birth and about 5 years of age, when there is a rapid progress in mobility, speech and language, communication and independence skills. During school age, evidence of developmental progression is predominantly through cognitive development, abstract thinking and skills of conceptualisation, although there is also some further maturation of early developmental skills.

Normal development in the first few years of life is monitored:

- by parents, who are provided with guidance about normal development in their child's personal child health record
- at regular child health surveillance checks
- whenever a young child is seen by a health care professional, when a brief opportunistic overview is made.

The main objective of assessing a young child's development is the early detection of delayed or abnormal development in order to:

- help children achieve their maximum potential
- provide treatment or therapy promptly (particularly important for impairment of hearing and vision)
- act as an entry point for the care and management of the child with special needs.
Influence of heredity and environment

A child's development represents the interaction of heredity and the environment on the developing brain. Heredity determines the potential of the child, while the environment influences the extent to which that potential is achieved. For optimal development, the environment has to meet the child's physical and psychological needs.

These vary with age and stage of development:

• infants are totally physically dependent on their parents and require a limited number of carers to meet their psychological needs
• primary school age children can meet some of their physical needs and cope with many social relationships
• adolescents are able to meet most of their physical needs while experiencing increasingly complex emotional needs.

Figure 3.1 Development can be impaired if the environment fails to meet the child's physical or psychological needs.
Fields of development

There are four fields of developmental skills to consider whenever a young child is seen. These are:

- gross motor
- vision and fine motor
- hearing, speech and language
- social, emotional and behavioural.

Gross motor skills are the most obvious initial area of developmental progress. As fine motor skills require good vision, these are grouped together; similarly, normal speech and language development depends on reasonable hearing and so these are also considered together. Social, emotional and behavioural skills are a spectrum of psychological development.

The acquisition of developmental abilities for each skill field follows a remarkably constant pattern between children, but may vary in rate. It is like a sequential story.

Thus the pattern of acquisition of skills:

- is sequentially constant
- should always be considered longitudinally, relating each stage to what has gone before and what lies ahead
- varies in rate between children.

A deficiency in any one skill area can have an impact on other areas. For instance, a hearing impairment may affect a child's language, social and communication skills and behaviour. As a child grows, additional skills become important, such as attention and concentration and how an individual child manages to integrate his skills.
- Sits unsupported
- Walks around furniture
- Walks unaided

- Follows a face
- Reaches for toys
- Grasps with palmar grip
- Picks up small objects

- Startles to loud noises
- Coos and babbles
- Turns head to sounds
- Says 'mama', 'dada' etc
- Understands commands
- Says words
- Talks in sentences

- Smiles
- Feeds himself solid food
- Drinks from a cup
- Helps with tasks like dressing
- Toilet-trained
Developmental milestones

Chronological age, physical growth and developmental skills usually evolve hand in hand
Just as there are normal ranges for changes in body size with age, so there are ranges over which new skills are acquired.
Important developmental skills are called developmental milestones.

When considering developmental milestones:

The **median age** is the age when half of a standard population of children achieve that level; it serves as a guide to when stages of development are likely to be reached but does not tell us if the child's skills are outside the normal range.

**Limit ages** are the age by which they should have been achieved. Limit ages are usually 2 standard deviations from the mean. They are more useful as a guide to whether a child's development is normal than the median ages.

Failure to meet them gives guidance for action regarding more detailed assessment, investigation or intervention.
Median and limit ages

The difference between median and limit ages can be demonstrated by considering the age range for the important developmental milestone of walking unsupported. The percentage of children who take their first steps unsupported is:

- 25% by 11 months
- 50% by 12 months
- 75% by 13 months
- 90% by 15 months
- 97.5% by 18 months.

The median age is 12 months and is a guide to the common pattern to expect, although the age range is wide.

The limit age is 18 months (two standard deviations from the mean). Of those not achieving the limit age, many will be normal late walkers, but a proportion will have an underlying medical problem, such as cerebral palsy, a primary muscle disorder or global developmental delay.

A few may be understimulated from social deprivation. Hence, any child who is not walking by 18 months should be assessed and examined. Thus 18 months can be set as a 'limit age' for children not walking.

Setting the limit age earlier may allow earlier identification of problems, but will also increase the number of children labelled as 'delayed' who are in fact normal.
Variation in the pattern of motor development

There is variation in the pattern of motor development between children. For example, normal motor development is the progression from immobility to walking, but not all children do so in the same way. Whilst most achieve mobility by crawling (83%), some bottom-shuffle and others crawl with their abdomen on the floor, so-called commando crawling (creeping) A very few just stand up and walk. The locomotor pattern (crawling, creeping, shuffling, just standing up) determines the age of sitting, standing or walking. The limit age of 18 months for walking applies predominantly to children who have had crawling as their early mobility pattern.

Children who bottom-shuffle or commando crawl tend to walk later than crawlers, so that within those not walking at 18 months there will be some children who demonstrate a locomotor variant pattern, with their developmental progress still being normal.

For example, of children who become mobile by bottom-shuffling, 50% will walk independently by 18 months and 97.5% by 27 months of age, with even later ages for those who initially commando crawl.

Figure 3.3 Early locomotor patterns. Most children crawl on all fours prior to walking, but some ‘bottom-shuffle’ and others ‘commando crawl’ (creep). Bottom-shuffling often runs in families. The late walking that often goes with this locomotor variant needs to be differentiated from an abnormality such as cerebral palsy.
Adjusting for prematurity

If a child has been born preterm, this should be allowed for when assessing developmental age by calculating it from the expected date of delivery. Thus the anticipated developmental skills of a 9-month baby (chronological age) born 3 months early at 28 weeks' gestation are more like those of a 6-month baby (corrected age). Correction is not required after about 2 years of age when the number of weeks early the child was born no longer represents a significant proportion of the child's life.

**primitive reflexes present at birth**

<table>
<thead>
<tr>
<th>Reflex - mode of eliciting it</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moro - sudden head extension</td>
<td>Symmetrical extension, then flexion of all limbs</td>
</tr>
<tr>
<td>Grasp - an object is placed in the palm at the base of the fingers</td>
<td>Flexion of the fingers of the hand</td>
</tr>
<tr>
<td>Rooting - stimulus near the mouth</td>
<td>Turning of the head towards the stimulus</td>
</tr>
<tr>
<td>Placing - infant held vertically and the dorsum of the feet brought into contact with a surface</td>
<td>Lifts first one foot, placing it on the surface, followed by the other</td>
</tr>
<tr>
<td>Positive supporting reflex - infant held vertically, feet on a surface</td>
<td>Legs take body weight, may push up against gravity</td>
</tr>
</tbody>
</table>
Is development normal?

When evaluating a child's developmental progress and whether it is normal or not:

- Concentrate on each field of development (gross motor; vision and fine motor; hearing and speech/language; social, emotional and behavioural) separately.

- Consider the pattern of development reached by thinking longitudinally about each developmental field.

- Ask about the sequence of development already achieved as well as those skills to be anticipated shortly.

- Determine the stage the child has reached for each skill field.

- Now relate the progress of each developmental field to the others. Is the child progressing similarly through each skill field, or does one or more field of development lag behind the others?

- Then relate the child's developmental achievements to his age (chronological or corrected).

This will enable you to decide if the child's developmental progress is normal or delayed.

Normal development implies steady progress in all four developmental fields with acquisition of skills occurring before recognised limit ages are reached. If there is developmental delay, does it affect all four developmental fields (global delay), or one or more developmental field only (specific developmental delay)?

As children grow older and acquire further skills, it becomes easier to make a more accurate assessment of their abilities and developmental status.
Pattern of child development

This is described in detail for each field of development, including key developmental milestones and limit ages:

- gross motor development
- vision and fine motor
- hearing, speech and language.
- social, emotional and behavioural.

In order to screen a young child's development, it is necessary to know only a limited number of key developmental milestones and their limit ages.
Cognitive development

Cognition refers to higher mental function.

This progresses with age.

In infancy, thought processes are centred around immediate experiences. The thought processes of preschool children (which have been called preoperational thought by Piaget), tend to be:

• that they are the centre of the world
• that inanimate objects are alive and have feelings and motives
• that events have a magical element
• that everything has a purpose.

Toys and other objects are used in imaginative play as aids to thought to help make sense of experience and social relationships.

In middle school children, the dominant mode of thought is practical and orderly, tied to immediate circumstances and specific experiences. (This has been called operational thought.)

It is only in the mid-teens that an adult style of abstract thought (formal operational thought) begins to develop, with the ability for abstract reasoning, testing hypotheses and manipulating abstract concepts.
INTELLIGENCE TESTING (IQ)

Cognitive function can be assessed objectively by formal IQ tests but disadvantages are that the tests:

- may be affected by cultural background and linguistic skills
- do not test all skill areas
- do not necessarily reflect an individual child's ultimate potential
- may be compromised by individual disabilities, such as a motor disorder as in cerebral palsy, necessitating care in interpreting results.

'Performance' or 'non-verbal' intelligence tests assess abilities independent of language. 'Verbal' intelligence tests, especially those for younger children, reflect general intellectual skills, particularly relating to language. Performance and verbal intelligence testing allows formulation of a performance IQ (PIQ) and verbal IQ (VIQ) which together give an overall IQ figure. Children with disabilities may have problems such as with speech or hand skills that may compromise testing so that results in these situations have to be interpreted with care.
The speech milestones:

- throaty at birth
- vowel or vocal turn – 3 months
- babble – 9 months
- proto words few meaningful words – 12 months
- many words, points to many objects – 18 months
- many words, telegraphic speech (two-word sentences) names objects – 2 years
  - three word sentences, tells name age and sex, counts to 10 – 3 years
  - likes rhymes, tells stories, tells full name and address – 4 years
  - fluent speech, tells name, age, address and birthday – 5 years.
<table>
<thead>
<tr>
<th>MILESTONE</th>
<th>AVERAGE AGE OF ATTAINMENT (MO)</th>
<th>DEVELOPMENTAL IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holds head steady while sitting</td>
<td>2</td>
<td>Allows more visual interaction</td>
</tr>
<tr>
<td>Pulls to sit. with no head lag</td>
<td>3</td>
<td>Muscle tone</td>
</tr>
<tr>
<td>Brings hands together in midline</td>
<td>3</td>
<td>Self-discovery of hands</td>
</tr>
<tr>
<td>Asymmetric tonic neck reflex gone</td>
<td>4</td>
<td>Can inspect hands in midline</td>
</tr>
<tr>
<td>Sits without support</td>
<td>6</td>
<td>Increasing exploration</td>
</tr>
<tr>
<td>Rolls back to stomach</td>
<td>6.5</td>
<td>Truncal flexion, risk of falls</td>
</tr>
<tr>
<td>Walks alone</td>
<td>12</td>
<td>Exploration, control of proximity to parents</td>
</tr>
<tr>
<td>Runs</td>
<td>16</td>
<td>Supervision more difficult</td>
</tr>
</tbody>
</table>

**Figure 3.4** Gross motor development (median ages).
<table>
<thead>
<tr>
<th>MILESTONE</th>
<th>AVERAGE AGE OF ATTAINMENT (MO)</th>
<th>DEVELOPMENTAL IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grasps rattle</td>
<td>3.5</td>
<td>Object use</td>
</tr>
<tr>
<td>Reaches for objects</td>
<td>4</td>
<td>Visuomotor coordination</td>
</tr>
<tr>
<td>Palmar grasp gone</td>
<td>4</td>
<td>Voluntary release</td>
</tr>
<tr>
<td>Transfers object hand to hand</td>
<td>5.5</td>
<td>Comparison of objects</td>
</tr>
<tr>
<td>Thumb-finger grasp</td>
<td>8</td>
<td>Able to explore small objects</td>
</tr>
<tr>
<td>Turns pages of book</td>
<td>12</td>
<td>Increasing autonomy during book time</td>
</tr>
<tr>
<td>Scribbles</td>
<td>13</td>
<td>Visuomotor coordination</td>
</tr>
<tr>
<td>Builds tower of 2 cubes</td>
<td>15</td>
<td>Uses objects in combination</td>
</tr>
<tr>
<td>Builds tower of 6 cubes</td>
<td>22</td>
<td>Requires visual, gross, and fine motor coordination</td>
</tr>
</tbody>
</table>

**Vision and fine motor (median ages)**

- **6 weeks**
  - Follows moving object or face by turning the head (illustrated).

- **4 months**
  - Reaches out for toys

- **4–6 months**
  - Palmar grasp

- **7 months**
  - Transfers toys from one hand to another

- **10 months**
  - Mature pincer grip

- **14 months–4 years**
  - Tower of three (18 months)
  - Tower of six (2 years)
  - Tower of eight or a train with four bricks (2 1/2 years)
  - Bridge (from a model) (3 years)
  - Steps (after demonstration) (4 years)

- **16–18 months**
  - Makes marks with a crayon

- **2–5 years**
  - Line (2 years)
  - Circle (3 years)
  - Cross (2 1/2 years)
  - Square (4 years)
  - Triangle (5 years)
  - Ability to draw without seeing how it is done. Can copy (draw after seeing it done) 6 months earlier.

*Figure 3.5 Vision and fine motor skills (median ages).*
<table>
<thead>
<tr>
<th>MILESTONE</th>
<th>AVERAGE AGE OF ATTAINMENT (MO)</th>
<th>DEVELOPMENTAL IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smiles in response to face, voice</td>
<td>1.5</td>
<td>More active social participant</td>
</tr>
<tr>
<td>Monosyllabic babble</td>
<td>6</td>
<td>Experimentation with sound, tactile sense</td>
</tr>
<tr>
<td>Inhibits to “no”</td>
<td>7</td>
<td>Response to tone (nonverbal)</td>
</tr>
<tr>
<td>Follows one-step command with gesture</td>
<td>7</td>
<td>Nonverbal communication</td>
</tr>
<tr>
<td>Follows one-step command without gesture</td>
<td>10</td>
<td>Verbal receptive language (e.g., “Give it to me”)</td>
</tr>
<tr>
<td>Says “mama” or “dada”</td>
<td>10</td>
<td>Expressive language</td>
</tr>
<tr>
<td>Points to objects</td>
<td>10</td>
<td>Interactive communication</td>
</tr>
<tr>
<td>Speaks first real word</td>
<td>12</td>
<td>Beginning of labeling</td>
</tr>
<tr>
<td>Speaks 4–6 words</td>
<td>15</td>
<td>Acquisition of object and personal names</td>
</tr>
<tr>
<td>Speaks 10–15 words</td>
<td>18</td>
<td>Acquisition of object and personal names</td>
</tr>
<tr>
<td>Speaks 2-word sentences (e.g., “Mommy shoe”)</td>
<td>19</td>
<td>Beginning grammaticization, corresponds with 50+ word vocabulary</td>
</tr>
</tbody>
</table>

**Hearing, speech and language (median ages)**

**NEWBORN**
- **Startles to loud noises**

**3–4 MONTHS**
- **Vocalizes alone or when spoken to, coos and laughs**

**7 MONTHS**
- **Turns to soft sounds out of sight**

**7–10 MONTHS**
- **At 7 months, sounds used indiscriminately. At 10 months, sounds used discriminately to parents**

**12 MONTHS**
- **Two to three words other than ‘dada’ or ‘mama’**

**18 MONTHS**
- **Where is your nose?**

**6–10 words. Shows two parts of the body**

**20–24 MONTHS**
- **Give me teddy**

**Uses two or more words to make simple phrases**

**2½–3 YEARS**
- **Push me fast daddy**

**Talks constantly in 3–4 word sentences**

**Figure 3.6 Hearing, speech and language (median ages).**
<table>
<thead>
<tr>
<th>MILESTONE</th>
<th>AVERAGE AGE OF ATTAINMENT (MO)</th>
<th>DEVELOPMENTAL IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stares momentarily at spot where object disappeared</td>
<td>2</td>
<td>Lack of object permanence (out of sight, out of mind) [e.g., yarn ball dropped]</td>
</tr>
<tr>
<td>Stares at own hand</td>
<td>4</td>
<td>Self-discovery, cause and effect</td>
</tr>
<tr>
<td>Bangs 2 cubes</td>
<td>8</td>
<td>Active comparison of objects</td>
</tr>
<tr>
<td>Uncovers toy (after seeing it hidden)</td>
<td>8</td>
<td>Object permanence</td>
</tr>
<tr>
<td>Egocentric symbolic play (e.g., pretends to drink from cup)</td>
<td>12</td>
<td>Beginning symbolic thought</td>
</tr>
<tr>
<td>Uses stick to reach toy</td>
<td>17</td>
<td>Able to link actions to solve problems</td>
</tr>
<tr>
<td>Pretend play with doll (e.g., gives doll bottle)</td>
<td>17</td>
<td>Symbolic thought</td>
</tr>
</tbody>
</table>

Social, emotional and behavioural development (median ages)

(a) 6 WEEKS
Smiles responsive

(b) 6–8 MONTHS
Puts food in mouth

(c) 10–12 MONTHS
Waves bye-bye, plays peek-a-boo

(d) 12 MONTHS
Drinks from a cup with two hands

(e) 18 MONTHS
Holds spoon and gets food safely to mouth

(f) 18–24 MONTHS
Symbolic play

(g) 2 YEARS
Dry by day. Pulls off some clothing

(h) 2.5–3 YEARS
Parallel play. Interactive play evolving. Takes turn

Figure 3.7 Social, emotional and behavioural development (median ages).
### Fields of development with limit ages

#### Gross motor development
- Acquisition of tone and head control
- Primitive reflexes disappear
- Sitting
- Locomotor patterns
- Standing, walking, running
- Hopping, jumping, peddling

<table>
<thead>
<tr>
<th>Gross motor</th>
<th>Limit ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head control</td>
<td>4 months</td>
</tr>
<tr>
<td>Sits unsupported</td>
<td>9 months</td>
</tr>
<tr>
<td>Stands independently</td>
<td>12 months</td>
</tr>
<tr>
<td>Walks independently</td>
<td>18 months</td>
</tr>
</tbody>
</table>

#### Vision and fine motor development
- Visual alertness, fixing and following
- Grasp reflex, hand regard
- Voluntary grasping, pincer, points
- Handles objects with both hands, transfers from hand to hand
- Writing, cutting, dressing

<table>
<thead>
<tr>
<th>Vision and fine motor</th>
<th>Limit ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixes and follows visually</td>
<td>3 months</td>
</tr>
<tr>
<td>Reaches for objects</td>
<td>6 months</td>
</tr>
<tr>
<td>Transfers</td>
<td>9 months</td>
</tr>
<tr>
<td>Pincer grip</td>
<td>12 months</td>
</tr>
</tbody>
</table>

#### Hearing, speech and language development
- Sound recognition, vocalisation
- Babbling
- Single words, understands simple requests
- Joining words, phrases
- Simple and complex conversation

<table>
<thead>
<tr>
<th>Hearing, speech and language</th>
<th>Limit ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polysyllabic babble</td>
<td>7 months</td>
</tr>
<tr>
<td>Consonant babble</td>
<td>10 months</td>
</tr>
<tr>
<td>Saying 6 words with meaning</td>
<td>18 months</td>
</tr>
<tr>
<td>Joins words</td>
<td>2 years</td>
</tr>
<tr>
<td>3-word sentences</td>
<td>2.5 years</td>
</tr>
</tbody>
</table>

#### Social, emotional, behaviour development
- Smiling, socially responsive
- Separation anxiety
- Self-help skills, feeding, dressing, toileting
- Peer group relationships
- Symholic play
- Social/communication behaviour

<table>
<thead>
<tr>
<th>Social behaviour</th>
<th>Limit ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smiles</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Fear of strangers</td>
<td>10 months</td>
</tr>
<tr>
<td>Feeds self/spoon</td>
<td>18 months</td>
</tr>
<tr>
<td>Interactive play</td>
<td>2–2.5 years</td>
</tr>
<tr>
<td></td>
<td>3–3.5 years</td>
</tr>
</tbody>
</table>
### Developmental milestones by median age

<table>
<thead>
<tr>
<th>Age</th>
<th>Gross motor</th>
<th>Vision and fine motor</th>
<th>Hearing, speech and language</th>
<th>Social, emotional and behavioural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>Flexed posture</td>
<td>Fixes and follows face</td>
<td>Stills to voice</td>
<td>Smiles – by 6 weeks</td>
</tr>
<tr>
<td>7 months</td>
<td>Sits without support</td>
<td>Transfers objects from hand to hand</td>
<td>Startles to loud noise</td>
<td>Finger feeds</td>
</tr>
<tr>
<td>1 year</td>
<td>Stands independently</td>
<td>Pincer grip (10 months)</td>
<td>Turns to voice</td>
<td>Fears strangers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Points</td>
<td>Polysyllabic babble</td>
<td>Drinks from cup</td>
</tr>
<tr>
<td>15-18 months</td>
<td>Walks independently</td>
<td>Immature grip of pencil</td>
<td>1–2 words</td>
<td>Waves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Random scribble</td>
<td>Understands name</td>
<td></td>
</tr>
<tr>
<td>2½ years</td>
<td>Runs and jumps</td>
<td>Draws</td>
<td>6–10 words</td>
<td>Feeds self with spoon</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Points to four body parts</td>
<td>Beginning to help with dressing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3–4 word sentences</td>
<td>Parallel play</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Understands two joined commands</td>
<td>Clean and dry</td>
</tr>
</tbody>
</table>

**Figure 3.8** Diagram highlighting the ages when there is the most rapid emergence of skills in each developmental field.
The approximate ages for the various types of play

<table>
<thead>
<tr>
<th>Age</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 months</td>
<td>solitary play</td>
<td>A child is playing alone</td>
</tr>
<tr>
<td>2 years</td>
<td>spectator play</td>
<td>A child watches other children playing, but does not join in.</td>
</tr>
<tr>
<td>3 years</td>
<td>role play</td>
<td>The symbolic objects are used in activity. The symbolic car is ‘driven’</td>
</tr>
<tr>
<td>4 years</td>
<td>imaginative play</td>
<td>Using their toys to create real-life situations – like playing ‘cops and robbers’.</td>
</tr>
<tr>
<td>5 years</td>
<td>small-world play</td>
<td>Play using miniature toys like soldiers and animals.</td>
</tr>
<tr>
<td>6 years</td>
<td>fantasy play</td>
<td>Using toys to create situations that exist only in imagination and they know little about</td>
</tr>
</tbody>
</table>
Analysing developmental progress

Detailed assessment
So far, emphasis has been mainly on thinking about developmental progress in a longitudinal way, taking each skill field and its progression individually, and then relating the progress in each to the others and to chronological age.

This is the fundamental concept of learning how to think about developmental assessment of children.

Detailed questioning and observation is required to assess children with developmental problems but is unnecessary when checking developmental progress in normal clinical practice, when a short cut approach can be adopted.
The short cut approach
This concentrates on the most actively changing skills for the child's age.

The age at which developmental progress accelerates differs in each of the developmental fields.

- gross motor development: an explosion of skills during the first year of life
- vision and fine motor development: more evident acquisition of skills from 1 year onwards
- hearing, speech and language: a big expansion of skills from 18 months
- social, emotional and behavioural development: expansion in skills is most obvious from 2.5 years.

Understanding the time when acceleration in each skill field becomes more obvious and knowing the child's age helps guide the direction of initial developmental questioning. Thus for a child aged:

- <18 months - it is likely to be most useful to begin questions around gross motor abilities, acquisition of vision and hearing skills, followed by questions about hand skills.

- 18 months to 2.5 years - initial developmental questioning is likely to be most usefully directed at acquisition of speech and language and fine motor (hand) skills with only later and brief questioning about gross motor skills (as it is likely the child would have presented earlier if these were of concern).

- 2.5 to 3.5 years - initial questions are best focused around speech and language and social/emotional/behavioural skills.

Developmental questioning needs to cover the whole area of developmental progression but this more focused way of taking a developmental history allows a quicker and more appropriate assessment.

It directs the assessment to current abilities instead of concentrating on parents trying to remember the age when their child acquired developmental milestones some time in the past.
**Observation during questioning**

Of equal importance to taking the developmental history is the examiner's ability to observe the child throughout any visit.

Not only will this provide an almost immediate guide to where to begin questioning, it will offer the opportunity for a rapid overview of the child's abilities, behaviour, peer group and parent-child relationships, all of which will go towards determining the overall picture about the child and his developmental abilities.

**Equipment for developmental testing**

Simple basic equipment is all that is needed for most developmental assessment. Equipment is aimed at bringing out the child's skills using play.

Cubes, a ball, picture book, doll and miniature toys such as a tea-set, crayons and paper will allow a quick, but useful screen of mobility, hand skills, play, speech and language.

These items allow the child to relax by having fun at the same time as facilitating observer assessment of his skills.

**Developmental screening and assessment**

Developmental screening (checks of whole populations of children at set ages by trained professionals) is a formal process within the child health surveillance and promotion programme.

It is also an essential role of all health professionals to screen a young child's developmental progress opportunistically at every health contact, e.g. by the general practitioner for a sore throat, in the accident and emergency department for a fall or on admission to a paediatric ward.

In this way, every child contact is optimised to check that development is progressing normally.

There are a number of problems inherent in developmental screening:
It is based on clinical opinion, which is subjective and therefore has its limitations.

A single observation of development may be limited by the child being tired, hungry, shy or simply not wishing to take part.

Whilst much of the focus of early development and progress in infants is centred on motor development, this is a poor predictor of problems in cognitive function and later school performance.

Development of speech and language is a better predictor of cognitive function but is less easy to assess rapidly.
The reliability of screening tests can be improved by adding a questionnaire completed by parents beforehand. Increasingly, screening is being targeted towards children at high risk or when there are parental concerns. If an abnormal pattern of development has been identified, the child should be referred to a therapist for an early intervention programme.

Developmental assessment is the detailed analysis of a particular area of development and follows concern after screening that a child's developmental progress is abnormal in some way. It is part of the diagnostic process and relates to investigation, therapy and counselling. Developmental assessment is by referral to a specialist service and this may be the developmental paediatrician, therapy disciplines, or the local multidisciplinary child development service, which will include a paediatrician.

A range of tests have been developed to screen development in a formal reproducible manner (e.g. the Schedule of Growing Skills and the Denver Developmental Screening Test).

There are also standardised tests to assess the development of infants and young children, such as the Griffiths and the Bailey Infant Development Scales. They are used, for example, in follow-up studies of preterm infants.

There are also standardised tests concentrating on specific aspects of development (e.g. the Reynell language scale, the Gross Motor Function Measure (GMFM) and the Autism Diagnostic Interview). All but the screening tests are time-consuming and require training for reliable results. Cognitive (higher mental function) assessment of school-age children using IQ and other tests is carried out by clinical or educational psychologists.
Hearing and vision

Normal child development, hearing and vision

Children acquire functional skills throughout childhood. The term 'child development' is used to describe the skills acquired by children between birth and about 5 years of age, when there is a rapid progress in mobility, speech and language, communication and independence skills. During school age, evidence of developmental progression is predominantly through cognitive development, abstract thinking and skills of conceptualisation, although there is also some further maturation of early developmental skills.

Normal development in the first few years of life is monitored: by parents, who are provided with guidance about normal development in their child's personal child health record at regular child health surveillance checks whenever a young child is seen by a health care professional, when a brief opportunistic overview is made. The main objective of assessing a young child's development is the early detection of delayed or abnormal development in order to: help children achieve their maximum potential provide treatment or therapy promptly (particularly important for impairment of hearing and vision) act as an entry point for the care and management of the child with special needs.
Vision

Each year around 500 children are registered blind or partially sighted. Early diagnosis is important because:

- Appropriate treatment may reduce the severity of the disability or stop progression
- Other medical conditions associated with visual problems can be diagnosed
- Genetic counselling can be offered
- Pre-school learning support can be started

Vision testing

All children in the UK are screened for visual acuity, squint at school entry.

Some parts of the UK screening is carried out in preschool children at 4-5 yrs.

There is no neonatal universal screen but current recommendation is to do newborn screen:-

- If there are eye anomalies (red reflex) (cataract).
- Cataract and fundoscopy if born < 28 wk repeat at 6wk old age.

Babies slowly develop the ability to focus at different distances.

Visual acuity also improves:

- From 6/60 at 3 months.
- Able to poke at 1 cm objects at 8 mon and at 1mm objects at 15 mon.
- Adult levels are reached by 3-4 years of age, when the child can match pictures or letters at 6/6 using both eyes together.
# Vision examination test

<table>
<thead>
<tr>
<th>Age</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>Recent recommendation for NB screen</td>
</tr>
<tr>
<td></td>
<td>- If there are any eye anomalies</td>
</tr>
<tr>
<td></td>
<td>- VLBW less than 28wk for ROP</td>
</tr>
<tr>
<td></td>
<td>By</td>
</tr>
<tr>
<td></td>
<td>- Exam Face fixation, following and see red reflex, cataract</td>
</tr>
<tr>
<td></td>
<td>- Repeat at 6wks old age</td>
</tr>
<tr>
<td></td>
<td>- Fundoscopy</td>
</tr>
<tr>
<td>4 weeks</td>
<td>Visual-evoked potentials test</td>
</tr>
<tr>
<td>6 weeks</td>
<td>Looking at a moving, striped target follow 90 c</td>
</tr>
<tr>
<td></td>
<td>Both eyes should move together when following a light source</td>
</tr>
<tr>
<td></td>
<td>See red reflex</td>
</tr>
<tr>
<td></td>
<td>Optokinetic nystagmus (normal)</td>
</tr>
<tr>
<td>12 weeks</td>
<td>No squint should be present</td>
</tr>
<tr>
<td>6 months</td>
<td>Reaches well for toys (Use toys that have hard shiny surfaces)</td>
</tr>
<tr>
<td>8 months</td>
<td>Baby can pick up raisn</td>
</tr>
<tr>
<td></td>
<td>Check Eye movement look for squint</td>
</tr>
<tr>
<td>2 years</td>
<td>Can identify pictures of reducing size</td>
</tr>
<tr>
<td></td>
<td>(Picture card) and (prefrentaial looking test) at 3 meter</td>
</tr>
<tr>
<td>3 years onwards</td>
<td>Letter matching using single letter charts (log MAR)</td>
</tr>
<tr>
<td></td>
<td>Sheridan garden test at 3meter (Optotypes matching tests)</td>
</tr>
<tr>
<td>5 years onwards</td>
<td>Can identify a line of letters on a log MAR or</td>
</tr>
<tr>
<td></td>
<td>Snellen chart by name or matching</td>
</tr>
</tbody>
</table>
Hearing

During the later stages of pregnancy, the fetus responds to sound.

At birth, a baby startles to sound, but there is a marked preference for voices.

The ability to locate and turn towards sounds comes later in the first year.

**Hearing checklist for parents**

<table>
<thead>
<tr>
<th>Shortly after birth</th>
<th>Startles and blinks at a sudden noise, e.g. slamming of door</th>
</tr>
</thead>
<tbody>
<tr>
<td>By 1 month</td>
<td>Notices sudden prolonged sounds, e.g. a vacuum cleaner, and pauses and listens when they begin</td>
</tr>
<tr>
<td>By 4 months</td>
<td>Quietens or smiles to the sound of your voice even when he cannot see you. He may also turn his head or eyes towards you if you come up from behind and speak to him from the side</td>
</tr>
<tr>
<td>By 7 months</td>
<td>Turns immediately to your voice across the room or to very quiet noises made on each side, so long as he is not too occupied with other things</td>
</tr>
<tr>
<td>By 9 months</td>
<td>Listens attentively to familiar every day sounds and searches for very quiet sounds made out of sight. Should also show pleasure in babbling loudly and tunefully</td>
</tr>
<tr>
<td>By 12 months</td>
<td>Shows some response to his own name and to other familiar words. May respond when you say 'no' and 'bye-bye' even when he cannot see any accompanying gesture</td>
</tr>
</tbody>
</table>
Hearing test

Newborn

Early detection and treatment of hearing impairment improves the outcome for speech and language and behavior.

In order to detect hearing impairment in the newborn period, hearing can be tested by:

- **Evoked otoacoustic emission (EOAE)** an earpiece is inserted into the ear canal and produces a sound which evokes an echo or emission from the ear if cochlear function is normal.
- **Auditory brainstem response (ABR)** audiometry computer analysis of EEG waveforms evoked in response to a series of clicks.

**Universal neonatal hearing screening** has been introduced in the UK and other countries by using different combinations of evoked otoacoustic emission (EOAE) testing or auditory brainstem response (ABR) audiometry.

If a normal response cannot be obtained, the child is referred to an audiologist.

**Other countries only high-risk infants are screened.**

- Low birth weight
- Jaundice at the exchange level
- Anomalies of the ears, preauricular pits, tags
- Special Care Baby Unit (SCBU) admission for more than 72 hours
- Family history of deafness
- Gentamicin treatment
Assessment of auditory function

Babies

- Diagnostic auditory brainstem response testing
- Otoacoustic emissions test

8 months

- Hearing distraction test

2 years

- Visual reinforcement audiometry
- Performance games
- Speech discrimination test
- Free-field audiometry

3 years and over

- Pure-tone audiometry

It is important to consider both the developmental and the chronological age when deciding which test to use.
Hearing screening of newborn infants

(a) Evoked otoacoustic emission (EOAE)

Click generated from ear phones
Detects normal sound vibrations from outer hair cells in the cochlea

Advantages:
- Simple and quick to perform, though is affected by ambient noise

Disadvantages:
- Misses auditory neuropathy as function of auditory nerve or brain not tested
- Relatively high false-positive rate in first 24 hours after birth as vernix or amniotic fluid are still in ear canal
- Not a test of hearing but a test of cochlear function

(b) Automated auditory brainstem response (AABR)

Auditory stimulus via earphones
Signal via ear and auditory nerve to brain

EEG waveforms – computerised analysis determines if normal or abnormal

Advantages:
- Screens hearing pathway from ear to brainstem
- Low false-positive rate

Disadvantages:
- Affected by movement, so infants need to be asleep or very quiet, so time consuming
- Complex computerised equipment, but is mobile
- Requires electrodes applied to infant’s head, which parents may dislike

Figure 3.9 Universal neonatal hearing screening is usually performed using (a) otoacoustic emission testing or (b) auditory brainstem response audiometry.
Distraction testing

This has been the mainstay of hearing screening but has been replaced by universal neonatal screening.

It is now only used as a screening test for infants who have not had newborn screening, or as a diagnostic test.

It is performed at 7-9 months of age, the test relies on the baby locating and turning appropriately towards sounds.

High and low frequency sounds are presented out of the infant's field of vision.

Testing is unreliable if not carried out by properly trained staff since it can be difficult to identify hearing-impaired infants as they are particularly adept at using non-auditory cues.
Visual reinforcement audiometry

This is particularly useful to assess impairment in infants between 10 and 18 months, although it can be used between the age of 6 months and 3 years.

Hearing thresholds are established using visual rewards (illumination of toys) to reinforce the child's head turn to stimuli of different frequencies.

Localisation of the stimuli is not necessary and insert earphones may be used to obtain ear specific information, thus making it more useful than free field tests such as distraction and performance testing.

Visual reinforcement audiometry.

While an assistant plays with the child, sounds of a specific frequency are emitted from a speaker.

When the child turns to it, the tester lights up a toy by the speaker to reinforce the sound with a visual reward.

This test is particularly useful at 10-18 months.
Performance and speech discrimination testing

Performance testing using high- and low-frequency stimuli and speech discrimination testing using miniature toys can be used for children with suspected hearing loss at **18 months to 4 years of age**

Speech discrimination testing using miniature toys to detect hearing loss in children between 18 months and 4 years of age.
**Free-field testing**

Suitable for children aged 2 years and over.

It does not require understanding or cooperation so is useful for children with developmental delay or behavioural problems.

Sounds are produced within a free field at different frequencies. The child's reaction to sound is observed and assessed if satisfactory.

**Pure-tone audiometry**

By 4 years of age a child should be able to co-operate with this test.

Both ears can be tested separately.

The audiometer delivers sounds at different frequencies and intensities. It is possible to determine the child's threshold at each sound frequency.

It takes at least 10 minutes to perform.
The audiogram

Key to symbols used:

x-axis = frequency (Hz)

y-axis = hearing level (dBHL)

0 = air conduction right ear

x = air conduction left ear

A = bone conduction unmasked - vibrator vibrates whole skull no matter which mastoid it is placed on, assesses both cochleas unless one ear is masked.

[ = masked bone conduction right

l = masked bone conduction left

↓ = off scale (no response)

Air conduction assesses the whole auditory system, bone conduction assesses the auditory pathway from the cochlea and beyond.

difference between the two suggests a conductive loss (middle or outer ear).

Equal impairment suggests a sensorineural loss.

Impairment greater in air than bone suggests a mixed loss.

- Normal range -10 to +20 dBHL
- Moderate hearing loss 20-40 dBHL
- Profound hearing loss 90-120 dBHL
High-frequency hearing loss in a child with speech delay
WEBER’S AND RINNE’S TEST

Detailed testing of hearing is done monaurally, ideally while occluding the opposite ear, as by pressing the tragus over the canal, and the patient is asked to compare the sound intensity between the two ears.

The examiner may also compare the distance from each ear at which a sound of the same intensity can be heard.

- **Tuning forks**—typically 128, 256, or 512 Hz—are sometimes used to give more specific information and to assess air conduction (AC) and bone conduction (BC).

- The patient may be asked to compare the loudness of the vibrating fork in the two ears, or the examiner may compare the distance on each side at which the fork begins or ceases to be heard.

- **The Rinne test** compares the patient’s AC and BC; done in at least two ways.
  - An activated fork may be placed first on the mastoid process, then immediately beside the ear (or vice versa), and the patient asked which is louder; it should always be louder by the ear-AC.
  - The more time-consuming, traditional method is to place the tuning fork on the mastoid and when no longer heard there move it beside the ear, where it should still be audible.
  - The fork should be heard twice as long by AC as by BC.

  The Rinne test is **normal or positive when** AC is better than BC

  **abnormal or negative**

  - In **conductive hearing loss**, AC is impaired but BC is preserved; sound is not conducted normally through the canal or from the tympanic membrane through the ossicular chain to the cochlea, but the sensorineural mechanisms are intact.

  - In **sensorineural hearing loss (SNHL)**, both AC and BC are impaired while retaining their normal relationship of AC better than BC.
- **In the Weber test**, to compares the defect between the tow ears, a vibrating tuning fork is placed in the midline on the vertex of the skull. It may be placed anywhere in the midline, over the nasal bridge, forehead, or maxilla, but works best over the vertex.

- Normally, the sound is heard equally in both ears or seems to resonate somewhere in the center of the head; it is “*not lateralized.*”

- In conductive hearing loss, the sound is heard better on (“*lateralized to*”) the involved side.

- In sensorineural deafness, the sound is heard best in the normal ear.

**In summary**

**With unilateral conductive hearing loss (CHL)** there is primarily loss of AC; but BC is preserved or even exaggerated and the Weber lateralizes to the involved side

**With unilateral SNHL, AC and BC are both diminished**, but AC remains better than BC, and the Weber lateralizes to the normal ear.

**Rinne and Weber Tests**

<table>
<thead>
<tr>
<th></th>
<th>Auditory Acuity</th>
<th>Rinne Test</th>
<th>Weber Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHL</strong></td>
<td>Decreased</td>
<td>BC &gt; AC</td>
<td>Lateralizes to abnormal side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rinne negative or abnormal</td>
<td></td>
</tr>
<tr>
<td><strong>SNHL</strong></td>
<td>Decreased</td>
<td>AC &gt; BC</td>
<td>Lateralizes to normal side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rinne positive or normal</td>
<td></td>
</tr>
</tbody>
</table>
Descriptors of hearing impairment

1. Degree of hearing impairment (mild, moderate, severe, profound)
   - normal 0 -20 dB HL
   - mild hearing loss 20 – 40 dB HL
   - moderate hearing loss 41–70 dB HL
   - severe hearing loss 71– 95 dB HL
   - profound hearing loss > 95 dB HL

Using the average of the pure tone threshold hearing levels at
(250, 500, 1000, 2000, 3000, 4000 Hz in the better ear)

2. Bilateral or unilateral sensorineural hearing loss

3. Bilateral or unilateral fixed conductive hearing loss

4. Bilateral or unilateral mixed hearing loss

5. With or without vestibular function

6. Auditory neuropathy spectrum disorder
**Sweep audiometry**

Same principle as above but quicker to perform because various sound frequencies are tested at only one intensity (around 25 dB).

It is used as a screening test at the pre-school entry.

If the child fails at any frequency then full audiometry is performed.

**Tympanometry**

The compliance of the tympanic membrane and ear ossicles is assessed by a probe that fits snugly in the external auditory canal and which is able to generate positive and negative pressures while recording the sound reflected back from a small microphone within the probe.

Suitable for any age child. Primarily used to check for ‘glue ear.

In the normal ear, the peak is at 0 pressure, reflecting the equal pressures either side of the drum.

The trace is flattened if a middle-ear effusion is present.

![Normal trace](image.png)

*Normal trace*

If compliance is much greater than normal (peaked) consider flaccid drum or disarticulation of the ossicles.
Flattened trace with no clear peak
- middle-ear effusion
- fixed ear ossicles

Peak at negative pressure (shift to left)
- eustachian tube dysfunction
  (retracted drum)
Developmental problems and the child with special needs

Any child whose development is delayed or disordered needs assessment to determine the cause and management.

Neurodevelopmental problems present at all ages, with an increasing number now recognised antenatally.

Many are identified in the neonatal period because of abnormal neurology or dysmorphic features.

During infancy and early childhood, problems often present at an age when a specific area of development is most rapid and prominent, i.e. motor problems during the first 18 months of age, speech and language problems between 18 months and 3 years and social and communication disorders between 2 and 4 years.

Abnormal development may be caused not only by neurodevelopmental problems but also by ill health or if the child's physical or psychological needs are not met.

When performing a clinical examination on a young child with a developmental problem:

- Ask the parent what their child can and cannot do.
- Observe the child from the first moment seen.
- Make it fun. Your examination should be perceived as a game by the child although he may not always follow your rules.
- Toys to use are cubes, a ball, car, doll, pencil, paper, pegboard, miniature toys, picture book, adapting their use to the child.
- Formulate a developmental picture in terms of gross motor; vision and fine motor; hearing, speech and language; and social, emotional and behavior. You will be screening all of these skills simultaneously.
- At the end of developmental screening you should be able to describe what a child is able to do and what the child cannot do, if his abilities are within normal limits for their age and, if not, which developmental fields are outside the normal range.
Clinical signs to look for that may aid diagnosis or guide investigation are:

- patterns of growth - height, weight, head circumference with centile plotting
- dysmorphic features - face, limbs, body proportions, cardiac, genitalia
- skin - neurocutaneous stigmata, injuries, cleanliness nutrition
- central nervous system examination - wasting, abnormal posture/symmetry, power tone, deep tendon reflexes, clonus, plantar responses, sensory examination, cranial nerves
- cardiovascular examination - abnormalities are associated with many dysmorphic syndromes
- visual function and ocular abnormalities
- hearing - by questioning parents about hearing and language development and checking if neonatal hearing screening was done
- patterns of mobility, dexterity, communication and social skills, general behavior
- cognition.

<table>
<thead>
<tr>
<th>Table 4.1 Features that may suggest neurodevelopmental concerns by age</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prenatal</strong></td>
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<td></td>
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<tr>
<td><strong>Perinatal</strong></td>
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<td></td>
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<tr>
<td><strong>Infancy</strong></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>Preschool</strong></td>
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<tr>
<td></td>
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<tr>
<td><strong>School age</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Any age</strong></td>
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</tbody>
</table>
Abnormal development - key concepts

The terminology can be confusing, but:

- **Delay** – implies slow acquisition of all skills (global delay) or of one particular field or area of skill (specific delay), particularly in relation to developmental problems in the 0-5 years age group.
- **Learning difficulty** – used in relation to children of school age and may be cognitive, physical or both (complex).
- **Disorder** – maldevelopment of a skill.

The following are agreed definitions:

- **Impairment** – loss or abnormality of physiological function or anatomical structure.
- **Disability** – any restriction or lack of ability due to the impairment.
- **Handicap** – a disadvantage from a disability which limits or prevents fulfilment of a normal role.

The term handicap is now discouraged as it can imply a person deserves pity.

Difficulty and disability are often used interchangeably, but difficulty is used particularly in an educational context.
The pattern of abnormal development (global or specific) can be categorised as:

- slow but steady
- plateau effect
- showing regression.

The severity can be categorised as:

- mild
- moderate
- severe
- profound.

Other features of developmental delay are:

- the gap between normal and abnormal development becomes greater with increasing age and therefore becomes more apparent over time. It may be the presentation of a wide variety of underlying conditions.
- the site and severity of brain damage influence the clinical outcome, i.e. whether there is specific or global developmental delay, learning and/or physical disability.
- it may be genetic, with important implications for the family.
- there is a wide age band across which it can be normal to achieve a developmental skill. Limit ages denote beyond normal range.
Figure 4.1 Patterns of abnormal development. These may be slow but steady, plateau or regression.

Figure 4.2 For children with abnormal development, the gap between their abilities and what is normal widens with age.
developmental regression beyond the age of 2 years

- sub-acute sclerosing pan encephalitis
- mitochondrial disorders.
- n.degenerative (H.chorea)
- wilson dis.

Developmental regression before the age of 2 years is

- Hypothyroidism,
- HIV encephalopathy,
- aminoaciduria and
- lysosomal disorders such as mucopolysaccharidoses
GLOBAL DELAY IN DEVELOPMENT

Global developmental delay implies delay in acquisition of all skill fields (gross motor, vision and fine motor, hearing and speech/language, social/emotional and behavior).

It usually becomes apparent in the first 2 years of life. However, some children present later with, for instance, delay in speech and language but review of their developmental history may reveal delayed gross and fine motor skills (but insufficient at the time to generate referral), and a diagnostic label of global developmental delay may then be more appropriate than specific language delay.

Global developmental delay is likely to be associated with cognitive difficulties although these may only become apparent several years later.
Table 4.2 Conditions which cause abnormal development and learning difficulty

<table>
<thead>
<tr>
<th><strong>Prenatal</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic</td>
<td>Chromosome/DNA disorders, e.g. Down syndrome, fragile X syndrome, chromosome microdeletions or duplications, Cerebral dysgenesis, e.g. microcephaly, absent corpus callosum, hydrocephalus, neuronal migration disorder</td>
</tr>
<tr>
<td>Vascular</td>
<td>Occlusions, haemorrhage</td>
</tr>
<tr>
<td>Metabolic</td>
<td>Hypothyroidism, phenylketonuria</td>
</tr>
<tr>
<td>Teratogenic</td>
<td>Alcohol and drug abuse</td>
</tr>
<tr>
<td>Congenital infection</td>
<td>Rubella, cytomegalovirus, toxoplasmosis, HIV</td>
</tr>
<tr>
<td>Neurocutaneous syndromes</td>
<td>Tuberous sclerosis, neurofibromatosis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Perinatal</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme prematurity</td>
<td>Intraventricular haemorrhage/periventricular leukomalacia</td>
</tr>
<tr>
<td>Birth asphyxia</td>
<td>Hypoxic-ischaemic encephalopathy</td>
</tr>
<tr>
<td>Metabolic</td>
<td>Symptomatic hypoglycaemia, hyperbilirubinaemia</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Postnatal</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection</td>
<td>Meningitis, encephalitis</td>
</tr>
<tr>
<td>Anoxia</td>
<td>Suffocation, near drowning, seizures</td>
</tr>
<tr>
<td>Trauma</td>
<td>Head injury – accidental or non-accidental</td>
</tr>
<tr>
<td>Metabolic</td>
<td>Hypoglycaemia, inborn errors of metabolism</td>
</tr>
<tr>
<td>Vascular</td>
<td>Stroke</td>
</tr>
</tbody>
</table>

| **Other** | |
| Unknown (about 25%) | |

The site and severity of brain damage influences the clinical outcome, i.e. whether specific or global developmental delay, learning and/or physical disability.
The choice of investigations is influenced by the child's age, the history and clinical findings. In some children no cause can be identified even after extensive investigation.

Many parental concerns about their child's development are found to be variations of normal, in which case the parents should be reassured. If in doubt, observe the child's progress over a period of time.

### Table 4.3 Investigations or assessment to consider for developmental delay

<table>
<thead>
<tr>
<th>Category</th>
<th>Investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cytogenetic</strong></td>
<td>Chromosome karyotype(^a)</td>
</tr>
<tr>
<td></td>
<td>Fragile X analysis(^a)</td>
</tr>
<tr>
<td></td>
<td>DNA FISH analysis, e.g. for chromosome 7, 15, 22 deletions, CGH microarray</td>
</tr>
<tr>
<td></td>
<td>(comparative genomic hybridisation), telomere screen</td>
</tr>
<tr>
<td><strong>Metabolic</strong></td>
<td>Thyroid function tests, liver function tests, bone chemistry, urea and</td>
</tr>
<tr>
<td></td>
<td>electrolytes, plasma amino acids(^a)</td>
</tr>
<tr>
<td></td>
<td>Creatine kinase, blood lactate, VLCFA (very long chain fatty acids), ammonia,</td>
</tr>
<tr>
<td></td>
<td>blood gases, white cell (lysosomal) enzymes, urine amino and organic acids,</td>
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<tr>
<td></td>
<td>urine mucopolysaccharide (GAG) and oligosaccharide screen, urine reducing</td>
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<tr>
<td></td>
<td>substances, lead levels, urate, ferritin, biotinidase</td>
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<tr>
<td></td>
<td>Maternal amino acids for raised phenylalanine</td>
</tr>
<tr>
<td><strong>Infection</strong></td>
<td>Congenital infection screen</td>
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<tr>
<td><strong>Imaging</strong></td>
<td>Cranial ultrasound in newborn</td>
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<td></td>
<td>CT and MRI brain scans</td>
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<tr>
<td></td>
<td>Skeletal survey, bone age</td>
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<tr>
<td><strong>Neurophysiology</strong></td>
<td>EEG (for seizures and can be specific for some progressive neurological</td>
</tr>
<tr>
<td></td>
<td>disorders and syndromes</td>
</tr>
<tr>
<td></td>
<td>Nerve conduction studies, EMG, VEP (visual evoked potentials), ERG (electroretinogram)</td>
</tr>
<tr>
<td>**Histopathology/</td>
<td>Nerve and muscle biopsy</td>
</tr>
<tr>
<td>histochemistry**</td>
<td></td>
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<tr>
<td><strong>Other</strong></td>
<td>Hearing(^a)</td>
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<tr>
<td></td>
<td>Vision(^a)</td>
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<td></td>
<td>Clinical genetics</td>
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<tr>
<td></td>
<td>Cognitive assessment</td>
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<tr>
<td></td>
<td>Therapy assessment – physiotherapy, occupational therapy and speech and</td>
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<tr>
<td></td>
<td>language therapy</td>
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<td></td>
<td>Child psychiatry</td>
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<tr>
<td></td>
<td>Dietician</td>
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<td></td>
<td>Nursery/school reports</td>
</tr>
</tbody>
</table>

\(^a\)Basic screening tests.
Developmental examination for the Short Case examination

It is important when assessing development to make comments under the four main headings (see above).

Inspect
Look for clues. Remember the families will have come equipped for the day. Look for feeding equipment, nappy bag, the toys they have brought. Is the child well? Does the child look dysmorphic? Are there any obvious neurological abnormalities?

Assessment
Pitch in at around the age you think the child is, i.e. if they look around 18 months do not start asking them to copy circles, etc.

Assess each of the four developmental categories. Once you have demonstrated they can do one level push up to the next level until they are not able to perform the task.
For example: if you have demonstrated the child can copy a square do not ask them to copy a circle as you have already demonstrated the child is past this level, instead see if they can copy a triangle.

Keep control of the situation. If the child is playing already, WATCH. You may be able to complete the whole assessment by observation alone.

If the child is already sitting use the opportunity to assess language, social and fine motor development. Do not disrupt the child to do gross-motor tests - you may well have difficulty settling him again and in the older child gross motor gives you the least additional information. Leave it to the end.

Use the parents if the child is shy or apprehensive, e.g. ask the parents to draw a circle for the child to copy or test the child about colours, numbers; stories, etc.

If the child does not co-operate do not panic. You can still get clues from observing. Remember stranger awareness and non-compliance are developmental milestones in themselves.
**Presentation**

Summarize any relevant clinical findings, e.g. this girl looks ill, has a drip in, a Hickman line, etc, which may be affecting your assessment. If the child looks dysmorphic then say so.

This child has a developmental age of X because:
- Gross motor - I have demonstrated that they can do this but not that
- Fine motor - I have demonstrated, etc

'Demonstrated' is better than 'can' or 'cannot'. It means that the parents cannot correct you by saying 'yes he can! Remember you are only assessing the child over a few minutes.

If you have a developmental discrepancy between the four areas then present this, e.g. this child has a developmental age of 4 in gross- and fine-motor skills but a developmental level

Child Development level of 2 years in speech and language and social skills.

Follow this by saying what you would like to do next, e.g. I would like to formally test his hearing to exclude a hearing problem.

**Children likely to be seen**

- Dysmorphic, e.g. Down syndrome. Just keep to the same format and in each of the four sections demonstrate what they can and cannot do to determine their developmental level
- Global developmental delay
- Gross-motor delay (cerebral palsy)
- Delay in specific areas
History

A good history is essential to help determine the cause and appropriate investigations. Information is required on prenatal history, perinatal history and postnatal development. Are there any associated symptoms such as seizures? General health is important when considering metabolic disorders. Family history may give the strongest clue to a chromosomal disorder. Enquire about previous pregnancy losses.

Examination

A thorough examination is essential. Neurodegenerative conditions affecting the grey matter tend to present with dementia and seizures. Conditions affecting the white matter tend to present with spasticity, cortical deafness and blindness.

Inspect for:
- **Sex of child** - X-linked conditions such as fragile X, Menkes, Hunter, Lesch-Nyhan syndromes
- **Age of the child:**
  - First 6 months - Tay-Sachs disease, Leigh disease, infantile spasms, tuberose sclerosis
  - Toddlers - infantile metachromatic leukodystrophy, mucopolysaccharidoses, infantile Gaucher, Krabbe disease
  - Older children - juvenile Batten disease, SSPE, Wilson disease, Huntington chorea
- **Dysmorphic features** - Down syndrome, mucopolysaccharidoses
- **Neurocutaneous signs** - ataxia telangiectasia, Sturge-Weber syndrome, incontinentia pigmenti, tuberose sclerosis
- **Extrapyramidal movements** - cerebral palsy, Wilson disease, Huntington chorea
- **Tremor** - Wilson disease, Friedreich's ataxia, metachromatic leukodystrophy
Note growth of child

- Large head - Alexander, Canavan, Tay-Sachs syndromes, mucopolysaccharidoses
- Small head - cerebral palsy, autosomal recessive microcephaly, Rubinstein-Taybi, Smith-Lemli-Opitz, Cornelia de Lange syndromes
- Growth pattern (e.g. faltering growth with metabolic disease, gigantism with Soto syndrome)

**Systematic examination**

- Eyes - corneal clouding, cataract, cherry-red spot, optic atrophy
- Neurological examination including gait, scoliosis, tremor, extrapyramidal movements, tone, power and reflexes of limbs
- Associated system involvement (e.g. cardiac abnormalities, organomegaly in metabolic disease)
- Genitalia
- Hearing and vision should be checked

Further assessment often involves input from other professionals of the child development team, e.g. speech and language therapists and physiotherapist.
**Investigations**
A thorough history and examination may lead to targeted investigations, e.g. a specific genetic test or metabolic test. For approximately 40% of cases no Cause is found. The two most useful investigations are genetic studies and brain imaging.

If no specific diagnosis is suggested then consider:

**Blood tests**
- Chromosomal analysis
- Thyroid function tests
- TORCH serology in infants (TORCH, toxoplasmosis, other (congenital syphilis and viruses), rubella, cytomegalovirus and herpes simplex virus)
- Plasma amino acids
- Ammonia
- Lactate
- White cell enzymes

**Urine tests**
- Urinary organic acids
- Urinary amino acids
- Urinary mucopolysaccharidoses
- Esrenti~l Revision Notes in rcledintrrics 69. the MKI-YCM 2nd Edition

**Brain imaging**
This will identify congenital brain abnormalities and diagnose degenerative conditions such as the leukodystrophies and grey matter abnormalities.

**EEG**
This will identify SSPE, Batten disease
Management

This is multidisciplinary. The precise make-up of the team depends on local resources. It can include:

- Community paediatrician
- Speech and language therapist
- Physiotherapist
- Occupational therapist
- Child psychologist/psychiatrist
- Play therapist
- Pre-school therapist, e.g. portage
- Nursery teachers
- Health visitors
- Social workers
ABNORMAL MOTOR DEVELOPMENT

This may present as delay in acquisition of motor milestones, e.g. head control, rolling, sitting, standing, walking or as problems with balance, an abnormal gait, asymmetry of hand use, involuntary movements or rarely loss of motor skills.

Concern about motor development usually presents between 6 months and 2 years of age when acquisition of motor skills is occurring most rapidly.

Examination may reveal underlying abnormal motor signs.

Causes of abnormal motor development include:

• cerebral palsy
• congenital myopathy/primary muscle disease
• spinal cord lesions, e.g. spina bifida
• global developmental delay as in many syndromes or of unidentified cause.

As hand dominance is not acquired until 1-2 years or later, asymmetry of motor skills during the first year of life is always abnormal and may suggest an underlying hemiplegia.

Late walking (>18 months old) may be caused by any of the above but also needs to be differentiated from children who display the locomotor variants of bottom-shuffling or commando crawling and needs to be differentiated from organic causes such as cerebral palsy.

Concern about abnormal motor development needs assessment by a neurodevelopmental pediatrician and physiotherapist.

Ongoing physiotherapy input and subsequent involvement of an occupational therapist is likely to be needed.
Cerebral palsy

It is an umbrella term which includes a heterogeneous group of conditions and can arise at any point during brain development.

Cerebral palsy is a disorder of movement and posture due to a nonprogressive lesion of motor pathways in the developing brain up to the age of 2 years.

After this age, it is more appropriate to use acquired brain injury as the diagnosis.

CP is defined by the Oxford Register of Early Childhood Impairments as permanent impairment of voluntary movement or posture presumed to be due to permanent damage to the immature brain.

Children with progressive disorders and those with profound hypotonia and no other neurological signs (often associated with severe intellectual delay) are excluded.

The motor disorders of CP are often accompanied by disturbances of cognition, communication, perception, sensation, behavior and seizure disorder and secondary musculoskeletal problems.

Although the lesion is non-progressive, the clinical manifestations emerge over time, reflecting the balance between normal and abnormal cerebral maturation.

Cerebral palsy is the most common cause of motor impairment in children, affecting about 2 per 1000 live births.
In addition to disorders of movement and posture, children with cerebral palsy often have other problems reflecting more widespread brain dysfunction.

These include:

•learning difficulties (about 60%)
•epilepsy (40%)
•squints (30%)
•visual impairment from errors of refraction and cortical damage (20%)
•hearing impairment (20%)
•speech and language disorders
•behavior disorders
•feeding problems
•joint contractures, hip subluxation, scoliosis.
Causes

About 80% of cerebral palsy is antenatal in origin due to vascular occlusion, structural maldevelopment or cortical migration disorders, genetic syndromes, and congenital infection.

Only about 10% of cases are thought to be due to hypoxic-ischaemic injury at birth and this proportion has remained relatively constant over the last decade.

About 10% are postnatal in origin due to:

- Preterm brain damage from periventricular leucomalacia (PVL) secondary to ischaemia and/or severe intraventricular haemorrhage. The rise in survival of extremely preterm infants has been accompanied by an increase in survivors with cerebral palsy, although the number of such children is relatively small.
- Meningitis/encephalitis/encephalopathy
- Head trauma from accidental or non-accidental injury
- Symptomatic hypoglycaemia
- Hydrocephalus
- Hyperbilirubinaemia.

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The timing of events causing cerebral palsy

- Conception: Chromosomal abnormalities
- Pregnancy: Fetal hypoxia-ischaemia, Fetal infection
- Labour: Intrapartum hypoxia-ischaemia
- Postnatal: Neonatal complications, Postneonatal trauma or infection

Cerebral palsy

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### Causes of cerebral palsy

#### Prenatal (80%)

<table>
<thead>
<tr>
<th>Genetic</th>
<th>Chromosome/DNA disorders, e.g. Down’s syndrome, fragile X syndrome, Cerebral dysgenesis, e.g. microcephaly, absent corpus callosum, hydrocephalus, neuronal migration disorder, vascular occlusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic</td>
<td>Hypothyroidism, phenylketonuria</td>
</tr>
<tr>
<td>Teratogenic</td>
<td>Alcohol and drug abuse</td>
</tr>
<tr>
<td>Congenital infection</td>
<td>Rubella, cytomegalovirus, toxoplasmosis</td>
</tr>
<tr>
<td>Neurocutaneous syndromes</td>
<td>Tuberous sclerosis, neurofibromatosis</td>
</tr>
</tbody>
</table>

#### Perinatal (10%)

| Extreme prematurity          | Intraventricular haemorrhage, periventricular leucomalacia                                                                                                                                              |
| Birth asphyxia               | Hypoxic-ischaemic encephalopathy (10%)                                                                                                                                                                 |
| Metabolic                    | Symptomatic hypoglycaemia, hyperbilirubinaemia                                                                                                                                                           |

#### Postnatal (10%)

| Infection                    | Meningitis, encephalitis                                                                                                                                                                               |
| Anoxia                       | Suffocation, near drowning, seizures                                                                                                                                                                   |
| Trauma                       | Head injury - accidental or non-accidental                                                                                                                                                              |
| Metabolic                    | Hypoglycaemia, inborn errors of metabolism                                                                                                                                                              |
Clinical presentation

Many children who develop cerebral palsy will have been identified as being at risk in the neonatal period.

Early features of cerebral palsy are:

- abnormal limb tone and/or trunk posture in infancy
- delayed motor milestones
- may be accompanied by slowing of head growth
- feeding difficulties with slow feeding and vomiting
- abnormal gait once walking is achieved
- asymmetric hand function before 12 months of age
- primitive reflexes may persist and become obligatory

There are three main clinical types of cerebral palsy, each reflecting dysfunction of a specific motor pathway, namely

- spastic (70%)
- ataxic hypotonic (10%)
- dyskinetic (10%).
- There may also be a mixed pattern (10%).

Spastic cerebral palsy - Pyramidal - (70%)

In this type, there is damage to the upper motor neuron (pyramidal or corticospinal tract) pathway.

Limb tone is increased (spasticity) with associated brisk deep tendon reflexes and extensor plantar responses.

The increased limb tone may suddenly under pressure in a 'clasp knife' fashion.

Spasticity tends to present early and may even be seen in the neonatal period. Sometimes there is initial hypotonia, particularly of the head and trunk.

There are three main types of spastic cerebral palsy:

- Hemiplegia
- Quadriplegia
- Diplegia
**Hemiplegia (25% of all cases of CP)**

Unilateral involvement of the arm and leg, the arm is usually affected more than the leg, with the face spared.

Affected children often present at 4-12 months of age with

- initially affected limbs may be flaccid and hypotonic
- fisting of the affected hand
- flexed arm
- pronated forearm
- asymmetric hand function.

Subsequently a tiptoe walk (toe-heel gait) become evident.

The past medical history is usually normal, with an unremarkable birth history with no evidence of hypoxic-ischaemic encephalopathy.

The cause is usually neonatal stroke as an infarction within the distribution of the middle cerebral artery.
CS aspect of middle cerebral artery infarction
left parietal-temporal-frontal porencephalic lesion
Diplegia

All four limbs, but the legs are affected to a much greater degree than the arms, so that hand function may appear to be relatively normal.

Walking is abnormal with difficulty in putting the heel to the ground; the outward flinging and stiffness of one leg with adduction, elbow flexion and limited swinging of the arm on the same side.

Recent magnetic resonance studies show that the underlying lesion in most cases of spastic diplegia is periventricular leucomalacia in prematurity (damage to white matter)
MRI periventricular leukomalacia

- ventricular expansion
- reducing the depth of periventricular white matter, mostly posteriorly.
- delay of myelination
- periventricular T2 hyperintense signal /hypointense signal T1

Magnetic resonance image (MRI) of a 1-year-old boy who was born at gestational week 27, examination was consistent with **spastic diplegic cerebral palsy with periventricular leukomalacia seen as**

- decreased volume of the white matter posteriorly
- Evidence of diffuse polymicrogyria
- thinning of the corpus callosum.

Cerebral CT Scan aspect of periventricular leukomalacia:

ventricular dilatation reducing the depth of peri-ventricular white substance, mostly posterior, with deepening the sulcuses and gyri.
Quadriplegia

All four limbs are affected, often severely, the arms may be affected more than the legs but trunk also involved with extensor posturing and poor head control and low central tone.

Pt will show scissoring legs due to over adduction of hip with pronated forearm and bilateral fisted hand.

often associated with seizures, microcephaly and moderate or severe MR.

The clinical correlate is the later development of dyskinetic cerebral palsy, often with relatively preserved cognitive function.

May have been a history of perinatal asphyxia (HIE) about 10% of all cases or brain injury in late third trimester a consequence of antepartum haemorrhage
cord prolapse
uterine rupture

With bilateral cerebral hemisphere infarction, sometimes with extensive cyst formation (multicystic encephalomalacia) may lead to damage in the basal ganglia and thalami – extrapyrimedial (mixed CP), which may be confirmed on MR scanning.
16-month-old boy who was born at term but had an anoxic event at delivery. Examination findings were consistent with a spastic quadriplegic cerebral palsy with asymmetry (more prominent right-sided deficits).

**Magnetic resonance image (MRI) show** Cystic encephalomalacia in the left temporal and parietal regions, delayed myelination, decreased white matter volume, enlarged ventricles can be seen in this image. These findings are most likely the sequelae of a neonatal insult (eg, periventricular leukomalacia with a superimposed left-sided cerebral infarct).

9-day-old girl who was born at full term and had a perinatal hypoxic-ischemic event. Examination of the patient at 1 year revealed findings consistent with a mixed quadriparetic cerebral palsy notable for dystonia and spasticity.

**MRI show**

Severe hypoxic-ischemic injury to the medial aspect of the cerebellar hemispheres, medial temporal lobes, bilateral thalami, and bilateral corona radiata.
Ataxic - hypotonic cerebral palsy (10%)

Is mainly of prenatal origin.

There may be strong familial patterns, with modes of inheritance as

- autosomal dominant
- X-linked
- autosomal recessive.
- Sporadic cases are also seen.

Congenital abnormalities of cerebellar area

Genetic causes

Metabolic disorders

Signs are relatively symmetrical with early

poor balance
trunk and limb hypotonia
delayed motor development.

later complain that reflecting dysfunction in the cerebellum or its connections:

- incoordinate movements
- ataxic gait
- intention tremor
- dyskinesia

Some may achieve independent walking by 4–6 years, although in these cases handwriting remains problematic and About 30% show normal or borderline intellectual function.

in more severe cases, learning difficulties and seizures may complicate the presentation.
A magnetic resonance study of ataxic CP showed that

- over 50% were unclassifiable
- 23% were genetic
- only 4% (3 cases) may have had a perinatal cause

porencephalic lesion in cerebellum in an ataxic CP patient
Dyskinetic -Extrapyramidal (nonspastic or dyskinetic) CP (10%)

There is dyskinesia (fluctuating tone) leading to frequent involuntary movements (generally of all four limbs) more evident with movement or stress.

These involuntary movements may be:

• **chorea** - irregular, sudden and brief non-repetitive jerky movements
• **dystonia** - writhing movement due to simultaneous and sustained contraction of agonist and antagonist muscles of the trunk or proximal limbs
• **athetosis** writhing movement due to simultaneous and sustained contraction of agonist and antagonist muscles of distal parts of the limb

Intellect may be relatively unimpaired.

Affected children often present in infancy with

Floppiness
poor trunk control
delayed motor development
abnormal movements sometimes not appearing before 1 year of age.

The signs are due to damage to the basal ganglia or their associated pathways (extrapyramidal).

In the past, hyperbilirubinaemia due to rhesus disease of the newborn was a common cause but prevention and improved management of rhesus isoimmunization have resulted in a dramatic fall in the number of cases.
FLAIR hyperintense signal bially laterally in thalamus, in an extrapiramidal CP.

In preterm newborn there are shown signs of periventricular leukomalacia associated with thalamic and basal ganglia lesions.

Kernicterus is shown as hyperintense signal T2 bilateral in posterior-medial region of globus pallidus; sometimes, they may not be visible.
Diagnosis

made by clinical examination, with particular attention to assessment of the pattern of tone in the limbs and trunk, posture, hand function and gait there is no specific test, **MRI brain scans** may assist in identifying the cause of the cerebral palsy but is not necessary to make the diagnosis

**Haematological problems** due to thrombophilia or clotting disorders should be excluded in neonatal stroke (Hemiplegia spastic CP)

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**Table 4.4 Gross Motor Function Classification System (GMFCS)**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Walks without limitations</td>
</tr>
<tr>
<td>II</td>
<td>Walks with limitations</td>
</tr>
<tr>
<td>III</td>
<td>Walks using a handheld mobility device</td>
</tr>
<tr>
<td>IV</td>
<td>Self-mobility with limitations; may use powered mobility</td>
</tr>
<tr>
<td>V</td>
<td>Transported in a manual wheelchair</td>
</tr>
</tbody>
</table>
Laboratory studies

The diagnosis of cerebral palsy is generally made based on the clinical picture.

There are no definitive laboratory studies for diagnosing the condition, only studies, including the following, to rule out other symptom causes:

**Thyroid function studies**: Abnormal thyroid function may be related to abnormalities in muscle tone or deep tendon reflexes or to movement disorders

**Lactate and pyruvate levels**: Abnormalities may indicate an abnormality of energy metabolism (ie, mitochondrial cytopathy)

**Ammonia levels**: Elevated ammonia levels may indicate liver dysfunction or urea cycle defect

**Organic and amino acids**: Serum quantitative amino acid and urine quantitative organic acid values may reveal inherited metabolic disorders

**Chromosomal analysis**: Chromosomal analysis, including karyotype analysis and specific DNA testing, may be indicated to rule out a genetic syndrome, if dysmorphic features or abnormalities of various organ systems are present

**Cerebrospinal protein**: levels may assist in determining asphyxia in the neonatal period; protein levels can be elevated, as can the lactate-to-pyruvate ratio

Imaging studies

Cranial imaging studies to help evaluate brain damage and identify persons who are at risk for cerebral palsy include the following:

**Cranial ultrasonography**: Can be performed in the early neonatal period to delineate clear-cut structural abnormalities and show evidence of hemorrhage or hypoxic-ischemic injury

In severe cases, a cranial ultrasound may be performed one week after deliver for IVH, and again at 4 and 8 weeks of delivery if PVL is suspected.

The cranial ultrasound may also be used to rule out other conditions such as infections in and around the brain (encephalitis or meningitis), evaluate large or increasing head size, or screen for a build-up of excess cerebrospinal fluid in the brain at birth (congenital hydrocephalus).
**Computed tomography scanning of the brain:** In infants, helps to identify congenital malformations, intracranial hemorrhage, and periventricular leukomalacia or early craniosynostosis.

**Magnetic resonance imaging of the brain:** The diagnostic neuroimaging study of choice because this modality defines cortical and white matter structures and abnormalities more clearly than does any other method; is thought to define brain structure and abnormality more accurately than CT Scans or ultrasound also allows for the determination of whether appropriate myelination is present for a given age.

**Other**

Additional studies in cerebral palsy can include the following:

**Electroencephalography:** Important in the diagnosis of seizure disorders

**Electromyography and nerve conduction studies:** Helpful when a muscle or nerve disorder is suspected
What questions would you ask to elucidate a cause?

An underlying cause may not be apparent, but the following should be considered in history-taking:

**Prenatal:** - (mainly Ataxic CP)

- familial
- Genetic
- Infection (e.g. CMV, rubella, chorioamnionitis)
- Toxins (e.g. drugs, alcohol)
- placental insufficiency

**Perinatal:**

- Prematurity (mainly diplegic CP)
  - intraventricular haemorrhage
  - periventricular haemorrhage
  - periventricular leucomalacia
- Infection (e.g. meningitis)
- Toxins (e.g. hyperbilirubinaemia -mainly dyskinetic CP)
- Symptomatic hypoglycaemia
- Perinatal asphyxia (mainly Quadriplegia CP)
• **Postnatal:**
  
  – Infection (Meningitis, encephalitis)
  
  – Vascular accidents
  
  – Head injury (accidental or non-accidental)
  
  – Encephalopathy
  
  – drowning and anoxic event.

**Family history** mainly Ataxic CP

• for cosangulity

• affect sibilants

**Physical examination**

• syndromic or coarse face

• small or large head

• skin rash or organomegaly

• special odour

• assessment tone in the limbs and trunk, posture, hand function and gait
If history and examination Findings Suggest Diagnosis of CP (non-progressive
disorder of motor control)

1. Confirm that the history does not suggest a progressive or degenerative
central nervous system disorder.
2. Assure that features suggestive of progressive or degenerative disease are
not present on examination.
3. Classify the type (quadriplegia, hemiplegia, diplegia, ataxic, dyskinetic).
For the most part this classification system is one of convenience, i.e., easy
communication.
It does not necessarily relate to prognosis or to what treatments are
indicated.
4. Screen for associated conditions including:
   • Developmental delay/mental retardation
   • Feeding/swallowing dysfunction
   • Ophthalmologic/hearing impairments
   • If history of suspected seizures, obtain an EEG
   • Speech and language delay
Finally did the child have previous neuroimaging or other laboratory studies?
(e.g., in neonatal period) that determined the etiology of CP?

If YES no need for further diagnostic testing

If No obtain neuroimaging study (MRI preferred to CT)

If normal MRI
Consider metabolic or genetic testing if upon follow-up the child has:
   • Evidence of deterioration or episodes of metabolic decompensation
   • No etiology determined by medical evaluation
   • Family history of childhood neurologic disorder associated with CP

If abnormal MRI
Determine if neuroimaging abnormalities in combination with history and
examination establishes a specific etiology of CP.
If developmental malformation is present, consider genetic evaluation.
If previous stroke, consider evaluation for coagulopathy
## EVIDENCE FOR DIAGNOSTIC ASSESSMENT FOR CHILDREN WITH CP

### Neuroimaging (MRI and CT)

<table>
<thead>
<tr>
<th>Strong evidence supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Neuroimaging is recommended in the evaluation of a child with CP if the etiology has not been established, for example by perinatal imaging (Level A*, Class** I and II evidence).</td>
</tr>
<tr>
<td>• MRI, when available, is preferred to CT scanning because of the higher yield of suggesting an etiology and timing of insult leading to CP (Level A, Class I-III evidence).</td>
</tr>
</tbody>
</table>

### Metabolic and genetic testing

<table>
<thead>
<tr>
<th>Good evidence supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic and genetic studies need not be routinely obtained in the evaluation of the child with CP (Level B, Class II and III evidence).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coagulopathies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Because the incidence of unexplained cerebral infarction seen with neuroimaging is high in children with hemiplegic CP, diagnostic testing for a coagulation disorder should be considered (Level B, Class II-III evidence). There is insufficient evidence to be precise as to what studies should be ordered.</td>
</tr>
</tbody>
</table>

### Metabolic and genetic testing

<table>
<thead>
<tr>
<th>Weak evidence supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>• If the clinical history or findings on neuroimaging do not determine a specific structural abnormality or if there are additional and atypical features in the history or clinical examination, metabolic and genetic testing should be considered (Level C, Class III and IV).</td>
</tr>
<tr>
<td>• Detection of a brain malformation in a child with CP warrants consideration of an underlying genetic or metabolic etiology (Level C, Class III and IV evidence).</td>
</tr>
</tbody>
</table>

## EVIDENCE FOR EVALUATION OF ASSOCIATED CONDITIONS FOR CHILDREN WITH CP

### EEG for Epilepsy

<table>
<thead>
<tr>
<th>Strong evidence supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>• An EEG should not be obtained for the purpose of determining the etiology of CP (Level A; Class I and II evidence).</td>
</tr>
<tr>
<td>• An EEG should be obtained when a child with CP has a history or examination features suggesting the presence of epilepsy or an epileptic syndrome (Level A; Class I and II evidence).</td>
</tr>
</tbody>
</table>

### Screening for mental retardation, ophthalmologic impairments, speech and language disorders

<table>
<thead>
<tr>
<th>Strong evidence supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Because of the high incidence of associated conditions, children with CP should be screened for mental retardation, ophthalmologic and hearing impairments, and speech and language disorders (Level A, Class I and II evidence). Nutrition, growth, and swallowing should be monitored. Further specific evaluations are warranted if screening suggests areas of impairment.</td>
</tr>
</tbody>
</table>
Q2. What are the possible diagnoses?

One likely cause for this history is CP and this is confirmed by abnormal physical signs.

A familial delay should also be considered, as well as rarer causes such as Duchenne muscular dystrophy in boys.

It is important to remember that everything that looks like CP may not be. Many infants with complex congenital abnormalities (dysmorphic syndromes) will display central motor impairment.

These children will require similar services.
Differential Diagnosis of CP

SPASTICITY

- Familial Spastic paraparesis
- Intrauterine drug withdrawal
- Transient dystonia of prematurity
- Tethered cord Severe
- Congenital tightness of heel cords
- Toe walkers (Autism, Use of walkers)
- Rule out neuro-degenerative diseases (Primary and Metabolic)

Worster- Drought Syndrome

- Pseudo-bulbar form of Cerebral palsy
- MRI may be normal
- If MRI shows polymicrogyria of the perisylvian fissures; then it is “Congenital
- Bilateral Perisylvian Syndrome”
- Severe feeding and swallowing
- difficulties with excessive drooling
- Speech disorders
- May develop seizures
- Abnormal shape to jaw and tooth malalignment
- Mild spasticity of extremities
- Congenital foot abnormalities
- Ambulation is clumsy
- Learning problems are common

Differential Diagnosis of CP ATHETOSIS / ATAXIA

- Metabolic disorders e.g Glutaric aciduria
- Dopamine responsive dystonia
- Chromosomal disorders e.g Angleman's
- Rett Syndrome
- Intracranial lesions
Q3. **What are the principles of management?**

This depends upon the stage of the disorder.

Different approaches to treatment have, from time to time, attracted considerable interest and enthusiasm, as well as opposition.

Only recently have attempts been made to study the relative merits of each in objective ways.

No single approach will suit all children with a particular form of CP.

In most centres in the UK staff follow an eclectic approach, deriving therapeutic ideas from a variety of ‘methods’.

No study has convincingly shown benefits of one approach over another.

Management involves regular assessment of the child (with parent/carer involvement) and close multidisciplinary working.
Management

Multidisciplinary child development services

Although children with a wide range of conditions have additional needs, the term 'special needs' is usually used for children with developmental problems and disabilities.

In order to optimise their assessment and care on an ongoing basis, child development services have been developed nationally on a geographic area as a secondary care service.

A child developmental service (CDS):

multidisciplinary with predominantly health professionals (pediatrician, physiotherapist, occupational therapist, speech and language therapist, clinical psychologist, specialist health visitor, dietician) in the team but often also includes a social worker

is multi-agency and may include health, social services, education, volunteers, voluntary agencies, parent support groups

aims to provide a coordinated service with good interagency liaison to meet the functional needs of the child predominantly sees preschool children with moderate or severe difficulties but may have resources to support children with milder problems it may provide multidisciplinary support and monitor children up to school-leaving age (16-19 years)

maintains a register of children with disabilities and special needs (this may be held by Social Services, but there is an increasing trend to single multi-agency Special Needs registers)

is community or hospital based but has emphasis on children's needs within the community (home, nursery, school), regardless of its location

often has a nominated key worker for a child, to facilitate parents getting access to information and services their child may need.
Emphasis is on:

• diagnosis
• assessment of functional skills
• provision of therapy
• regular review
• a coordinated approach to care (multidisciplinary, multi-agency)

Functional skills kept under review include:

• mobility
• hand function
• vision
• hearing
• speech, language and communication including social/communication skills
• behavior, social and emotional skills
• self help skills including continence learning.

Many children with special needs have medical problems which require investigation, treatment and review.

Good inter-professional communication is vital for well-coordinated care.

This will be assisted by all professionals keeping entries in the child's Personal Child Health Record up-to-date.
In addition to locally organised child development services, **specialist neurodisability services** are required for:

- rehabilitation following acquired brain injury
- surgery for cerebral palsy, scoliosis
- gait analysis
- spasticity management including botulinum toxin
- epilepsy unresponsive to two or more anticonvulsants or where there is severe cognitive and behavioural regression related to epilepsy
- complex communication disorders, diagnosis and therapeutic intervention
- mixed complex learning problems, often with neuropsychiatric co-morbid symptoms
- provision of communication aids sensory impairments, e.g. cochlear implants
- services for severe visual and hearing impairment
- specialised seating/wheelchairs and orthoses
- management of movement disorders, e.g. intrathecal baclofen.

Needs are likely to change over time with key stages being at transition to school and adult services.

A care plan should be developed at each stage and needs to be shared with the child and family and then regularly reviewed.

Involvement with specialist services may be of variable frequency throughout childhood.

Collaboration across services is vital in promoting a service tailored around the child and family.
a) A standing frame assisting a boy with cerebral palsy to be upright. (b) A boy with athetoid cerebral palsy is able to walk with the help of a frame. (c) A 6-year-old boy with four-limb spasticity is able to steer this electric wheelchair.
Summary of the common medical conditions and the many health professionals in the child development service involved in the care of children with developmental problems
Key professionals

• The physiotherapist is responsible for development of motor skills, assessment for lower limb orthoses, and specialized supportive equipment, such as standers and mobility aids.

In the early stages physiotherapy is aimed at interrupting the circle of malachievement caused by abnormal muscle tone.

The child’s carers are shown methods of handling and carrying out every day tasks that help this.

• The speech and language therapist plays these key roles in CP:
  – Most importantly, helping with feeding early in life
  – Helping early communication development
  – Help with speech, which may be severely impaired
  – Management of dribbling
  – Provision of communication aids.

• The occupational therapist will assess the need for equipment to facilitate aspects of daily living, e.g. bathing, toileting, static seating, feeding etc., and fine motor skill function, perceptual skills and the use of upper limb orthoses. Adaptations may also be required in the home.
**Specialized equipment**

- **Orthoses.** The purpose of an orthosis is to restore the normal distribution of forces acting through the limb, thereby normalizing musculoskeletal relationships and establishing a normal pattern of motion and/or prevention of progressive deformity.

Hence children with a persistently equinus foot may wear an ankle orthosis. Other orthoses facilitate hand function.

Some children experience upper limb spasticity at night; a night resting splint will hold the hand in a neutral position in children, thus optimizing functional use during the day.

- **Special seating, standing and lying frames.**

These are used to try to maintain good posture and to give the child optimal positioning and support for feeding and play.

- **Supportive bracing.**

This may be needed in some quadriplegic patients to prevent progression of spinal deformity.

**Specific drug treatment**

**Drugs are now being used more widely in CP:**

- **Botulinum toxin A (BT A).**

This works by chemically denervating the muscle, allowing it to relax, which may enable improved gait or easier care, for example.

Relaxation of the muscle may also enable it to grow better by allowing stretching and thereby reducing contractures.

The duration of effect is usually **10–14 weeks**, and measurable effects may persist for up to 26 weeks.
• Baclofen.

This analogue of gamma-aminobutyric acid (GABA) impedes excitatory neurotransmission at a spinal level.

Oral baclofen is rapidly absorbed, but is protein-bound and has poor penetration into CSF because of poor lipid solubility.

The half life is 3–4 hours, requiring regular dosing (3 times daily).

Response to oral baclofen is unpredictable; a number of children will show a satisfactory response, with reduction in muscle tone, but others will develop unacceptable side-effects, including somnolence, confusion, difficulties with oral control, ataxia and increased frequency of micturition.

Recently, baclofen by continuous infusion has been given by an intrathecal catheter and pump delivery system to achieve higher and continuous CSF baclofen levels.

Baclofen is perhaps most useful when there is generalized increase in tone, which would require multiple injections of botulinum toxin, e.g. in the child with severe spastic tetraplegia.
Surgery

The orthopaedic surgeon has a major role to play in management of CP. Orthopaedic surgery may be indicated to improve function, to prevent deterioration, to relieve pain and to facilitate care.

There are two surgical aspects to the management of CP:

- **Selective posterior rhizotomy.**

  Two groups of patients are most suitable: children who are of good intelligence, well motivated and sufficiently strong to achieve walking after spasticity is reduced, and severely affected, non-ambulant patients in whom painful spasm can be reduced.

- **Single event multilevel surgery with associated gait analysis.**

  When fixed contracture of muscles occurs, surgical release has been required to correct the deformity.

  The traditional approach has been to undertake soft tissue surgery in a ‘phased’ manner, dealing with one area at a time.

  Recently it has become clear that this approach of repeated operations, often on a yearly basis, frequently does not improve long-term function.

  As a result, techniques of thorough pre- and postoperative assessment have been developed, in particular gait analysis.

  The latter has led to a better understanding of normal gait in children and hence the abnormal gait of the child with CP.

  Detailed surgical planning is based upon objective rather than subjective information.

  Gait analysis also allows proper objective review after surgery.
Associated problems

Difficulty may arise from motor problems:

• Feeding difficulties.

Feeding may be a considerable problem, leading to inadequate quantity and quality of intake.

Children with spastic quadriplegia or athetoid CP may have such severe feeding difficulties that they fail to thrive.

Recurrent aspiration during feeding may lead to serious chest complications, and children with severe CP commonly suffer from significant gastro-oesophageal reflux (up to 70% having oesophagitis).

It is important to address positioning and consistency of food, and to consider the need for gastrostomy feeding.

A multidisciplinary approach is essential for significant feeding problems and many places will have a ‘feeding clinic’.

• Drooling.

This is associated with speech and feeding problems and can be a significant cosmetic handicap, as well as being very messy and affecting the skin around the mouth and neck.

It is usually due to a problem with swallowing saliva rather than excessive production.

Techniques used to help it are:

– Prompting and rewards for swallowing

– Positioning and exercises to improve oromotor function and sensory awareness, now sometimes aided by intra-oral training appliances

– Medication with anticholinergics to reduce secretions

– Surgery to direct the ducts further towards the back of the mouth

– Occasionally, removal of salivary glands

– Intraglandular botulinum toxin injections.
• **Dislocated hips.**

These are an important complication in CP and routine screening by X-ray is needed.

Good postural management will help to prevent dislocation.

• **Bowel and bladder problems.**

Incontinence may result from learning difficulties, but may be a problem of not being able to get to the toilet in time or undress quickly enough.

Constipation is common, particularly in the immobile child and those with restricted diets.

It may also be associated with abnormal gut sensitivity and motility.

It is important to try to prevent problems by explaining to the parents and child about normal bowel function and giving dietary advice.

If constipation occurs, the earlier it is treated, the better.

• **Osteopenia.**

The increased risk of bone fractures in children with motor disabilities is linked to reduced bone density.

Measures such as weightbearing, particularly ambulation, good nutrition (especially calcium, vitamin D and magnesium) and sunlight will help.
Other associated problems include:

- **Vision problems.**
  These are common (50%), particularly myopia, cortical visual impairment and squint.

- **Hearing problems.**
  These occur in 20–30%, particularly sensorineural deafness. It is also important to look for conductive problems.

- **Learning disabilities.**
  These are found in all types of CP. Generalized learning difficulties tend to be related to severity of physical problems; however, not all children with severe motor problems have learning difficulties and children with relatively mild motor problems may have significant learning difficulties.

- **Specific learning difficulties.**
  These are also seen more frequently in CP and can easily be overlooked. Assessment can be very difficult if there are severe motor problems.
• **Epilepsy.**

Around 21% of children with CP develop epilepsy, which may be difficult to control.

• **Psychological problems.**

These may be due to physical difficulties, or children may have problems directly related to the underlying brain disorder.

• **Educational issues.**

Most children will go to mainstream school and need a minimum of help.

Some adaptations may be necessary, e.g. ramps, handrails, lifts, special toilet facilities and adapted working surfaces in the classroom.
Abnormalities of vision

Visual impairment may present in infancy with:

- loss of red reflex from a cataract
- a white reflex in the pupil, which may be due to retinoblastoma, cataract or retinopathy of prematurity (ROP).
- not smiling responsively by 6 weeks post-term
- lack of eye contact with parents
- visual inattention
- random eye movements
- nystagmus
- squint
- photophobia
Causes of visual impairment in childhood

Cataract
Glaucoma
Optic nerve
- teber's optic atrophy
- Septo-optic dysplasia
- Raised intracranial pressure, e.g. hydrocephalus
Retinal
- Retinopathy of prematurity
- Hereditary Leber's amaurosis
- Retinoblastoma
Amblyopia as a result of squint, refractive error, ptosis

Causes of visual impairment

<table>
<thead>
<tr>
<th>Genetic</th>
<th>Antenatal and perinatal</th>
<th>Postnatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>Congenital infection</td>
<td>Trauma</td>
</tr>
<tr>
<td>Albinism</td>
<td>Retinopathy of prematurity</td>
<td>Infection</td>
</tr>
<tr>
<td>Retinal dystrophy</td>
<td>Hypoxic-ischaemic encephalopathy</td>
<td>Juvenile idiopathic arthritis</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>Cerebral abnormality/damage</td>
<td></td>
</tr>
<tr>
<td>Glaucoma</td>
<td>Optic nerve hypoplasia</td>
<td></td>
</tr>
</tbody>
</table>
Severe visual impairment

This affects 1 in 1000 live births in the UK but is higher in developing countries.

A family history of severe visual impairment, developmental delay or extreme prematurity places the infant at an increased risk.

In developed countries, about 50% of severe visual impairment is genetic; in developing countries acquired causes such as infection are more prevalent. When visual impairment is of cortical origin, resulting from cerebral damage, examination of the eye, including the pupillary responses, may be normal.

Although few causes of severe visual impairment can be cured, early detection is important as certain elements may require treatment and much can be done to help the child and parents.

Parents of a partially sighted or severely visually impaired child need appropriate advice on how to provide non-visual stimulation using speech and touch, on providing a safe home environment and on how to build the child's confidence. In the UK this is usually provided by peripatetic teachers for children with visual impairment.

The teachers provide input at both preschool and school ages. Partially sighted children may be able to attend a mainstream school but require special assistance with low vision aids, which include filtered lenses, high-powered magnifiers and small telescopic devices and computers.

Severely visually impaired children may need special schooling. Some will need to be taught Braille to enable them to read. While many severely visually impaired children have a visual disability alone, at least half have additional neurodevelopmental problems.
Childhood Amaurosis (Blindness):
Principal Neurologic Considerations

Congenital Malformations
- Optic nerve hypoplasia
- Congenital hydrocephalus
- Micrencephaly
- Encephalocele, (occipital type)

Phakomatoses
- Tuberous sclerosis
- Neurofibromatosis (optic glioma)
- Sturge-Weber syndrome
- von Hippel-Lindau disease

Tumors
- Retinoblastoma
- Optic glioma
- Perioptic meningioma
- Craniopharyngioma
- Cerebral glioma

Neurodegenerative Diseases (Cerebral storage disease)
- Tay-Sachs disease
- Sandhoff

Mucopolysaccharidoses,
- Hurler and Hunter syndrome
- metachromatic leukodystrophy
- Canavan disease
- Leigh disease,
- Refsum disease=

Infectious Processes
- Toxoplasma gondii,
- Cytomegalovirus
- rubella virus
- T pallidum
- Meningitis;
- arachnoiditis
- Optic neuritis
- Chorioretinitis

Hematologic Disorders
- Leukemia with CNS involvement

Vascular and Circulatory Disorders
- Collagen-vascular diseases
- AVM:
  - intracerebral hemorrhage,
  - subarachnoid hemorrhage

Trauma
- Contusion or avulsion of optic nerves or chiasm
- Cerebral contusion or laceration
- Intracerebral, subarachnoid, or subdural hemorrhage

Drugs and Toxins
Causes of Monocular Visual Loss

- Refractive error
- Corneal disease
- Open-angle glaucoma
- Central retinal occlusion
- Vitreous hemorrhage
- Amaurosis fugax
- Migraine
- Diffuse retinopathy
- Endophthalmitis

Cataract
Iritis
Angle-closure
Retinal detachment
Transient migraine
Optic neuropathy
Papilledema (chronic)

glaucoma
Congenital cataracts
Causes of nystagmus and poor Vision

- **Opacities of the Media**
  - Bilateral corneal opacities  Bilateral cataracts

- **Retinal Disorders**
  - *Ophthalmoscopically visible*
    - Optic nerve
      - Optic atrophy
      - Developmental anomalies
      - Hypoplasia
      - Coloboma
  - Macular disease
    - Infections:
      - “coloboma”
    - Developmental
    - Hypoplasia
    - Traction
  - Rare bilateral association
    - retinal dysplasia
    - posterior PHPV
  - *Ophthalmoscopically variable*
    - Achromatopsia
    - Leber congenital amaurosis
    - Congenital night blindness X-linked with myopia

- **Systemic Diseases**
  - Neurologic disorders (e.g., hydrocephalus)
  - Metabolic disorders (e.g., Lowe syndrome)
  - Chromosomal abnormalities (e.g., Down syndrome)  Somatic malfunctions (e.g., de Lange syndrome)

- **Disturbances of Higher Centers, Cause Unknown**
  - Congenital
  - nystagmus
  - Latent nystagmus
  - Occlusion nystagmus
Squint (strabismus)

Squints are common, occurring in approximately 4% of children. There is a strong familial incidence.

A squint is usually noticed by the parents first and parental report of squint should be taken seriously because are often intermittent.

Newborn babies often give the appearance of having a squint.

In older infants and young children, marked epicanthic folds may cause confusion (pseudo-squint).

Any infant with a squint persisting beyond 2 months of age should be referred for a specialist ophthalmological opinion.

A squint is a misalignment of the visual axis of one eye usually caused by failure to develop binocular vision due to refractive errors, but cataracts, retinoblastoma and other intraocular causes must be excluded.

It is either:
• Latent - i.e. only there at certain times (such as fatigue, illness, stress)
• Manifest - i.e. present all the time

It is either:
• Alternating - the patient uses either eye for fixation while the other eye deviates. As each eye is being used in turn, vision develops more or less equally in both
• Monocular - only one eye is used for fixation and the other eye consistently deviates.

The child is more prone to develop amblyopia as the deviated eye is consistently not being used

It is either:
• Convergent - i.e. turns in
• Divergent - i.e. turns out
It is commonly divided into:
• Non-paralytic
• Paralytic

**Concomitant (non-paralytic, common) (congenital)**
'This is the more common type of squint and includes the majority of the congenital and infantile accommodative convergent squints.
This type of deviation most commonly occurs around 18 months to 2 years of age.
The child is also usually long-sighted that correct with glasses for the long-sightedness but may require surgery.
These squints are particularly common in children with neurodevelopmental delay.
In a few cases a non-paralytic squint is the result of an underlying ocular or visual defect, e.g. cataract, high refractive errors, retinopathy of prematurity, retinoblastoma.
The squinting eye most often turns inwards (convergent), but there can be outward (divergent) or, rarely, vertical deviation.

**Paralytic (rare)**
These are the result of weakness or paralysis of one or more of the extraocular muscles.
The deviation worsens on gaze into the direction of action of the affected muscle.
When rapid in onset, this can be sinister because of the possibility of an underlying space-occupying lesion such as a brain tumour.

Congenital paralytic squints are more commonly the result of developmental defects of the cranial nerves, muscle disease, or congenital infection.
Acquired paralytic squints usually signify with rapid in onset, this can be sinister because of the possibility of an underlying space-occupying lesion such as brain tumour, central nervous system infection, neurodegenerative disease.

It is important to refer children with squints over age of 6 months for further investigation and prevent permanent blindness in that eye.

Transient squints of only a few seconds duration may be acceptable up to 18 months of age.

Hypermetropia is a common cause of squints in children.
Convergent squints are more common.
<table>
<thead>
<tr>
<th>Type of Strabismus</th>
<th>Presenting Symptoms and Signs</th>
<th>Cause</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duane syndrome</td>
<td>Esotropia with deficient abduction or exotropia with deficient adduction of one eye; head turn</td>
<td>Absence of sixth nerve nucleus and aberrant innervation of lateral rectus muscle from third cranial nerve</td>
<td>Strabismus surgery for correction of large deviations or abnormal head position</td>
</tr>
<tr>
<td>Brown syndrome</td>
<td>Head tilt; inability to elevate eye in adduction</td>
<td>Restriction of free passage of superior oblique tendon through trochlea</td>
<td>Observation if not severe; superior oblique tendon surgery if severe</td>
</tr>
<tr>
<td>Möbius syndrome</td>
<td>Mask like facies inability to abduct both eyes difficulty closing eyes</td>
<td>Bilateral sixth and seventh nerve palsies</td>
<td>Protect corneas from exposure; strabismus surgery</td>
</tr>
<tr>
<td>Third nerve palsy</td>
<td>Exotropia and hypertropia; ptosis; dilated, nonreactive pupil</td>
<td>Congenital absence of third nerve; trauma; or tumor</td>
<td>Ptosis and strabismus surgery</td>
</tr>
<tr>
<td>Myasthenia gravis</td>
<td>Variable ptosis and eye movement abnormalities</td>
<td>Blockage of acetylcholine receptor sites by immune complexes</td>
<td>Treatment of systemic myasthenia; strabismus surgery if patient is stable</td>
</tr>
</tbody>
</table>
Assessment of squint

Ocular movements assessed to exclude paralytic squint

**Corneal light reflex test**
examined, looking for symmetry of the light reflex
For the non-specialist, the light reflex test is used to detect squints. It is easiest to use a pen torch held at a distance to produce reflections on both corneas simultaneously. The light reflection should appear in the same position in the two eyes.
If it does not, a squint is present. However, a minor squint may be difficult to detect.

Corneal light reflex (reflection) test to detect a squint. The reflection is in a different position in the two eyes because of a small convergent squint of the right eye
Cover/uncover test.

The child sits comfortably on a parent's lap. Their attention is attracted and while they are looking at an object one of the eyes is covered. If the uncovered eye moves to fix on the object there is a squint present, a manifest squint. This may be a:

- Unilateral squint - the squinting eye takes up fixation of the object when the other eye is covered.
- When the cover is removed the squinting eye returns to its original squinting position
- Alternating squint - the squinting eye takes up fixation of the object when the other eye is covered.
- When the cover is removed the squinting eye maintains fixation and the previously fixing eye remains in a deviated position, i.e., the squint alternates from one eye to the other

Rapaid cover/ uncover test

Some time squint is not present all time appear only with tiredness or stress in rapaid cover/ uncover test the ocular is move quickly between the eyes if the eye that has been uncovered move to take fixation there latent squint

The cover test is used to identify a squint. If the fixing eye is covered, the squinting eye moves to take up fixation. This diagram shows a left convergent squint.
Principles of treatment for a squint

Develop best possible vision for each eye:
- Correct any underlying defect, e.g. cataract
- Correct refractive errors with glasses
- Treat any amblyopia with occlusion therapy

Achieve best ocular alignment:
- In accommodative squints correction of long-sightedness by glasses usually controls the excessive convergence.
- For other types of squints surgery is required. This is particularly important for congenital squints. The longer the defect persists untreated the less chance there is for development of good visual function.
Evaluation of strabismus.

Nonparalytic

- Infantile esotropia
- Nystagmus blockage syndrome
- Infantile exotropia
- Dissociated vertical deviation

Paralytic

- Cyclic esotropia
- Acquired comitant esotropia
- Convergence insufficiency
- Accommodative esotropia
- Intermittent exotropia

Congenital syndromes

- Congenital fibrosis syndrome
- Duane syndrome
- Möbius syndrome
- Brown syndrome
- Congenital nerve palsy (birth trauma)

Acquired ocular nerve palsies

- CNS tumor/lesion
- Trauma (CNS, orbital)
- Infection (meningitis)
- Postinfectious
- Hydrocephalus
- Ophthemoplastic
- Migraine
- Myasthenia gravis
- Gradening syndrome (orbital media)
Examination of the eyes for the Short Case

- Observe for obvious eye abnormalities, e.g. coloboma, ptosis, squint
- Assess visual acuity of both eyes separately
- Assess visual fields
- Test eye movements
- Cover test for squint
- Direct and consensual light reflex
- Examination of the fundi

Order of examination may be influenced by your findings along the way, e.g. if you find an abnormality such as a squint you may focus on the assessment of that.
Hearing impairment

Any concern about hearing impairment should be taken seriously. Any child with delayed language or speech, learning difficulties or behavioural problems should have their hearing tested, as a mild hearing loss may be the underlying cause without parents or other carers realising it.

Hearing loss may be:
- sensorineural - caused by a lesion in the cochlea or auditory nerve and its central connections and usually present at birth
- conductive - from abnormalities of the ear canal or the middle ear, most often from otitis media with effusion.

Causes of hearing loss

<table>
<thead>
<tr>
<th>Causes</th>
<th>Sensorineural 84%</th>
<th>Conductive 16%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenatal and perinatal:</td>
<td>• Congenital infection</td>
<td>• Eustachian tube dysfunction:</td>
</tr>
<tr>
<td></td>
<td>• Preterm</td>
<td>• Down’s syndrome</td>
</tr>
<tr>
<td></td>
<td>• Hypoxic-ischaemic encephalopathy</td>
<td>• Cleft palate</td>
</tr>
<tr>
<td></td>
<td>• Hyperbilirubinaemia</td>
<td>• Pierre Robin sequence</td>
</tr>
<tr>
<td></td>
<td>Postnatal:</td>
<td>• Mid-facial hypoplasia</td>
</tr>
<tr>
<td></td>
<td>• Meningitis/encephalitis</td>
<td>• Wax (only rarely a cause of hearing loss)</td>
</tr>
<tr>
<td></td>
<td>• Head injury</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Drugs, e.g. aminoglycosides, furosemide</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Neurodegenerative disorders</td>
<td></td>
</tr>
</tbody>
</table>

| Hearing loss                  | May be profound (>95 dB)                                                        | Maximum of 60 dB                                                            |
| Natural history               | Does not improve and may progress                                               | Intermittent or resolves                                                    |
| Management                    | Amplification and H. aid or cochlear implant if necessary                       | Conservative, amplification gromet tube with or without the removal of adenoids or surgery |
Conductive hearing loss

Conductive hearing loss from middle ear disease is usually mild or moderate but may be severe. It is much more common than sensorineural hearing loss. In association with upper respiratory tract infections, many children have episodes of hearing loss which are usually self-limiting. In some cases of chronic otitis media with effusion, the hearing loss may last many months or years. In most affected children there are no identifiable risk factors present but children with Down's syndrome, cleft palate and atopy are particularly prone to hearing loss from middle ear disease. Impedance audiometry tests, which measure the air pressure within the middle ear and the compliance of the tympanic membrane, determine if the middle ear is functioning normally.

If the condition does not improve spontaneously, medical treatment (decongestant or a long course of antibiotics or treatment of nasal allergy) can be given. If that fails, surgery is considered, with insertion of tympanostomy tubes (grommets) with or without the removal of adenoids. Hearing aids are used in cases where problems recur after surgery.
Sensorineural hearing loss

This type of hearing loss is uncommon (1 in 1000 of all live births; 1 in 100 in extremely low birthweight infants).
It is usually present at birth or develops in the first few months of life. It is irreversible and can be of any severity, including profound.

The child with severe bilateral sensorineural hearing impairment will need early amplification with hearing aids for optimal speech and language development.
Hearing aid use requires close supervision, beginning in the home together with the parents and continuing into school.
Children often resist wearing hearing aids because background noise can be amplified unpleasantly.
Cochlear implants may be required where hearing aids give insufficient amplification.

Many children with moderate hearing impairment can be educated within the mainstream school system or in partial hearing units attached to mainstream schools.
Children with hearing impairment should be placed in the front of the classroom so that they can readily see the teacher.
Gesture, visual context and lip movement will also allow children to develop language concepts.
Speech may be delayed, but with appropriate therapy can be of good quality.
Modified and simplified signing such as Makaton can be helpful for children who are both hearing-impaired and learning-disabled.
Specialist teaching and support in preschool and school years is provided by peripatetic teachers for children with hearing impairment.
Those with profound hearing impairment may need to attend a school for children who are deaf.
Figure 4.6 (a) Audiogram showing normal hearing and the loudness of normal speech (blue area). The consonants are high-frequency sounds, the vowels are low-frequency sounds. (b) Audiogram showing bilateral conductive hearing loss. There is a 30–40 dB hearing loss in both the right and left ears. (c) Audiogram showing bilateral profound sensorineural hearing loss. (d) Audiogram showing bilateral high-frequency sensorineural hearing loss.

Figure 4.7 Cochlear implant. There is a microphone to detect sound, a speech processor and a transmitter and receiver/stimulator. They convert speech into electric impulses which are conveyed to the auditory nerve, bypassing the ear. It provides a deaf person with a representation of sounds.
Genetic conditions associated with auditory neuropathy spectrum disorder

Non-syndromic,
- such as mutations in the otoferlin (OTOF) gene or pejvakin gene (PJVK)

Syndromic,
- Charcot-Marie- Tooth syn.
- Friedreich ataxia
- CHARGE association (absent semicircular canals)
- Pendred syndrome (enlarged vestibular aqueducts with or without Mondini cochlea) (with CHD and cong hypothyroidism)
- Gusher (deficiency of lamina cribrosa, bulbous internal auditory meatus)
- Usher syndrome types I and III (no anatomical vestibular malformation)
- Jervell and Lange-Nielsen syndrome (no anatomical vestibular malformation)
- alport syndrome
Investigation of the child with permanent hearing impairment

Severe to profound bilateral SNHL
- Vestibular areflexia/hypofunction
  - Electroretinogram
  - MRI imaging
  - ECG

More than 95th lb
- Vestibular function normal
  - Syndromal
  - Non-syndromal
    - Level 1 investigations
      - Genetic
      - Non-genetic
        - Consider level 2 investigations

Syndrome specific investigation

investigations

Level 1 investigations (modified):
1. Clinical history
2. Clinical examination
3. Family and sibling audiograms
4. Cytomegalovirus (CMV) testing
5. Genetic testing
6. Imaging
7. Ophthalmology
8. ECG – in certain groups
9. Urinalysis
10. Vestibular assessment

Level 2 investigations:
1. Serology and DNA PCR testing for congenital infection
2. Haematology and biochemistry
3. Autoimmune disease investigation
4. Blood and urine metabolic screen
5. Renal ultrasound
6. Clinical photography
7. Chromosomal studies
8. Further genetic testing
9. Vestibular assessment
speech and language

Abnormal speech and language development

Communication; Acquisition of communication involves:

Speech
- Expressive - production of speech
- Comprehension - understanding what is being said
- Comprehension development is ahead of expressive development

Non-verbal communication
- Eye contact, pointing, body gestures

Social communication
- Reciprocity and sharing of communication, insight into what is socially acceptable, sharing communication, listening skills

Problems in speech and language development are very common in pre-school children (5-10%) and more common in boys

Speech and language delay may be due to
- hearing loss
- global developmental delay
- difficulty in speech production from an anatomical deficit, e.g. cleft palate, or oromotor incoordination, e.g. cerebral palsy
- environmental deprivation/lack of opportunity for social interaction normal variant/familial pattern
Differential diagnosis of speech and language problem

**Problem with language input (receptive dysphasia)**
inability or difficulty in comprehending speech and language
- Hearing deficit
- Reduced exposure to spoken language, e.g. social circumstances, twins, poor parenting skills

**Problems with language output (expressive dysphasia)**
inability or difficulty in producing speech whilst knowing what is needing to be said
- Neurological or muscular problems, e.g. cerebral palsy

**Problems with language processing**
- Specific speech and language delay
- Associated with general developmental delay
- Associated with reduced communicative intent and poor social skills, i.e. autistic spectrum disorder
- Associated with brain abnormalities, e.g. epilepsy, Llandau-Kleffner syndrome

**Specific speech and language delay**
Problems in auditory/linguistic processing leading to difficulties with:
- Phonology - articulation and making the speech sounds such as stammering (dysfluency), dysarthria or verbal dyspraxia
  - Grammar - understanding the forms and structure of language

Problems in understanding the appropriate meaning and use of language
- Semantics - the meaning of words and sentences
- Pragmatics - the appropriate social use of language

Many children have a mixture of problems.
Diagnosis

Speech and language problems are usually first suspected by parents or primary healthcare professionals.

Clinical assessment

Clinical assessment determines:
- The nature of the speech and language problem
- If there are other problems such as general delay, autistic spectrum as in early years there is considerable overlap between language and cognitive (intellectual) development, Involvement of a neurodevelopmental pediatrician and paediatric audiological physician is indicated.
- Any underlying cause, e.g. if suspected deafness assessment by a speech and language therapist are the initial steps.

Investigations
- It is important to confirm that the hearing is normal (hearing test)
- EEG if there is a clear history of loss of language skills to exclude epilepsy syndromes
- Chromosomal studies if there are other associated difficulties

Warrant referral to a speech and language therapist
- Parental concern
- non intelligible words by 2 yrs
- Speech intelligible to mother only at four years old age
- Lisp at 3 years
- Stammer at 6 years
Management of speech and language problem

If speech and language delay is the only problem it is usually managed by speech and language therapists alone without continuing paediatric input.

If there are other additional problems, multidisciplinary assessment is usually necessary, involving some or all of the multidisciplinary team.

It is also important that advice is given to education about the child's difficulties to enable them to access the national curriculum.

Many children with early speech and language problems will need learning support at school entry.

There are many tests of language development including:
- the Symbolic Toy test - assesses very early language development
- the Reynell test for receptive and expressive language - used for preschool children

Children with severe difficulties are sometimes placed in language units with access to on-site speech and language therapists.

The majority, however, are managed in mainstream school with a speech and language programme incorporated into their individual education plans. Speech and language therapists then review the programme intermittently.
slow acquisition of cognitive skills
general learning difficulty

The term 'learning difficulty' (reflecting cognitive learning difficulties) is now preferred to 'mental retardation' or 'mental handicap'.
In the UK learning difficulties are classified as:

- mild (IQ 70-80)
- moderate (IQ 50-70)
- severe (IQ 35-50)
- profound (IQ less than 35).

Children with mild learning difficulties are usually supported by additional helpers (learning support assistants, LSA) in mainstream schools whereas children with moderate, severe and profound learning difficulties are likely to need the resources of special schools.

Severe or profound learning difficulties are usually apparent from infancy as marked global developmental delay whereas moderate learning difficulties emerge only as delay in speech and language becomes apparent.

Mild learning difficulties may only become apparent when the child starts school.

A child with profound learning difficulties will have no significant language and be completely dependent for all of his needs.

A child with severe learning difficulties is likely to be able to learn minimal self care skills and acquire simple speech and language.

Both will need high or total supervision and support throughout life.

The prevalence of severe learning difficulty is about 3-4 per 1000 children. Most have an organic cause irrespective of social class, in contrast to moderate learning difficulty (30 per 1000 children) in which children of parents from lower socioeconomic classes are over-represented.
Specific learning disorders

Specific learning difficulty implies the skill described is more delayed than would be expected for the child’s level of cognitive ability.

Developmental coordination disorder (DCD) or dyspraxia

is a common type of sensory-processing problem that causes difficulty in performing co-ordinated actions - disorder of motor planning and/or execution with no significant findings on standard neurological examination and the child is often described as clumsy.

It is a disorder of the higher cortical processes and there may be associated problems of perception (how the child interprets what he sees and hears), use of language and putting thoughts together.

Concern about dyspraxia is one of the commonest reasons for a referral to a paediatrician from education.

Children may have:
planning dyspraxia where there are difficulties with:
  • planning a sequence or order of coordinated movements
  • actions that involve manipulation of objects

executive dyspraxia where there are difficulties with:
  • knowing what to do but being unable to do it
  • moving from one activity to another
  • copying actions.

The difficulties may impact on educational progress and self-esteem and suggest the child has greater academic difficulties than may be the case.

Features include
In the younger child:
  • Slow gross-motor development
  • Poor motor skills, e.g. running, jumping, not able to catch a ball
  • Difficulty dressing
  • Poor pencil grip
  • Difficulty with jigsaws
  • Anxiety

In the older child:
  • Avoidance of physical education
  • Slow school progress
  • Reduced attention span
  • Difficulty with maths, reading
  • Trouble copying from blackboard
  • Poor writing skills
  • Inability to follow instructions
  • Poor organizational skills
Differential diagnosis

- Learning disability
- Neuromuscular problem
- Attention-deficit hyperactivity disorder
- Specific speech and language delay
- Visual problem

*Remember that a child can have more than one difficulty, e.g. dyspraxia and attention-deficit hyperactivity disorder.*

Assessment

**In the pre-school child** initial assessment is usually by a **paediatrician** to exclude other pathologies, including general developmental delay. **The school-age child** is also often assessed by a **paediatrician**, but information should also be obtained from the school about the child’s difficulties and overall progress.

Often a speech and language assessment and occupational therapy assessment are also required.

The occupational therapist examines:

- Fine- and gross-motor developmental levels
- Visual motor integration (e.g. doing puzzles or copying shapes)
- Visual perception
- Balance and posture
- Responses to sensory stimulation
- Bilateral co-ordination
- Motor planning

Management

Dyspraxia is not curable but the child often improves in some areas with maturity. Liaison between education, health professionals and the child and parents is crucial to help the child within the classroom and the home environment.

The school's special educational needs co-ordinator (**SENCO**) and school nurse can play an important role in the communication between health and education.

Speech and language therapists and occupational therapists give advice to the school to help with difficulties in the classroom. Sometimes group and individual therapy can help, e.g. a phonology course for articulation difficulties. Advice for parents to help with home activities is also important.

Dyspraxia in its milder form often goes undetected during the first few years of life as the child achieves gross motor milestones at the normal times. With therapy (emphasis on sensory integration, sequencing and executive planning) and maturity, the condition should improve.
**developmental dyslexia**

Unexpected reading and writing problems at an early age amongst otherwise intelligent children. Young children’s difficulties in reading and writing, which cannot be attributed to poor vision and auditory functions, low intelligence or poor educational opportunities, may be diagnosed as developmental dyslexia. Usually, boys have higher numbers of dyslexia problems than girls. Both genetics and environmental factors are likely to be partially responsible.

**Dyscalculia, dysgraphia**

These are disorders in the development of calculation or writing skills.

**Associated co-morbidities of specific learning disorders**

- These are:
  - attention deficit disorder
  - hyperactivity
  - poor sensory integration skills (touch, balance)
  - depression, conduct disorders

**Management of specific learning disorders**

Assessment may include vision and hearing and assessment by an occupational therapist, physiotherapist and educational psychologist. Co-morbidities need to be identified.

Treatment is aimed at improving skill acquisition, with educational and information technology support as appropriate.
Abnormal development of social/communication skills

(autistic spectrum disorder)

Children who fail to acquire normal social and communication skills may have an autistic spectrum disorder.

The prevalence of autistic spectrum disorder is **3-6/1000 live births**.

**It is more common in boys.**

Presentation is usually between **2 and 4 years of age** when language and social skills normally rapidly expand.

The children present with a triad of difficulties and associated co-morbidities.

Where only some of the behaviours are present, the child is described as having autistic features but not the full spectrum.

**Asperger's syndrome** refers to a child with the social impairments of an autistic spectrum disorder but at the milder end, and near-normal speech development and intellectual functioning. In early childhood it becomes apparent that the child has behavioural and social difficulties and some speech and language problems. The diagnosis can often be missed.

Such children still have major difficulties with the give-and-take of ordinary social encounters, a stilted way of speaking and narrow, strange interests which they do not share with others, and are often clumsy.

In reality autistic spectrum disorders are a continuum of behavioural states ranging from the severe form of autism with or without severe learning difficulties to the milder Asperger's syndrome to autistic features occurring secondary to other clinical problems.

No cause has been identified; there is probably multiple aetiology with a genetic component in at least some.

The condition is not the result of emotional trauma or deviant parenting.

There is no evidence for a suggested link with the MMR vaccine.
Features of autistic spectrum disorders

impaired social interaction
- does not seek comfort, share pleasure, form close friendships
- no interest or ability in interacting with peers (play or emotions)
- gaze avoidance
- socially and emotionally inappropriate behavior
- does not appreciate that others have thoughts and feelings
- lack of appreciation of social cues

Speech and language disorder:
- delayed development, may be severe
- limited use of gestures and facial expression
- formal pedantic language
- impaired comprehension with over-literal interpretation of speech
- echoes questions, repeats instructions, refers to self as 'you'
- superficially perfect expressive speech

Imposition of routines with ritualistic and repetitive behavior:
- on self and others, with violent temper tantrums if disrupted
- unusual stereotypical movements such as hand flapping and tip toe gait
- poverty of imagination in play and general activities
- peculiar interests and repetitive adherence
- restriction in behavior repertoire

Co-morbidities
general learning and attention difficulties (about two thirds)
seizures (about one quarter, often not until adolescence)
Assessment of children on the autistic spectrum

This is by multidisciplinary assessment. The format varies depending on local services but should include:

- a developmental paediatrician
- a psychiatrist
- a psychologist
- a speech and language therapy assessment.

**History**

Important to get thorough history including developmental milestones. Information about behaviour from other sources is helpful, e.g. nursery.

**Examination**

To exclude any other diagnosis presenting with autistic features, e.g. fragile X syndrome.

If possible, try to watch the child in different settings to observe the behavioural difficulties.

A child in a one-to-one consultation situation may behave very differently when put into a group. Hearing and vision should also be checked.

**Investigations**

There is no consensus regarding investigations.

Some perform EEGs and chromosomal studies routinely.

Others only perform the tests if there is a clinical indication, e.g. chromosomes if dysmorphic features are found, EEC if variation in symptoms or associated developmental regression.

**Individual profiling**

All children and young people with ASD should have a comprehensive evaluation of their speech and language and communication skills, which should inform intervention.

Occupational therapy and physiotherapy assessments should be considered where relevant, the need for the following should be reviewed for all children and young people with ASD:

- examination of physical status, with particular attention to neurological and dysmorphic features such as fragile X need karyotyping and DNA analysis
- examination of audiological status and vision EEG and IQ
Management
Each child needs to be assessed as an individual to determine the degree of difficulty in social and communication skills, and an individual management plan must be decided upon.

Principles of intervention is Behavioural modification By (Applied Behavioural Analysis)

Health
Communication with parents about their concerns and difficulties with management of the child is essential. Access to more information should be provided, e.g. the National Autistic Society. Access to psychiatric/psychology services for the individual and the family are essential.

Education
Liaison with education is essential.
Pre-school intervention within the home and nursery is possible with early diagnosis.
Local outreach services may be available to go into the home to give management advice.
Formal pre-school notification by health to education allows the child's needs to be assessed before school placement. School placement can vary from mainstream with support through to a special unit depending on the individual child.
Children on the autistic spectrum often require a high teacher to pupil ratio in a highly structured environment to minimize disruptions. Speech and language input to help communication skills is also important.

Social services
Living with a child on the autistic spectrum affects all members of the family. Families often need respite care and support in the home.
Community Paediatrics

child health surveillance

The health authority is responsible for ensuring that an adequate surveillance programme is offered to all children and that it is monitored effectively.

In the UK, the healthy child programme (HCP) was introduced in 2009 (previously the child health promotion programme). It spans from pregnancy to 19 years old, but the main emphasis on ages 0–5 years.

The programme should comprise:

- Oversight of health and physical growth of all children
- Monitoring developmental progress of all children
- Provision of adequate advice and support to parents
- Programme of infectious disease prophylaxis
- Participation in health education and training in parenthood
- Identification of 'children in need' in accordance with the Children Act
- Identification and notification of children with special educational needs in accordance with the 1981 Education Act

It offers families a programme of:

- screening early detection and intervention of physical and developmental problems.
- immunisation – disease prevention
- Developmental reviews – including aspecific screening at 2 years, an age when less obvious areas of developmental concern may arise with language skills
- health promotion - to minimise hazards and promote optimum physical and mental health
There is two programme
- a universal programme
- a progressive programme for families thought to be more at risk.

Those in the progressive programme include
- infants or children with health or developmental problems
- children at increased risk of obesity
- families considered to be at higher risk, e.g. at risk first time mothers; parents with learning difficulties, drug or alcohol abuse or serious mental illness, insensitive (i.e. intrusive or passive) parenting interactions or domestic violence.

These families receive additional intervention according to need.

The programme is a compromise between the desire to detect problems and potentially intervene early whilst avoiding an excessive number of visits.

At each review, a check is made for specific physical abnormalities and on the child's overall development, health and growth.

Selected health promotion topics are considered.

There is an emphasis on parental opinion for vision, hearing, speech and language, as parents are usually excellent at the early detection of any problems.

Details of each review are entered in the child's personal child health record. These books are kept by the parents and they are asked to bring them whenever the child is seen by a health professional.

The health child programme - HCP is carried out in primary care by health visitors. If problems are identified, an action plan is made for the child, which could involve giving advice and monitoring progress or referral to a specialist.
<table>
<thead>
<tr>
<th>Age and checked by whom</th>
<th>Screening</th>
<th>General examination and immunisation</th>
<th>Health promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenatal (by 12th week of pregnancy)</td>
<td>Antenatal screening for fetal conditions (see NICE guidelines for antenatal care)</td>
<td>Maternal health, fetal growth, maternal immunisation (rubella)</td>
<td>Universal: smoking and alcohol intake, mental health, breast-feeding</td>
</tr>
<tr>
<td>Newborn—72 h</td>
<td>Screening on examination includes eyes (red reflex), developmental dysplasia of the hip (DDH), tests in boys. Newborn Hearing Screening Programme</td>
<td>Normal newborn examination: general examination, weight and head circumference plotted on centile graph, RCG offered (repeated at 1, 2, 12 months) if at risk</td>
<td>Universal: feeding, personal child health record and Birth to Five book, promoting sensitive parenting, prevention of sudden infant death syndrome</td>
</tr>
<tr>
<td>5–8 days (ideally Day 5)</td>
<td>Blood spot test for biochemical and haematological screening</td>
<td>Vitamin K</td>
<td></td>
</tr>
<tr>
<td>New baby review (by 14 days)</td>
<td>Assess child and family health needs, including parental mental health needs</td>
<td>Examine baby for nutritional status and prolonged jaundice</td>
<td>Infant feeding, promote sensitive parenting, advice on promoting development, home safety</td>
</tr>
<tr>
<td>6–8 weeks</td>
<td>Physical examination: cardiac abnormalities (heart murmurs and formal pulses), DDH, testicular descent in boys, red reflex of fundus, matters of parental concern</td>
<td>Full physical examination, weight, head circumference and plot growth centiles</td>
<td>Nutrition, immunisations, recognition of illness, avoid passive smoking, crying and sleep problems, maternal mental health</td>
</tr>
<tr>
<td>3 months</td>
<td>General review of progress, address parental concerns such as growth</td>
<td>Vision/hearing — any parental concern? 1st immunisation — DTaP/IPV, Hib, PCV</td>
<td>Support families by providing access to parenting and child health information</td>
</tr>
<tr>
<td>4 months</td>
<td>General review of progress</td>
<td>2nd immunisation — DTaP/IPV/Hib, MenC</td>
<td>Weaning on to solids around 6 months</td>
</tr>
<tr>
<td>7–9 months</td>
<td>Systemic assessment of the child’s physical, emotional and social development and family needs</td>
<td>3rd immunisation — DTaP/IPV/Hib, PCV MenC</td>
<td>Distribution of books,* accident prevention: choking, scalds and burns, safety gates, nutrition and dental care, skin care (sunburn)</td>
</tr>
<tr>
<td>12–13 months</td>
<td>General review of progress</td>
<td>Immunisation — Hib, MenC, PCV, MMR</td>
<td>Dental health</td>
</tr>
<tr>
<td>2–2½ years</td>
<td>Nutrition, active play, personal, social and emotional development, speech, language and communication</td>
<td>Review immunisation status and physical status according to parental concerns</td>
<td>Obesity prevention, injury prevention, advice on how to seek medical help</td>
</tr>
<tr>
<td>3–5 years (preschool)</td>
<td>General review of progress</td>
<td>3-4 years immunisation — MMR, DTaP/IPV</td>
<td>Health promotion and supporting parents</td>
</tr>
<tr>
<td>5 years (to be completed soon after school entry)</td>
<td>Orthopist: screen all children for visual impairment (4–5 years) School nurse: hearing screening (audiology), growth</td>
<td>Review immunisation status</td>
<td>Health promotion and supporting parents</td>
</tr>
<tr>
<td>5–11 years</td>
<td>Immunisation — Hib, MenC, PCV, MMR</td>
<td>Measure height and weight, plot centiles* Physical examination if parental concern</td>
<td></td>
</tr>
<tr>
<td>School nurse</td>
<td>Nursing care provided according to needs</td>
<td>Nursing care provided according to needs</td>
<td>Promote healthy weight, support for parents and carers</td>
</tr>
<tr>
<td>11–16 years</td>
<td>Health review at school transition at 10–11 and 15–16 years by questionnaires, engaging primary care in mid-teens, emotional health, psychological well-being and mental health</td>
<td>Immunisation (13–16 years) — Td/IPV Human papilloma virus (HPV) in girls If at risk — BCG, Hep B, influenza</td>
<td>Sexual health, promote healthy weight</td>
</tr>
<tr>
<td>School nurse</td>
<td>Review immunisation status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16–19 years (Further Education)</td>
<td>Share information from school with adult services, emotional health, psychological well-being and mental health</td>
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<td></td>
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<tr>
<td>School nurse, GP</td>
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</tbody>
</table>


*Bookstart — national programme to encourage parents and carers to enjoy books with their children from an early age.

The national child measurement programme — height and weight of all reception and year 6 children.
Immunization

Immunisation is one of the most effective and economic public health measures to improve the health of both children and adults. The most notable success has been the worldwide eradication of smallpox achieved in 1979, but the prevalence of many other diseases has been dramatically reduced by immunisation programmes.

The World Health Organization (WHO) aimed to eradicate poliomyelitis from the world by the year 2000, and there are now only occasional outbreaks in Africa and Asia.

Differences exist in the composition and scheduling of immunisation programmes in different countries, and schedules change as new vaccines become available. The UK schedule from 2006 is shown in. Features are:

- In the newborn - BCG is given to infants at high risk of infection, but has otherwise been withdrawn from the routine vaccination schedule.

- At 2, 3 and 4 months of age - the '5 in 1' vaccination is given, against diphtheria, tetanus, pertussis, H. influenzae type b and polio. The oral, live polio vaccine has been replaced by killed-vaccine given by injection, owing to the risk of polio in unvaccinated children and to immunocompromised people from gastrointestinal excretions of vaccine recipients.

- At 2, 4 and 13 months the pneumococcal conjugate vaccine has been added to the immunisation programme.

- At 3, 4 and 12 months the conjugate vaccine against group C meningococcus (MenC) is given by separate injection.

- At 12 months a booster Hib vaccine is given (combined with the MenC).

- At about 13 months - measles, mumps, rubella (MMR) is given.

- Older children - booster doses as in the immunisation schedule.
Inactivated vaccines

- Pertussis
- Diphtheria
- Parenteral polio
- Monovalent whole cell
- Typhoid
- Tetanus
- Cholera
- Hepatitis B
- Haemophilus
- influensae type b (Hib)

Live vaccines

- Measles
- Mumps
- Rubella
- Oral polio vaccine (OPV)
Routine immunisations in the UK

- Diphtheria (T), tetanus (T), pertussis
- (I)Poliomyelitis (I)Conjugated Haemophilus influenzae b (S)
- Conjugated meningococcal C (S) Conjugated pneumococcal (S)
- Measles (L), mumps (L), rubella (L)

Additional routine immunisations in the USA

- Hepatitis B (S) Varicella (L)

Immunisations available for children at risk

- BCG for TB (L) Hepatitis A (S) and B (I) Influenza (S)

Immunisations available for children travelling abroad

- Typhoid - oral (L), parenteral (I)
- Cholera (I)
- Yellow fever (L)
- Rabies (I)
- Japanese encephalitis (I)
- Tick-borne encephalitis (I)
**Immunization schedule in the UK (2006)**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Birth</th>
<th>1 month</th>
<th>2 months</th>
<th>4 months</th>
<th>6 months</th>
<th>12 months</th>
<th>13 months</th>
<th>3½-5 years</th>
<th>13 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>BCG if at risk</td>
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</tr>
<tr>
<td>Hep B</td>
<td>Hep B if at risk</td>
<td>Hep B if at risk</td>
<td>Hep B if at risk</td>
<td>Hep B if at risk</td>
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<td></td>
</tr>
<tr>
<td>1 in 5 Diphtheria, tetanus, pertussis, polio, Hib (DTap/IPV/Hib)</td>
<td>1 in 5</td>
<td>1 in 5</td>
<td>1 in 5</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Pneumococcal conjugate vaccine</td>
<td>Pneumo vaccine</td>
<td>Pneumo vaccine</td>
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<td>Men C</td>
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<td>Hib/Men C</td>
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<td>MMR</td>
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<tr>
<td>Diphtheria, tetanus, pertussis, polio, (DTap/IPV)</td>
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<td>Diphtheria tetanus, polio (Td/IPV)</td>
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**Recommended Immunization Schedule for Persons Aged 0–6 Years — UNITED STATES • 2008**

*For those who fall behind or start late, see the catch-up schedule*

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B</td>
<td>Birth</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>1 month</td>
</tr>
<tr>
<td>Diphtheria, Tetanus, Pertussis</td>
<td>2 months</td>
</tr>
<tr>
<td>Haemophilus influenzae type b</td>
<td>4 months</td>
</tr>
<tr>
<td>Pneumococcal</td>
<td>6 months</td>
</tr>
<tr>
<td>Inactivated Poliovirus</td>
<td>12 months</td>
</tr>
<tr>
<td>Influenza</td>
<td>15 months</td>
</tr>
<tr>
<td>MMR</td>
<td>18 months</td>
</tr>
<tr>
<td>Varicella</td>
<td>18-36 months</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>3-5 years</td>
</tr>
<tr>
<td>Meningooccal</td>
<td>3-5 years</td>
</tr>
</tbody>
</table>
Other vaccine indication

BCG indication in UK

BCG is recommended for the following groups if BCG immunisation, as evidenced by a characteristic scar, has not previously been carried out and they are negative for tuberculoprotein hypersensitivity

- previously unvaccinated new immigrants from countries with a high incidence of TB
- all infants living in areas where the incidence of tuberculosis is greater than 40 per 100,000
- infants parent or grandparent born in a country with an incidence of tuberculosis greater than 40 per 100,000 contacts of those with active respiratory tuberculosis
- health service staff
- Staff working in prisons, in residential homes and in hostels for refugees and the homeless
- those intending to stay for more than 1 month in countries with a high incidence of tuberculosis
- neonates, infants, children or adults where immunisation is requested

Pneumococcal vaccine (< yrs pneumoventer) (> 2 yrs pneumovax)

- routine in UK
- extrem age
- scd
- immune deficiency (hypoglobenemia..-hypo-asplenia)
- leuckemia
viral influenza (inactivated virus) (annually) for all children >6 mon

- BA
- PDA
- CF
- CHD
- CRF
- BPD
- DM
- NS
- HIV
- MR-SEVER CP
- ALL

**Haemophilus influenzae type b**

causes invasive disease in young children including otitis media, pneumonia, epiglottitis, septic arthritis and meningitis.

The number of reports of infection dropped dramatically after the introduction of Hib vaccination but a gradual rise from 1988 occurred because protection was not maintained throughout childhood.

This was managed with a Hib catch-up programme, and to prevent a further resurgence a Hib booster dose has been introduced at 12 months of age.

**Meningococcal C**

was an uncommon but serious pathogen causing septicaemia and meningitis. The marked fall in the number of reports in all age groups is shown in. The number of vaccinations in the first year of life has been reduced from three to two as this has been shown to provide the same level of protection. A booster is given at 12 months to extend protection through early childhood.
Pneumococcal vaccination

was introduced into the immunisation programme in 2006. About 530 children under 2 years of age develop invasive pneumococcal disease in England and Wales each year. About a third develop pneumococcal meningitis, which has a high mortality, and more than 30% of survivors are left with permanent disabilities. The vaccine protects against seven common strains which are responsible for about 80% of invasive disease. Its introduction into the USA has resulted in a marked decline of invasive pneumococcal infection, not only in young immunised children but also in older children from a more widespread population effect.

Although the number of notifications of TB is rising, it remains uncommon and mainly confined to high risk populations. BCG immunisation in the neonatal period is therefore targeted to those at increased risk. Routine immunisation of all skin test negative schoolchildren has been discontinued as its efficacy was unproven.

In the USA and many other countries, vaccination against hepatitis B and varicella are part of the immunisation programme.

In many developing countries immunisation uptake is low for logistical and economic reasons, resulting in the preventable death of millions of young children every year.
Complications and contraindications

Following vaccination, there may be swelling and discomfort at the injection site and a mild fever and malaise.

Some vaccines, such as measles and rubella, may be followed by a mild form of the disease.

More serious reactions, including anaphylaxis, may occur but are very rare.

Local guidelines about vaccination and its contraindications should be followed.

Vaccination should be postponed if the child has an acute illness; however, a minor infection without fever or systemic upset is not a contraindication.

If there is a personal or family history of febrile convulsions, advice on fever prevention should be given.

Live vaccines should not be given to children with impaired immune responsiveness (except in children with HIV infection in whom MMR vaccine can be given).

Following pertussis vaccination, seizures and encephalopathy are rare complications, but publicity in the UK in the 1970s surrounding this risk resulted in a marked fall in vaccine uptake and was followed by several whooping cough epidemics.

It is now recognised that in many instances the complications were falsely attributed to the vaccine and that the neurological complications from the whooping cough itself are more frequent than from the vaccine.

The only contraindication to pertussis vaccination is if the child has experienced a severe local or general reaction to a preceding dose. If there is an evolving neurological problem, immunisation should be deferred until the condition is stable.

The recent controversy regarding a possible association between MMR vaccination and autism and inflammatory bowel disease has been discredited, but adversely affected uptake of the vaccine and public confidence in the immunisation programme. The MMR vaccine is only contraindicated in children with proven non-HIV-related immunodeficiency and those who are allergic to neomycin or kanamycin, which may be present in small quantities in the vaccine. Children with a history of anaphylaxis to egg (the virus is grown in fibroblast cultures generated from chick embryos) should be immunised with MMR under medical supervision.

The website www.gmmrthefacts.nhs.uk lives health professionals and parents detailed information on the MMR vaccine.
The only remaining absolute contraindications for pertussis-containing vaccines are:

- Confirmed anaphylactic reaction to a previous dose of pertussis-containing vaccine
- Confirmed anaphylactic reaction to neomycin, streptomycin or polymyxin B

**contra-indication to MMR vaccination:**

- children with allergy to gelatine

Three types of poliomyelitis virus (Types 1, 2 and 3) are included in the vaccine.

**Contraindications:**

- Postpone if acute illness with pyrexia, diarrhoea/vomiting
- Immunodeficiency/Treatment with steroids/immunosuppressants
- First four months of pregnancy
Children's rights

Children are now recognised as having their own human rights.

These are laid down in the United Nations Convention on the Rights of the Child, which has been ratified by all members of the United Nations, including the UK, but excluding the USA and Somalia.

Implications of the convention include the involvement of children in clinical decision-making and in issues of consent.

1. Survival rights The child’s right to life and to the most basic needs - food, shelter and access to health care

2. Developmental rights To achieve their full potential - education, play, freedom of thought, conscience and religion. Those with disabilities to receive special services

3. Protection rights Against all forms of abuse, neglect, exploitation and discrimination

4. Participation rights To take an active role in their communities and nations

Health care is now centred around the child and family. It is adapted according to the child’s condition. Good communication and cooperation between professionals is crucial. A key worker is often appointed to assist the family with this.
The new paediatrics and child health

In developed countries, there has been a marked shift in emphasis of paediatric practice from children with acute infections, which are now mostly prevented by immunisation or easily treated, to complex, multi-system physical disorders and disabilities and emotional and behavioural problems. This necessitates a more holistic approach to their care.

Instead of care being decided solely by doctors, the child and family are increasingly involved in a partnership determining the pattern of this care, based on the information provided to them.

Other services are often involved, including the primary healthcare team, paediatric community nurses, the playschool/nursery or school, social services, religious community, the voluntary services and complementary health practitioners. Specialist services may be from secondary or tertiary care paediatric centres, which are forming collaborative networks with district general hospitals or community services over a wide geographical area.

Good communication and close cooperation is required between all the parties involved.

A designated key worker is often chosen to help families with this. Information may also be obtained from professional or voluntary organisations or parent support groups, which may be national or, increasingly, international.
Care of the sick child

Most sick children are cared for by their parents at home. Medical management is initially given by general practitioners or, in some countries, primary care paediatricians. Most hospital admissions are at secondary care level. A smaller number of children will require tertiary care in a specialist centre, e.g. paediatric intensive care unit, cardiac or oncology unit. There are a few national centres for very rare and complex treatments, e.g. organ transplantation, craniofacial surgery.

Schematic representation of the 'clinical iceberg' of the provision of care for sick children.
(Adapted from Audit Commission, Children First, 1993.)
**Primary Prevention**

Reduction in number of new cases of a disease, disorder or condition (accidents)

**Tertiary Prevention**

Reduction of impairment and disability, and minimizing suffering (e.g. multidisciplinary approach of a child with Downs syndrome)

**Health Education**

Any activity which promotes health through learning

**Primary care**

The majority of acute illness in children is mild and transient (e.g. upper respiratory tract infection, gastroenteritis) or readily treatable (e.g. urinary tract infection).

Although serious conditions are uncommon, they must be identified promptly.

The condition of sick children, especially infants, may deteriorate rapidly, and parents require rapid access to a general practitioner or other healthcare professionals working in primary care, who in turn require ready access to secondary care.

Acutely ill children may also attend walk-in centres, be seen at home by emergency care practitioners (trained nurses or paramedics working in the pre-hospital setting). Advice may also be obtained from a health professional by telephone via NHS Direct, via the internet with NHS Direct Online or by NHS Direct cable TV services.

Although an individual general practitioner will care for relatively few children with serious chronic illnesses (e.g. cystic fibrosis, diabetes mellitus) or disability (e.g. cerebral palsy), each affected child and family are likely to require considerable input from the whole of the primary care team.
Number of years a general practitioner needs to work before encountering a child newly presenting with these conditions.
Hospital care

Accident and Emergency

Approximately 3.5 million children attend an Accident and Emergency (A&E) department each year in England and Wales, 1 in 4 children.

The number of departments able to meet these expectations is increasing, often by creating a dedicated children's A&E department.

Services which should be available for children attending an Accident and Emergency department

<table>
<thead>
<tr>
<th>Environment</th>
<th>Staff</th>
<th>Medical care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate waiting area, play facilities, child friendly treatment and recovery areas</td>
<td>Medical and nursing staff trained and experienced in the care and treatment of children</td>
<td>Resuscitation and other equipment for children Priority for prompt treatment</td>
</tr>
<tr>
<td>Access for parents to examination, X-ray and anaesthetic rooms</td>
<td>Non-paedicatric staff trained in communicating with children and families Effective communication with other health professionals</td>
<td>Rapid transfer if inpatient admission is needed Child protection policies Procedures and counselling are in place following the sudden death of a child</td>
</tr>
</tbody>
</table>
Hospital admission

In England and Wales, 1 in 11 children is admitted to hospital each year, representing 16% of all hospital admissions. About 42% of acute admissions are under the care of paediatricians, and the remainder are surgical patients (although a pediatrician is also involved in their care whilst they are in hospital, to oversee any medical requirements). Most paediatric admissions are of infants and young children under 5 years of age and are emergencies, whereas surgical admissions peak at 5 years of age, one-third of which are elective.

- Although primary and community health services for children have improved markedly over the last decade, the hospital admission rate has continued to rise. The reasons for this are unclear, but probably include: lower threshold for admission - there appears to be an increased expectation of hospital admission by parents and medical staff worried that the child's clinical condition may deteriorate.

- Repeated hospital admission of children with complex conditions who would have died in the past but are now surviving, e.g. very low birthweight infants from neonatal intensive care units, children with cancer or organ failure.

Strenuous efforts are being made to reduce the rate and length of hospitalisation: The new speciality of ambulatory paediatrics encompasses specialist paediatricians providing hospital care for immediate medical problems outside inpatient paediatric wards.

- Dedicated children's short stay beds within or alongside the A&E department are being introduced to allow children to be treated or observed for a number of hours and discharged home directly, avoiding the need for admission to the ward.

- Day-case surgery has been instituted for many operations which used to require overnight stay. Day units are used for complex investigations and procedures.
• Shared care may be provided between hospitals and primary care, with paediatricians and other healthcare professionals seeing children at home or in primary care settings.

• Home care teams aim to provide care in the child's home and thereby reduce hospital attendance, admission and length of stay. Most teams comprise community paediatric nurses, but some include doctors, and they either cover all aspects of paediatric care within a geographical area or are for a specific condition, e.g. cystic fibrosis or malignancy, usually centred around a tertiary referral centre.

• **The problems managed at home by such teams include:**

  • changing postoperative wound dressings or managing burns
  • day-to-day management and support for the family for chronic illnesses, e.g. diabetes mellitus, asthma and eczema
  • specialist care, e.g. home oxygen therapy, intravenous infusions via a central venous catheter (e.g. antibiotics or chemotherapy) or peritoneal dialysis
  • symptom and pain control and emotional support of terminally ill children. Some teams provide a 'hospital at home' service for children who are acutely ill, in order to avoid hospitalisation. Hospital admission of children: should be avoided whenever possible
  • most medical admissions are infants and young children, surgical admissions occur throughout childhood.
### Reason for paediatric medical admissions to a district general hospital

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td><strong>Respiratory 31%</strong></td>
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</tr>
<tr>
<td>Asthma</td>
<td>11%</td>
</tr>
<tr>
<td>URTI</td>
<td>6%</td>
</tr>
<tr>
<td>Croup</td>
<td>4%</td>
</tr>
<tr>
<td>Bronchiolitis</td>
<td>4%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>3%</td>
</tr>
<tr>
<td>Tonsillitis</td>
<td>2.5%</td>
</tr>
<tr>
<td><strong>Environment 22%</strong></td>
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<tr>
<td>Head injury</td>
<td>12%</td>
</tr>
<tr>
<td>Poisoning</td>
<td>8%</td>
</tr>
<tr>
<td>Child protection</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Gastroenterology 15%</strong></td>
<td></td>
</tr>
<tr>
<td>Gastroenteritis</td>
<td>7%</td>
</tr>
<tr>
<td>Constipation/soiling</td>
<td>2%</td>
</tr>
<tr>
<td>Abdominal pain/vomiting</td>
<td>2%</td>
</tr>
<tr>
<td>Failure to thrive</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Infection 10%</strong></td>
<td></td>
</tr>
<tr>
<td>Viral infection</td>
<td>6%</td>
</tr>
<tr>
<td>Septicaemia/meningitis</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Neurology 8%</strong></td>
<td></td>
</tr>
<tr>
<td>Febrile convulsions</td>
<td>3%</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Kidney and urinary tract 3%</strong></td>
<td></td>
</tr>
<tr>
<td>Apnoea/cyanotic attacks</td>
<td>2%</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>2.5%</td>
</tr>
<tr>
<td><strong>Other 11%</strong></td>
<td></td>
</tr>
</tbody>
</table>
Hospital admissions as inpatients of children aged 0-18 years in England and Wales in 1990-91. (Adapted from Audit Commission, *Children First*, 1993.)
**children in hospital**

Children should only be admitted to hospital if their care cannot be provided safely at home. Removing young children from their familiar environment to a strange ward is stressful and frightening for the child, parents and family.

Ill or injured children may regress in their behavior, acting younger than their actual age. It also disrupts family routines, not only of the child in hospital but also of siblings who still need to be looked after at home and transported to and from nursery or school.

**Family-centred care**

Care in hospital should be child- and family-centred. Parents and siblings should be involved in the child's care, which should be appropriate for the child's physical and emotional maturity and needs.

A holistic approach should be adopted towards the child and his family rather than simply focusing on the medical condition. Young children may interpret the pain experienced in hospital and separation from their home or parents as punishment. In general, the distress arising from separating children from their mothers is greatest in young children, and increases the longer the length of stay and the more frequently the child is admitted. Parents of infants and young children should be encouraged to stay with their child overnight and continue to provide the care and support they would give at home. Parents know best about their child's usual behavior and habits and due attention must be paid to their worries or comments. Many parents rapidly learn some of the nursing skills, e.g. tube feeding, required by their child. Good communication is needed between staff and parents to arrive at a mutually agreed plan of responsibilities for looking after the child. This will avoid parents either feeling pressurised to accept responsibilities they are not confident about or feeling brushed aside and undervalued by staff. Parents should be able to stay overnight with their child.
Inpatient admission rates for children aged 0-14 years in England. There has been a marked increase in the paediatric admission rate, whereas the surgical admission rate has fallen slightly. In both, there has been a marked reduction in the average length of stay.

(Adapted from Audit Commission, *Children First*, 1993.)
Child-orientated environment

Children should be cared for within a children's ward. Adolescents should be with others of their own age and not forced to accept ward arrangements designed for babies or adults. Education and facilities for play should be provided.

Information and psychosocial support

Detailed information should be provided, given personally and preferably also written and available in appropriate ethnic languages. Staff should be sensitive to the family's individual needs according to their social, educational, cultural and religious background. Play specialists should be part of the ward team because they can help children understand their illness and its treatment through play. Emotional and psychological support should be given to all. For elective admissions, children and their families should be offered an advance visit and have details of proposed treatment and management explained at an appropriate level

Skilled staff

Children in hospital should be cared for by specially trained medical, nursing and support staff. Every child admitted to hospital should be supervised by a children's physician or surgeon. Children constitute only a relatively small proportion of the workload in acute surgical specialities, so surgeons and anaesthetists should treat a sufficient number of children to maintain their skills. There should be a 'named nurse' responsible for planning and coordinating care by other nurses to ensure that families receive all the information they need and provide a link with staff involved in discharge planning and post-discharge arrangements
Multidisciplinary care

Successful management of paediatric conditions often relies on a network of multidisciplinary care, with all the professionals working well together as a coordinated team. If this breaks down, particularly when dealing with complex issues such as child protection, the consequences may be disastrous for the child, family and professionals involved. Child psychiatrists, the community paediatric team and social services are important members of the team.
Tertiary care

As the number of children requiring tertiary care is relatively small, it is concentrated in specialist centres.

Increasingly, the centre is linked to several district general hospitals to form a clinical network.

These centres have the advantage of having a wide range of specialists, not only medical staff but also nursing and other healthcare professionals, and diagnostic and other services.

A disadvantage is that they are often some distance from the child's home and hospital stay may be prolonged, e.g. following a bone marrow transplant. Accommodation for parents should be provided.

Shared care arrangements between tertiary centres and local hospitals are designed to minimise the need for the child to travel to the specialist centre. For example, a child with malignant disease would attend a tertiary centre for the initial diagnostic assessment and treatment, and subsequently for specialised treatment and periodic review, but much of the maintenance therapy would be provided by the local hospital together with monitoring of their health and regular blood and other tests performed by a specialist nurse at home.
Pain

It is easy to ignore or underestimate pain in children. Pain should ideally be anticipated and prevented.

**Acute pain**

This may be caused by:

- tissue damage, e.g. burns or trauma
- specific disease process, e.g. sickle cell crisis
- medical intervention - investigations or procedures
- surgery.

**Chronic pain**

In children, chronic severe pain sometimes occurs as a result of disease such as malignant disease or juvenile idiopathic arthritis (juvenile chronic arthritis). Intermittent pain of mild or moderate severity, e.g. headache or recurrent abdominal pain, is more common.

Older children can describe the nature and severity of the pain they are experiencing.

In younger children, assessing pain is more difficult.

Observation and parental impression are commonly used and a number of self-assessment tools have been designed.
Management

This should allow pain to be prevented or kept to a minimum.

Age-appropriate explanation should be given when possible and the approach be reassuring; however, it is imperative not to lie to children, otherwise they will not believe what they are told in the future. Distraction techniques such as blowing bubbles, telling stories, holding family toys or playing computer games, as well as the involvement of trained play specialists, can be highly successful in ameliorating pain in children. Some children develop particular preferences for a particular venepuncture site or distraction technique, and this should be accommodated as far as possible.

For minor medical procedures, e.g. venepuncture or inserting an intravenous cannula, pain can be alleviated by explanation and the use of a topical anaesthetic.

Additional and appropriate use of inhalation agents such as nitrous oxide (laughing gas) or the adjunctive use of mild sedation alongside pain relief, e.g. intranasal midazolam, can be helpful for more painful procedures such as suturing a wound.

For more invasive procedures, e.g. bronchoscopy, a general anaesthetic should be given.

Postoperative pain can be markedly reduced by local infiltration of the wound, nerve blocks and postoperative analgesics.

For severe pain, there was reluctance in the past to use morphine in children for fear of depressing breathing.

This should not occur when morphine is given in appropriate dosage under nursing supervision to children with a normal respiratory drive.

Intravenous morphine can be given using a patient-controlled delivery system in older children or a nurse-controlled system in young children.

Pain should be anticipated and prevented rather than treated.
Approaches to pain management

Explanation and information

Psychological, by the parent, doctor, nurse or play specialist

• Behavioural
• Distraction
• Hypnosis

Medical

Local: anaesthetic cream, local anaesthetic infiltration, nerve blocks, warmth or cold, physiotherapy, transcutaneous electrical nerve stimulation (TENS)

Analgesics:

• Mild - paracetamol, NSAIDs
• Moderate - codeine, NSAIDs
• Strong - morphine

Sedatives and anaesthetic agents:

• Intranasal midazolam, nitrous oxide, general anaesthetic

Anti-epileptic and antidepressant drugs for neuropathic pain
Prescribing medicines for children

There are marked differences in the absorption, distribution and elimination of drugs between children and adults

Absorption

In the neonate and infant, oral formulations of drugs are given as liquids. However, their intake cannot be guaranteed and absorption is unpredictable as it is affected by gastric emptying and acidity, gut motility and the effects of milk in the stomach.

In acutely ill neonates and infants, drugs are given intravenously to ensure reliable and adequate blood and tissue concentrations. Intramuscular injections should be avoided if possible as there is little muscle bulk available for injection, absorption is variable and they are painful. Rectal administration can be used for some drugs; absorption is more reliable, but this route is not popular in the UK.

Significant systemic absorption can occur across the skin, particularly in preterm infants. Occasionally this can be used therapeutically, but is a potential cause of toxicity, e.g. alcohol and iodine absorption from cleansing solutions applied to the skin for procedures.

Young children find it difficult to take tablets and a liquid formulation is required. Most are glucose-free.

Persuading children to take medicines is often a problem, especially if the preparation has an unpleasant taste.

Adherence (compliance) is improved when medicines are only required once or twice a day and if regimens are kept simple.
**Distribution**

Water comprises a larger percentage of the body in the neonate (80%) than in older children and adults (55%).

Drugs which distribute within the extracellular fluid will require a larger dose relative to body weight in infants than in adults.

As extracellular fluid correlates with body surface area, this is used when accurate drug dosage is required, e.g. cytotoxic agents. For drugs with a high margin of safety, drug dosages are expressed per kilogram body weight or based on age, with the assumption that the child is of average size. Weight-based dosages should not simply be extrapolated to older children, as the dosage will be excessively large.

In the first few months of life, the plasma protein is low.

More of the drug may be unbound and pharmacologically active. In jaundiced babies, bilirubin may compete with some drugs, e.g. sulphonamides, for albumin binding sites, making such drugs unsuitable for use in this situation.

**Elimination**

In neonates, drug biotransformation is reduced, as microsomal enzymes in the liver are immature.

This leads to a prolonged half-life of drugs metabolised in the liver, e.g. theophylline.

Renal excretion is reduced by the low glomerular filtration rate which increases the half-life of some drugs, e.g. vancomycin. Measuring the plasma drug concentration is necessary under these circumstances.
Breaking bad news

Doctors often face the difficult task of imparting bad news to parents and children.

In paediatric practice it is often because there is:

• a serious congenital abnormality at birth, e.g. chromosomal disorder
• the diagnosis of a disabling condition, e.g. cerebral palsy, neurodegenerative disorder, gross intracranial abnormality seen at ultrasound in preterm infants
• a serious illness, e.g. meningitis or malignant disease, or an accident, e.g. head injury
• the sudden death of a child, e.g. sudden infant death syndrome (SIDS).

Initial interview

The manner in which the initial interview is conducted is very important.

It may have a profound influence on the parents' ability to cope with the problem and their subsequent relationship with health professionals.

Parents often continue to recall and recount, for many years, details of the initial interview when they were informed that their child had a serious problem. Parents of children with life-threatening illnesses have said that what they valued most was open, sympathetic, direct and uninterrupted discussion in private that allowed sufficient time for doctors to repeat and clarify information and for them to ask questions.
How parents wish to be told the diagnosis of a life-threatening illness

Setting

• In private
• Uninterrupted
• Unhurried
• Both parents (or friend/relative) present if possible
• Senior doctor
• Nurse or social worker present

Establish contact

• Find out what the family knows or suspects
• Respect family's vulnerability
• Use the child's name
• Do not avoid looking at them
• Be direct, open, sympathetic

Provide information

• Flexibility is essential
• Pace rather than protect from bad news
• Name the illness
• Describe symptoms relevant to child's condition
• Discuss aetiology - parents will usually want to know
• Anticipate and answer questions. Don't avoid difficult issues because parents have not thought to ask
Explain long-term prognosis

• If child is likely to die, listen to concerns about time, place and nature of death

• Outline the support/treatment available

Address feelings

• Be prepared to tolerate reactions of shock, especially anger or weeping

• Acknowledge uncertainty

• How is it likely to affect the family?

• What and how to tell other children, relatives and friends?

Concluding the interview

• Elicit what parents have understood

• Clarify and repeat

• Acknowledge that it may be difficult for parents to absorb all the information

• Mention sources of support

• If possible, give parents contact telephone number

• Give address of self-help group

Follow-up

• Offer early follow-up

• Suggest to families that they write down questions in preparation for next appointment

• Ensure adequate communication of content of interview to:

  • other members of staff
  • general practitioner and health visitor
  • other professionals, e.g. a referring pediatrician
Discharge from hospital

Children should be discharged from hospital as soon as clinically and socially appropriate. Although there is increasing pressure to reduce the length of hospital stay to a minimum, this must not allow discharge planning to be neglected.

**Before discharge from hospital, parents and children should be informed of:**

- the reason for admission and any implications for the future
- details of medication and other treatment
- any clinical features which should prompt them to seek medical advice, and how this should be obtained
- the existence of any voluntary self-help groups if appropriate
- problems or questions likely to be asked by other family members or in the community. These should be anticipated by the doctor and discussed. What do the nursery or school, baby-sitters or friends need to know? What about sports, etc.?

**In addition:**

- Suitability of home circumstances needs to be assessed, particularly when the home requires adaptation for special needs.
- Social support may need to be arranged, especially in relation to child protection.
- Medical information should be added to the child's personal child health record.
- Consider who else should be informed about the admission and what information it is relevant for them to receive. This must be done before or at the time of discharge. The aim is to provide a seamless service of care, treatment and support, with the family and all the professionals fully informed
- This can be facilitated for children with a chronic illness or disability by having a key worker to coordinate their care
Some of the professionals who may need to be informed on admission or discharge about a child admitted to hospital.
Non accidental injury

Child abuse

Types

physical abuse (non-accidental injury, NAI)

- bruises
- head injury
- burns
- lacerations
- fractures
- internal injuries

Neglection

Emotional abuse

sexual abuse, including the use of children for pornography

Non-accidental poisoning - where children are deliberately poisoned

Fabricated or induced illness (formerly known as Munchausen's syndrome by proxy) - where symptoms or signs of illness in the child are made up or deliberately
Physical Abuse

Several questions help to distinguish accidental from inflicted injury:

1. What is the age of the patient?

2. Is the history plausible?

3. Does the history change with changing information supplied to the caretaker?

4. Does the history change when related in subsequent accounts by other family members?

5. Are there nonfamilial eyewitnesses to the injury?

6. Was the injury unwitnessed by the caretaker?

7. Is the caretaker’s demeanor defensive, belligerent, hostile, or passive and not in keeping with the seriousness of the patient’s condition?

8. Is the social situation in which the injury occurred a high-risk environment?

9. Can the described mechanism of injury account for the observed injury?

10. What else might produce the clinical picture?
Indicators of abuse

In the child

• Unexplained or unusual injuries
• Injuries in inaccessible sites e.g. neck, armpit, behind ears, on soles of feet
• Bite marks, scalds, fingertip bruising, fractures (especially in infants)
• Apparent age of injuries inconsistent with account given
• Injuries blamed on siblings
• Evidence of repeated injury
• Poor overall care and failure to thrive e.g. poor growth and weight; child appears dirty and unkempt; child persistently left without adequate supervision
• Swallowing of harmful substances, inappropriate food or drink
• Evidence of self-harm/ self-mutilation
• Indications of sexually transmitted disease
• Evidence of sexual activity/relationship that is inappropriate to the child’s age
• Behavioural problems e.g. aggression, hyperactivity, nervousness, social withdrawal

The parent/carer

• Provides an inconsistent explanation of the child’s injuries
• Delays seeking medical treatment or advice
• Shows detachment
• Attributes cause of injury to a sibling or bullying
• Lacks concern at the severity or extent of the injuries
• Gives history of repeated injury to the child
• Is reluctant to give information
• Refuses or is reluctant to allow treatment
• Exhibits aggressive behavior towards child/children
Risk factor for child abuse

• A. Handicapping condition in the child
• B. Parental alcoholism
• C. Parental history of abuse as a child
• D. Preterm birth of a child
• E. 1st born baby
Presentation of physical abuse

Bruises

These are the commonest mode of presentation. Whereas bruises on the forehead and shins are common in toddlers learning to walk, they are exceptional in non-mobile babies.

Bruises on the face, back and buttock are commonly in non accidents.

There is little evidence that bruises can be accurately aged.

Some patterns of bruising are suggestive of particular injuries.

Bruises from fingertips gripping with excessive force are mostly on the trunk, often on either side of the spine, but may also be seen around the mouth from trying to stop a baby crying, or on the arms from shaking.

Slap marks resembling handprints may be seen on the face or buttocks. Bruises may outline a particular object, e.g. a hand, belt or flex used in beating.

Cutaneous injuries

Location of Cutaneous Injuries

Inflicted

- Upper arms
- Trunk
- Upper anterior legs
- Side of face
- Ears and neck
- Genitalia
- Shine of head before 1yr age
- Check of any age
- Wrist and elbow
- Different age
- Specific shape

Accidental

- Shins 1–3 yr
- Hips (iliac crest)
- Lower arms
- Prominences of spine
- Forehead 1–3 yr
- Under chin
Bruising

Cheek bruises and forehead old bruises in dirty baby
Bruises of different ages

Ear bruising
Bruising – unusual sites
Slap marks
Adult bite marks may be seen in abuse, but bites from other children are not uncommon.
Fingertip bruising

Lash marks

Lash marks from an electric cord.

Such marks are distinctive.

The deep lacerations, result in deep tissue damage, and there is a potential for keloid formation on healing
Bruising on the buttocks

Torn frenulum

Torn frenulum persist for many years
Non-haematological conditions, which may be mistaken for non-accidental bruising

Vasculitic
- meningococcal, streptococcal, viral
- Drug-related
- Erythema nodosum
- Henoch–Scho¨nlein purpura

Vascular
- Capillary haemangioma
- facial veins

Connective tissue disorders
- Ehlers–Danlos syndrome
- Hypermobility syndrome
- Scurvy

Traumatic
- Subconjunctival haemorrhage secondary to coughing or vomiting
- Cultural practices such as coining or cupping
- Self-harm

Artefactual
- Ink, paint or dye marks
- Factitious bruising
First-stage investigations for bruises which may be mistaken for non-accidental bruising

- Full blood count, of blood film, measurement of mean platelet volume
- Tests of liver and renal function
- Prothrombin time
- Activated partial thromboplastin time
- Thrombin time and Clauss fibrinogen concentration
- Factor VIII and factor IX assays
- von Willebrand factor antigen, ristocetin cofactor and blood group
- Factor XIII assay, platelet membrane glycoproteins

Second-stage investigations

- Repeat of abnormal investigations found in first stage
- Consider correction studies with normal plasma
- Factor assays – II, V, VII, VIII, IX, X
- Factor XIII assay (if not included in first-stage investigations)
- Investigation of thrombocytopenia if present
- Platelet aggregation tests (or flow cytometry in infants)
- Platelet nucleotide analysis
- Alpha-2-antiplasmin level
- Plasminogen activator inhibitor-1 activity
Diagnosis suggested by abnormal results

**Isolated prolongation of APTT**
- Heparin contamination
- von Willebrand disease
- Factor VIII deficiency
- Factor IX deficiency
- Factor XI deficiency
- Factor XII deficiency

**Isolated prolongation of PT**
- Liver disease
- Warfarin ingestion
- Congenital factor VII deficiency

**Prolonged PT and APTT with normal fibrinogen**
- Vitamin K deficiency $2_7_9_10$
- Warfarin ingestion
- Prothrombin deficiency
- Factor X deficiency
- Factor V deficiency
- Combined factor V and VIII deficiency

**Prolonged PT and APTT and decreased fibrinogen**
- Disseminated intravascular coagulation
- Severe liver disease
- Afibrinogenaemia
- Dysfibrinogenae
Laboratory Studies in Physical Abuse Cases

- Complete blood cell count with morphology analysis; serial hematocrit levels
- Serum electrolytes, blood urea nitrogen, creatinine, serum and urine osmolality
- Urinalysis
- Liver function studies (aspartate aminotransferase, alanine aminotransferase, bilirubin, alkaline phosphatase)
- Serum amylase
- Creatine phosphokinase
- Cultures of blood, urine, cerebrospinal fluid (if safe to perform LP)
- Prothrombin time, partial thromboplastin time, platelet count
- Stool for blood
- Arterial blood gases
Burns or scalds

It is often difficult to distinguish burns and scalds inflicted deliberately from those that are accidents.

Accidental hot water burns tend to be asymmetrical, spare the flexures and have geographical splash marks.

Deliberate bath scalds may scald the back, which is uncommon in accidents. The shape of the injury may be suggestive of its aetiology, e.g. a cigarette burn.

<table>
<thead>
<tr>
<th>Inflicted</th>
<th>Accidental</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td></td>
</tr>
<tr>
<td>Burns attributed to sibling</td>
<td>Compatible with observed injury</td>
</tr>
<tr>
<td>Unrelated adult seeks medical care</td>
<td></td>
</tr>
<tr>
<td>Differing accounts of injury</td>
<td></td>
</tr>
<tr>
<td>Treatment delay &gt;24 hr</td>
<td></td>
</tr>
<tr>
<td>Prior “accidents”</td>
<td></td>
</tr>
<tr>
<td>No parental concern</td>
<td></td>
</tr>
<tr>
<td>Lesion incompatible with history</td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
</tr>
<tr>
<td>Buttocks, perineum, genitalia, Ankles, wrists</td>
<td>Front of body</td>
</tr>
<tr>
<td>Palms, soles</td>
<td>Random and injury-specific</td>
</tr>
<tr>
<td><strong>Pattern</strong></td>
<td></td>
</tr>
<tr>
<td>Sharply demarcated edges</td>
<td>Associated irregular splash burns</td>
</tr>
<tr>
<td>Stocking-glove distribution</td>
<td>Partial thickness</td>
</tr>
<tr>
<td>Full thickness</td>
<td>Asymmetrical</td>
</tr>
<tr>
<td>Symmetrical</td>
<td>One traumatic event</td>
</tr>
<tr>
<td>Burns older than history</td>
<td></td>
</tr>
<tr>
<td>Burn neglected, infected</td>
<td></td>
</tr>
<tr>
<td>Numerous lesions of varying ages</td>
<td></td>
</tr>
<tr>
<td>Pattern of burn consist with instrume</td>
<td></td>
</tr>
<tr>
<td>Large area of uniform dry contact burn</td>
<td></td>
</tr>
</tbody>
</table>
Other medical conditions which need to be considered and excluded in suspected child abuse with burn

- Scalds and cigarette burns - may be misinterpreted in children with bullous impetigo or scalded skin syndrome. In cigarette burn is circular and less deep. Burns from a flat surface.

There are contact burns on the anterior and posterior parts on both soles. The child's feet were thought to have been placed on a hot cooking ring.

Burn from a hot iron
This child has immersion burns in a symmetrical stocking distribution which were sustained when she was lowered into a hot bath.

Accidental scalds often involve the upper parts of the body, e.g. from pulling over a hot drink, and the scalds are often irregular with splash marks.

Scalds
Cigarette burns

There is a deep punched-out crater on the dorsum of the hand, a typical site for nonaccidental cigarette burns.

This is not a particularly common form of abuse and may sometimes be difficult to distinguish from impetigo.

Accidental cigarette burns usually consist of a circular mark and a tail and are less deep.

This child has immersion burns in a symmetrical stocking distribution which were sustained when she was lowered into a hot bath.

Match burns

These injuries, like many other non-accidental burns, represent serious abuse and, suggest a sadistic intent on the part of the abuser.
Skeletal injuries

fractures due to child abuse are predominantly a problem of young children under 30 months, particularly babies. The most specific fractures for abuse are those of the ribs, which, if major trauma or bone disease is excluded, have a probability of abuse of (97%).

These rib fractures are due to squeezing and are usually posterior.

Anterior Rib Fractures can be caused by abuse but children who have cardiopulmonary resuscitation may rarely have anterior rib fractures.

When assessing fractures, it is the history and the child's age, mobility and development that are the crucial features in distinguishing accidental from non-accidental injuries.

In infants accidental fractures of the long bones are uncommon in the non-mobile child.

When considering humeral fractures, the type is important - only 4% of supracondylar fractures are due to abuse; however, non-supracondylar fractures of the humerus in infants are associated with abuse.

in children over 5 years most long-bone fractures are accidental.
Likelihood of a fracture being due to non-accidental injury

High

- Metaphyseal fractures.
- Scapular. Fx
- depressed and occipital skull Fx
- Posterior rib fractures .non supracondylar of humerus Fx and spiral Fx of long bone in nonmobil child

Moderate

- Multiple fractures
- Fractures of different ages
- Complex skull fracture

Low

- Clavicular fractures
- Long-bone shaft fractures (mobile child)
- Linear skull fractures
Differential Diagnosis of Skeletal Trauma

- Obstetric trauma
- Prematurity
- Nutritional-metabolic defects
- Scurvy
- Rickets
- Renal osteodystrophy
- Menkes syndrome
- Mucolipidosis type II (I-cell disease)
- Methotrexate osteodystrophy
- Prostaglandin therapy
- Hypervitaminosis A
- Congenital syphilis
- Osteomyelitis
- Cerebral palsy
- Myelodysplasia
- Skeletal dysplasias
- Osteogenesis imperfecta
- Caffey disease
- Leukemia
- Metastatic neuroblastoma
- Histiocytosis X
- Toddler fracture
- Normal variant
- Physiologic periosteal new bone
## Dating Fractures

<table>
<thead>
<tr>
<th>Category</th>
<th>Early (Days)</th>
<th>Peak (Days)</th>
<th>Late (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Resolution of soft tissues swelling</td>
<td>2-5</td>
<td>4-10</td>
<td>10-21</td>
</tr>
<tr>
<td>2. Periosteal new bone</td>
<td>4-10</td>
<td>10-14</td>
<td>14-21</td>
</tr>
<tr>
<td>3. Loss of fracture line definition</td>
<td>10-14</td>
<td>14-21</td>
<td></td>
</tr>
<tr>
<td>4. Soft callus</td>
<td>10-14</td>
<td>14-21</td>
<td></td>
</tr>
<tr>
<td>5. Hard callus</td>
<td>14-21</td>
<td>21-42</td>
<td>2-90</td>
</tr>
<tr>
<td>6. Remodeling</td>
<td>3 months</td>
<td>1 yr</td>
<td>&gt;2 yr</td>
</tr>
</tbody>
</table>
Metaphyseal fracture.

A, Lateral view of the knee in 5-month-old infant reveals a complete metaphyseal fracture of the tibia and an incomplete fracture of the fibula.

There are corner fractures of the femur.

B, Bucket-handle fracture of the tibia in a 3-month-old infant.
A metaphyseal fracture, usually caused by wrenching, is highly suggestive of non-accidental injury.

Posterior rib fractures are usually from squeezing rather than direct trauma. Anterior and posterior fractures are present.

There is a fracture line on the 9th rib on the right; the others are healing with callus formation.

The fractures are from different episodes of trauma.
The skeletal survey

• In children under the age of two where physical abuse is suspected, a full skeletal survey should always be performed.

• In children over the age of two years, the decision to perform a skeletal survey will be guided by clinical and social history and physical findings.

• Radionuclide bone scans can be substituted for skeletal surveys in children over 1 year of age

The standard child protection skeletal survey for suspected non-accidental injury

Skull

• Anterior posterior (AP), lateral, and Townes view (the latter if clinically indicated).

• Skull x-rays should be taken with the skeletal survey even if a CT scan has been doing

Chest

• AP including the clavicles.

• Oblique views of both of the sides of the chest to show ribs (‘left and right oblique’).

Abdomen

• AP of abdomen including the pelvis and hips.

Spine

• Lateral: this may require separate exposures of the cervical, thoracic and thoraco-lumbar regions.

• If the whole of the spine is not seen in the AP projection on the chest and abdominal radiographs then additional views will be required.

• AP views of the cervical spine are rarely diagnostic at this age and should only be performed at the discretion of the radiologist.
Limbs

• AP of both upper arms
• AP both forearms
• AP both femurs
• AP both lower legs
• PA of hands
• DP of feet

Additional/ supplementary imaging for suspected non-accidental skeletal injury

• a) When there are equivocal findings on the skeletal survey.
• b) Where the skeletal survey is negative but there remain ongoing clinical child protection concerns.

Other medical conditions which need to be considered and excluded in suspected child abuse with fracture

Osteogenesis imperfecta, commonly referred to as brittle bone disease. The type commonly involved with unexplained fractures is type I, which is inherited in a dominant manner, so there may be a family history.

Blue sclerae are a key clinical finding and there may be generalised osteoporosis and wormian bones in the skull on skeletal survey.

Copper deficiency.

Very rarely predisposes to fractures as there is sufficient copper to prevent deficiency in breast milk and all types of milk formula.

It can occur if the infant is preterm or malnourished
A radionuclide bone scan is more sensitive in detecting fractures in the early stages. This scan clearly shows multiple rib fractures.
Non-accidental head injuries

Head injury may follow severe shaking, particularly in children under 6 months.

Less often, there are direct blows to the head. Vigorous shaking of babies may rupture the small vessels crossing the subdural space, causing a subdural haemorrhage.

There may also be hypoxic-ischaemic damage caused by the apnoea associated with severe shaking. There may be no signs of bruising on the surface of the skull.

Retinal haemorrhages are often present in head injuries from non-accidental injury.

Clinical features include irritability, poor feeding, increasing head circumference, convulsions, reduced level of consciousness, anaemia and a full fontanelle.

Direct blows to the head are usually less of a diagnostic problem as there is bruising and there may be an underlying skull fracture.

Non-accidental head injury (NAHI) or shaken baby syndrome (SBS)

is characterised by the triad of

- subdural haemorrhage
- retinal haemorrhage
- encephalopathy.

The term ‘shaken baby syndrome’ has become controversial because it commits to the mechanism of causation of trauma. ‘Non-accidental head injury’ on the other hand is a more objective term.

It recognises presence of trauma as a cause when there is subdural haemorrhage and/or retinal bleeds.
Also, the term implies the history being incompatible with the findings the cornerstone of non-accidental injuries.

Head injury is the most common cause of death in physical child abuse. A total of 95% of severe head injury in the first year of life is inflicted. The mortality from NAHI is up to 30%.

Half of the survivors have residual disability of variable severity.

Factors associated with neurodevelopmental impairment are

- low initial GCS
- severe retinal haemorrhage
- skull fracture,
- cranial growth retardation
- intraparenchymal brain lesion in first 3 months.
Mechanism of brain damage in NAHI

Repeated acceleration and deceleration forces were initially thought to result in shearing of the bridging veins leading to subdural haemorrhage and tearing of retinal veins leading to retinal haemorrhage.

Evaluation

It is important that other causes for the different components of the triad have been excluded before the diagnosis of NAHI is committed to. The exact sequence of events, developmental status of the baby and vitamin K administration are important considerations in the history.

Thorough examination including examination of fundii should be done followed by proper ophthalmologic examination as soon as possible.

Investigations include social services involvement and an urgent strategy meeting, LP, CT head (and where possible followed by MRI if CT was abnormal) and skeletal survey and bone scan or repeat skeletal survey.

It has been recommended that repeat neuro-imaging be done on follow-up if initial test were abnormal.

Tests to rule out medical causes for bleeds: full septic screen, full blood count (FBC), clotting screen, urine Toxicology and metabolic screen.

A repeat FBC in 24–48 hours may show falling Hb.
Differential diagnosis

Retinal haemorrhages can occur after birth.

Most disappear rapidly within the first few days of life with occasional larger subhyaloid and intraretinal haemorrhages lasting up to 6 weeks.

Subdural haemorrhage may occur in the perinatal period associated with birth trauma and present severe symptoms or may be discovered incidentally in asymptomatic infants.

The latter resolve within 4 weeks.

Other rare causes of subdural haemorrhage include cranial malformations, glutaric aciduria type 1 postoperative complication of open-heart surgery or neurosurgery, hypernatraemic dehydration.

Glutaric aciduria type I is a rare metabolic condition presents within the first 12 months of life of an acute metabolic encephalopathic crisis.

Retinal haemorrhages are found in 20–30% of patients. Seizures are seen in 20% of children.

Repeated examinations of organic acids in the urine and enzyme assay may be necessary to confirm the diagnosis.

On neuro-imaging, it is nearly always accompanied by frontal lobe hypoplasia if there is suspicion that a head injury in a young child is non-accidental, it necessitates:

- an immediate CT scan followed later by a MRI scan
- a skeletal survey to exclude fractures
- an expert ophthalmological examination
- a coagulation screen.
Images in a 6-month-old with seizures. Computed tomographic image reveals a focal acute high-density hematoma over the right cerebral convexity.

There is generalized enlargement of the extracerebral spaces, reflecting either chronic subdural hematoma or brain atrophy.

B, Coronal T1-weighted magnetic resonance image shows the acute right convexity subdural hematoma as a mass with high signal intensity.

A subacute subdural hematoma with lower signal intensity surrounds the acute lesion. There is also generalized brain atrophy with increased extracerebral space; the normal cerebrospinal fluid over the left cerebral convexity is of lower signal intensity than is the subacute hematoma over the right convexity.

Unenhanced computed tomographic image in an abused 3-month-old infant reveals generalized right-sided decrease in brain density caused by diffuse cerebral edema.

The right lateral ventricle is effaced, and there is a shift of midline structures to the left.

Posterior and anterior subdural interhemispheric hemorrhages are also present.
Extensive retinal haemorrhage is present due to acceleration/deceleration forces associated with shaking.

Retinal haemorrhages may occur in neonates, but they disappear within a few days and their presence thereafter is a strong pointer towards abuse. There may be an associated brain injury; in particular, subdural haematoma should be excluded.
Imaging algorithm for suspected non-accidental head injury (neuroimaging)

Acute presentation

CT as soon as stable

CT normal
normal CNS

CT normal
Abn. CNS

CT abnormal
SDH or brain abn.

MRI 3-5 days

MRI nor.
well

stop

stop

Non acute

CT OR MRI timing

CT MRI abn.
SDH or brain abn.

MRI abn.
Abn. CNS

MRI repeat
depended on
clinical state

CT MRI normal
normal CNS

MRI 3-6 mo.

stop
Abdominal injuries

Visceral injuries, particularly to the small bowel, spleen and liver, may follow blows or kicks to the abdomen.

They are uncommon and often difficult to diagnose.

There may not be any abdominal bruising.

These injuries are usually in children under 5 years and small bowel injury is more common in abuse than in both road traffic accidents and falls.

Non-accidental abdominal trauma carries a high morbidity and mortality.
## Types of Abdominal and Thoracic Injuries

<table>
<thead>
<tr>
<th>Organ</th>
<th>Injury</th>
<th>Signs/Symptoms/Diagnostic Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypopharynx/lesion pharynx</td>
<td>Traumatic perforation</td>
<td>Feeding difficulty, drooling, palatal abrasion, sloughing</td>
</tr>
<tr>
<td>Esophagus</td>
<td>Traumatic perforation</td>
<td>Coughing, blood-tinged sputum, Interstitial emphysema, radiographic study</td>
</tr>
<tr>
<td>Stomach</td>
<td>Traumatic perforation</td>
<td>Shock and collapse, Distended abdomen, Free peritoneal air on plain radiographic study</td>
</tr>
<tr>
<td>Duodenum</td>
<td>Blunt abdominal trauma</td>
<td>High intestinal obstruction, Gastric dilatation, Vomiting</td>
</tr>
<tr>
<td>Jejunum, ileum</td>
<td>Blunt trauma</td>
<td>Possible peritonitis secondary to perforation, Obstruction</td>
</tr>
<tr>
<td>Genitourinary tract genitilia</td>
<td>Sexual abuse</td>
<td>Bruising, abrasions, tears of external Sadistic abuse Rupture of bladder</td>
</tr>
<tr>
<td>Liver</td>
<td>Blunt trauma</td>
<td>Abdominal distention, Shock, collapse, Elevated aspartate aminotransferase, CT or ultrasound evidence of injury</td>
</tr>
<tr>
<td>Alanine,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spleen</td>
<td>Blunt trauma</td>
<td>Peritoneal irritation, left shoulder pain, Blood loss, shock, CT or ultrasound evidence of injury</td>
</tr>
<tr>
<td>Pancreas</td>
<td>Deep epigastric blunt trauma</td>
<td>Abdominal distention, tenderness, Elevated amylase, CT or ultrasound evidence of injury</td>
</tr>
</tbody>
</table>
Neglect

- failure to thrive
- inadequate hygiene, including severe nappy rash or infestation
- poor development of emotional attachment to the child's caregiver
- delay in development and speech and language
- poor attendance for immunisations and school

In such cases, head circumference and length may be appropriate for age unless neglect has been long-standing.

Emotional abuse

the withdrawal of love by rejecting the child
- malicious criticism, threats and ridicule
- scapegoating
Fictitious or induced illness (induced) poisoning

• putting blood in vomit, stool and urine
• placing sugar in the urine so that a diagnosis of diabetes mellitus is made
• contaminating microbiological specimens

Clinical Indicators of Abuse by Poisoning

Age

- <1 yr or between 5 and 10 yr

History

- Nonexistent discrepant, or changing Does not fit child’s development
- Previous poisoning in this child
- Previous poisoning in siblings
- Does not fit circumstances or scene
- Third party, often a sibling, is blamed
- Delay in seeking medical care

Toxin

- Multiple toxins
- Substances of abuse
- Bizarre substances

Presentation

- Unexplained seizures
- Life-threatening events
- Apparent sudden infant death syndrome
- Death without obvious cause
- Chronic unexplained symptoms that resolve when the child is protected
- Other evidence of abuse or neglect
Essential Elements of the Management of Munchausen Syndrome by Proxy

1. Maintain high index of suspicion

2. Ensure child’s safety

3. Assemble multidisciplinary team

4. Collect evidence, including covert video surveillance,
   • before confronting parent with the suspected diagnosis

5. Parental personality is a poor predictor

6. Realize that confrontation rarely results in a confession

7. Present evidence to legal system to determine
   • a. Necessity of removal of child from home
   • b. Institution of a close monitoring system
Sexual abuse

A common definition of child sexual abuse is 'involvement of dependent, developmentally immature children and adolescents in sexual activities that they do not fully comprehend, are unable to give informed consent to and that violate social taboos of family roles'.

It includes a variety of acts

- genital exposure
- fondling
- genital, anal or oral sexual activity or intercourse, including rape
- involvement in pornography

Victims can be of any age and of either sex, but girls outnumber boys, in contrast to other forms of abuse

Children may be abused by:

- someone in the family
- a trusted adult, such as a baby-sitter
- someone outside the family, but this is much less common

Sexual abuse may also present with

- genital trauma or infection
- sexually transmitted disease
- highly sexualised behavior towards adults or children
- unexplained pregnancy
- inexplicable change in behavior or school work.
Family risk factors for child sexual abuse

- Poor parental sexual relationship
- Maternal depression or physical illness
- Mother sexually abused in childhood
- Father/abuser either inadequate or aggressive
- Family chaotic, disorganised or socially isolated
- Parentified daughter who has taken over mother's role
Clinical features include:

- bruising around the thighs, genitalia, anus, perineum, buttocks and lower abdomen
- tears and abrasions to the female genitalia - in particular, the hymen may be torn; however, vulval soreness is common in young girls and is rarely due to abuse
- tears and abrasions to the male genitalia
- anal fissures (may be associated with constipation)
- reflex anal dilatation - this is where the buttocks are parted for 30-45 seconds, and in a positive test the anus opens and the rectum can be seen because of incompetence of the internal sphincter.

Reflex anal dilatation and anal fissures in isolation are not reliable signs of child sexual abuse as they may have other causes such as constipation.

The goals of the physical examination are as follows:

1. First, do no harm.”
2. Diagnose and treat, when necessary, injured tissue.
3. Diagnose and treat sexually transmitted diseases (STDs).
4. Diagnose and make decisions regarding pregnancies for patients in the childbearing years.
5. Thoroughly examine and document medical forensic evidence when indicated.
6. Make decisions about disposition and further diagnosis and therapy.
7. Document the findings with a consideration of both medical and legal aspects.
The examination should be with the knowledge and agreement of the parent, although it may occasionally be performed at the request of the Court.

Adolescent girls must give their consent and all children should be accompanied by a trusted adult. In the case of young children, this is usually a parent.

It should be performed in privacy, calmly and in a non-threatening environment.

The medical examination is rarely diagnostic and significant physical findings are present in less than 30% of sexually abused children.

Physical signs must be interpreted in conjunction with the history.

There is considerable variation in the normal appearance of the female genitalia.

This is partly age-dependent.

A normal examination does not exclude abuse.

If sexual abuse is suspected, the procedures of the local safeguarding children committee should be followed. Further information may be obtained from the child during an interview held jointly by a social worker and police officer experienced in child sexual abuse work.

Psychological damage secondary to sexual abuse frequently occurs and may need specialist treatment.

Post-traumatic stress disorder is a recognised sequel and can persist into adult life.
Proposed Classification of Anogenital Findings in Children

**Normal (Class 1)**

- Periurethral or vestibular bands
- Longitudinal intravaginal ridges 3-9 o’clock
- Hymenal tags
- Posterior hymenal rim 1 mm wide
- Hymenal clefts in the anterior (superior)
- Half of the hymenal rim
- Hymenal bumps or mounds
- Diastasis ani at 6 or 12 o’clock
- Anal tag and perianal pigmentation

**Nonspecific (Class 2)**

- Erythema of vestibule or perianal tissues
- Increased vascularity of vestibule or hymen
- Labial adhesions
- Condyloma acuminata in a child younger than 2 yr old
- Anal fissures
- Flattened anal folds
- Anal dilation with stool present
- Venous congestion of perianal tissues

**Suspected for Abuse (Class 3)**

- Enlarged hymenal opening (>2 standard deviations above mean for age and position)
- Immediate venous congestion of perianal tissues with edema and/or distorted anal folds
- Anal dilation of at least 20 mm with stool not visible
- Posterior hymenal rim less than 1 mm in all views
- Condyloma acuminata in a child older than 2 yr of age
- Acute abrasions or lacerations in the vestibule or on the labia (not involving the hymen)
Suggestive of Abuse/Penetration (Class 4)

- Combination of two or more suspected anal findings or two or more suspected genital findings
- Scar of fresh laceration of the posterior fourchette
- Perianal scar

Clear Evidence of Penetrating Injury (Class 5)

- Posterior (inferior) half of the hymenal rim an
- Absence of hymenal tissue
- Obvious hymenal transections
- Perianal lacerations extending beyond (deep to) the external anal sphincter
- Recent hymenal-vaginal lacerations
- Lacerations through the hymen and posterior fourchette or perineum

Normal and nonspecific anogenital findings:

- Hymenal tags
- Hymenal bumps or mounds
- Labial adhesions
- Clefts or notches in the anterior half of the hymen
- Vaginal discharge
- Genital or anal erythema
- Perianal skin tags
- Anal fissures
- Anal dilatation with stool in ampulla
Physical findings that are concerning for sexual abuse:

- Notches or clefts in the posterior half of the hymen extending nearly to the vaginal floor, confirmed in all positions
- Condylomata acuminata in a child older than two years who gives no history of sexual contact
- Immediate, marked anal dilatation > 20mm with no stool
- Anal scarring

Physical findings that are diagnostic of penetrating trauma

- Acute laceration or ecchymosis of the hymen
- Absence of hymenal tissue in any portion of the posterior half
- Healed hymenal transection or complete cleft
- Deep anal laceration
- Pregnancy without history of consensual intercourse
Overall Assessment of the Likelihood of Sexual Abuse

Class 1: No Evidence of Sexual Abuse

1 Normal examination, no history, no behavioral changes, no witnessed abuse

2 Nonspecific findings with another known cause, and no history or behavioral changes

3 Child considered at risk for sexual abuse but gives no history and has nonspecific behavioral changes

4 Physical findings of injury consistent with accidental trauma with history given

Class 2: Possible Abuse

1 Class 1, 2, or 3 findings in combination with significant behavioral changes, especially sexualized behaviors, but child unable to give history of abuse

2 Presence of condyloma or herpes simplex type I (genital) in the absence of a history of abuse, with otherwise normal examination findings

3 Child has made a statement but given no detailed or consistent history

4 Class 3 findings with no disclosure of abuse
**Class 3: Probable Abuse**

1. Child gives a clear, consistent, detailed description of molestation, with or without other findings present

2. Class 4 or 5 findings in a child, with or without a history of abuse, in the absence of any convincing history of accidental penetrating injury

3. Culture-proven infection with Chlamydia trachomatis (child >2 yr of age) in a prepubertal child; also, culture-proven herpes simplex type 2 infection in a child or documented Trichomonas infection

**Class 4: Definite Evidence of Abuse or Sexual Contact**

1. The finding of sperm or seminal fluid in or on child’s body

2. A witnessed episode of sexual molestation; this also applies to cases in which pornographic photographs or videotapes are acquired as evidence

3. Nonaccidental, blunt penetrating injury to the vaginal or anal orifice

4. Positive, confirmed cultures for Neisseria gonorrhoeae in a prepubertal child, or serologic confirmation of acquired syphilis

5. Pregnancy
Lab results selected child sexual abuse victims at high risk

- gonorrheal cultures from pharyngeal, anal, and urethral or vaginal sites

- chlamydial cultures from vaginal and anal sites in girls and from anal and urethral sites in boys

- serologic testing for syphilis, HIV, hepatitis B

- examination for anogenital warts or ulcerative lesions

- in girls, culture or wet mounts of vaginal secretions for microscopic examination for Trichomonas species

- repeat serologic testing 2, 6, 12, and 24 weeks after the assault
Collecting Forensic Specimens in Sexual Abuse Cases

1. Obtain 2-3 swabbed specimens from each area of body assaulted (for sperm, acid phosphatase, P30, MHS-5 antigen, blood group antigen determinations), Most laboratories request air-dried specimens, which require drying for 60 min before they can be packaged.

2. Mouth: Swab under tongue and buccal pouch next to upper and lower molars. These areas are locations of seminal fluid.

3. Vagina: Use dry or moistened swab or 2 mL saline wash.

4. Rectum: Insert swab at least 1/2 to 1 inch beyond anus.

5. Specimens should be taken from any other suspicious site on the body.

6. Make saline wet mount of specimens from all assaulted orifices and examine immediately for presence of motile and nonmotile sperm.

7. Some forensic laboratories request a dry smear of each secretion.

8. Collect saliva specimen to determine the victim’s antigen secretion status.

9. Obtain a venous blood sample from the victim for antigen secretor status.

10. Save torn or bloody clothes or any clothing when semen staining is suspected.

11. If the victim was wearing a tampon, pad, or diaper during the assault or if a fresh tampon, pad, or diaper was used after the abuse, save this for analysis;

12. Save any foreign material found on removal of clothing.

13. Collect samples of combed pubic hair or scalp hair and fingernail scrapings.

14. Specimens should also be taken to screen for sexually transmitted diseases.
Conditions Confused with Child Sexual Abuse

Dermatologic Conditions

- Erythema and excoriations
- Diaper rash
- Poor hygiene
- Candida infection  Pinworms
- Allergy/irritants  Bruises
- Mongolian spots
- Hypersensitivity vasculitis
- Purpura fulminans
- Coining and other folk practices
- Phytodermatitis
- Seborrheic, atopic, and contact dermatitis
- Lichen planus
- Lichen simplex chronicus
- Psoriasis

Congenital Conditions

- Midline pits
- fusion defects
- shiny areas
- Prominent median raphe
- Midline tags
- Linea vestibularis
- Diastasis recti (depressed fan-shaped areas)
- Genital hemangiomas

Injuries

- Straddle injuries
- Violent abduction of the legs
- Motor vehicle accidents
- Self-destructive behavior in retarded children
- Female circumcision
Anal Conditions

- Severe or chronic constipation and megacolon
  Neurogenic patulous anus (myotonic dystrophy)
- Fistula
- Inflammatory bowel disease
- Pinworms
- Hemolytic-uremic syndrome
- Rectal polyps or tumor
- Eversion of the anal canal/rectal prolapse

Urethral Conditions

- Prolapse
- Caruncle
- Hemangioma
- Polyps
- Papilloma
- Cyst
- Condyloma
- Prolapsed bladder or ureterocele

Infections

- Vaginitis with organisms not sexually transmitted
- Group A b-hemolytic streptococcus
- Shigella species
- Pinworms
- Nonpathologic Neisseria species
- Haemophilus species
- Varicella
- Molluscum
- Chlamydia
- Syphilis
- Herpes simplex virus (HSV)
- Human papillomavirus (HPV) infection
View of the genitalia of a 7-year-old girl sexually molested by her father and uncle; labial traction method.

Narrow hymenal rim (arrow a) with exposed ridges (arrows b) at the 3- and 9-o’clock positions, anterior column (arrow c), and enlarged hymenal orifice.
Sexual abuse

A small tear is present at the posterior fourchette in this girl who disclosed sexual abuse.

In contrast to injuries caused by sexual abuse, accidental injuries to the vulva are more likely to occur anteriorly.

The anus is widely dilated on immediate parting of the buttocks in this boy who disclosed recent penile penetration by an older relative.
## Presentations of child abuse and neglect

<table>
<thead>
<tr>
<th>Presentation</th>
<th>May be indicative of</th>
<th>Response</th>
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</thead>
<tbody>
<tr>
<td>Non-accidental or unexplained injury possibly</td>
<td>Physical abuse</td>
<td>Social services and police investigation</td>
</tr>
<tr>
<td>Inadequate feeding, failure to thrive</td>
<td>Neglect of provision</td>
<td>Social services investigation</td>
</tr>
<tr>
<td>Child left alone</td>
<td>Neglect of supervision</td>
<td>Social services assessment</td>
</tr>
<tr>
<td>Unsafe environment</td>
<td></td>
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<tr>
<td>Variety or lack of continuity of caregivers</td>
<td></td>
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<tr>
<td>Various forms of parent–interaction including scapegoating and rejection; emotional unavailability; social and behavioural difficulties</td>
<td>Emotional abuse and emotional neglect</td>
<td>Psychological/psychiatric assessment</td>
</tr>
<tr>
<td>Illness that cannot be explained</td>
<td>Fabricated or induced</td>
<td>Reliant on paediatric diagnosis, with multiattention</td>
</tr>
<tr>
<td>Child presented very frequently for illness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allegations of sexual abuse</td>
<td>Sexual abuse</td>
<td>Social services and police investigation</td>
</tr>
<tr>
<td>Inappropriate sexualised behavior</td>
<td></td>
<td>Possibly paediatric examination</td>
</tr>
<tr>
<td>Sexually transmitted disease or pregnancy</td>
<td></td>
<td></td>
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<tr>
<td>Genital injuries</td>
<td></td>
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<tr>
<td>Unexplained developmental delay</td>
<td>Any of the above</td>
<td>Careful multidisciplinary assessment</td>
</tr>
<tr>
<td>Unexplained major change in behavior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression, misery and avoidant behavior (self-harm, running away)</td>
<td></td>
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</tbody>
</table>
Management of child abuse

What to do if you suspect abuse

- Discuss your concerns with the named professional for child protection or the designated member of staff within your organisation. If, after discussion, you still have concerns and consider the child may be in need or at risk of suffering significant harm, you should refer the child and family to social services, or in an emergency to the police.

- Communicate with the child in a way that is appropriate to their age and understanding.

Children have a right to know what is happening and, where appropriate, should be consulted on actions and decisions that affect them.

- When you make a referral to Social Services, clarify with them what the child and their parents or guardian will be told and by whom.

- If your referral to Social Services is done by telephone, confirm it in writing within 48 hours.

It is advisable to use local standard referral forms where they exist.

Social services should acknowledge a written referral within one working day of receipt.

If a written acknowledgement is not received within 3 working days, contact Social Services again.

- Make a record of all concerns and discussions about the child, the decisions you have taken and the reasons for these.
Management of suspected child abuse

Abused children may present to doctors in the hospital or to medical or nursing staff in the community.

They may also be brought for a medical opinion by social services or the police.

In all cases, the procedures of the local safeguarding children committee should be followed.

The medical consultation should be the same as for any medical condition, with a full history and full examination.

It is usually most productive when this is conducted in a sensitive and concerned way without being accusatory or condemning.

Any injuries or medical findings should be carefully noted, measured, recorded and drawn on a body map and photographed (with parental consent).

The height, weight and head circumference should be recorded and plotted on a centile chart.

The interaction between the child and parents should be noted.

All notes must be meticulous, dated, timed and signed.

Treatment of specific injuries should be instigated and blood tests and X-rays undertaken.

If abuse is suspected or confirmed, a decision needs to be made as to whether immediate treatment is required and if the child needs immediate protection from further harm.

If this is the case, this may be achieved by admission to hospital, which also allows investigations and multidisciplinary assessment.

If sympathetically handled, most parents are willing to accept medical advice for hospital admission for observation and investigation.
Occasionally this is not possible and legal enforcement is required.

The safety of other siblings or children at home needs to be considered.

If medical treatment is not necessary but it is felt to be unsafe for the child to return home, a placement may be found in a foster home.

**In addition to a detailed medical assessment:**

- evaluation by social workers and other health professionals will be required.

A child protection conference will be convened in accordance with local procedures.

In the UK, the conference will be chaired by a senior member of the social services department or of the National Society for the Prevention of Cruelty to Children (NSPCC).

Members of the conference may include social workers, health visitors, police, general practitioner, paediatricians, teachers and lawyers. Increasingly, parents attend all or part of the case conference.

Details of the incident leading to the conference and the family background will be discussed.

Good communication and a trusting working relationship between the professionals are vital as it can be extremely difficult to evaluate the likelihood that injuries were inflicted deliberately and the possible outcome of legal proceedings.
The conference will decide:

- whether to place the child's name on the Child Protection Register
- whether there should be an application to the Court to protect the child
- what follow-up is needed.

If the child is placed on the Child Protection Register, the social services department will produce a child protection care plan, which will include medical follow-up in many instances.

In the UK, there have been a number of high profile child protection court cases.

Where there is evidence, or reason to believe that a child may be being sexually abused, it is essential that prompt action is taken and that concerns are discussed with the appropriate agencies or individuals. However, some of the early local protocols stated that information about instances where a child under 13 years is believed to be, or has been, engaging in sexual activity, must always be reported to Social Services and/or the police.

If it is decided that referral may be warranted, the child’s consent should be sought whenever possible before disclosing confidential information.

**the Child Protection Register**

- Identify all children at risk of abuse
- Enable inter-agency working to support children in need
- To allow all people working with children access to a child’s risk status

much higher incidence of childhood sexual abuse is found in patients with dissociative identity disorder.

It is also associated with borderline personality disorder and antisocial traits.
The child may be de-registered from child at risk for three reasons:

1. The child reaches the age of 16 years, in which case his/her name will be automatically removed.

2. Following a review case conference in which the child is felt to no longer be at risk, in which case the case conference needs to be satisfied that the circumstances have significantly changed.

3. Following transfer to another local authority once the receiving local authority has accepted care of the child and organised their own case conference and appropriate registration.
Apparent life-threatening events (ALTE)

These occur in infants and are a combination of apnoea, colour change, alteration in muscle tone, choking or gagging, which are frightening to the observer. They may occur on more than one occasion. ALTEs may be the presentation of a potentially serious disorder, although often no cause is identified.

Management requires a detailed history and thorough examination to identify problems with the baby or in care-giving. The infant should be admitted to hospital. Multi-channel overnight monitoring is usually indicated. Detailed specialist investigation and assessment will be required if clinical, biochemical or physiological abnormalities are identified.

The risk of death is four times greater during infancy than at any other age in childhood.

In many, a serious condition will have been diagnosed before or after birth, such as a congenital abnormality or complications of prematurity. Deaths which occur suddenly and unexpectedly in infancy are known as sudden unexpected death in infancy (SUDI). In some, a previously undiagnosed congenital abnormality, e.g. congenital heart disease, will be found at autopsy.

Rarely, an inherited metabolic disorder is identified, in particular the fatty acid oxidation defect medium-chain acyl-CoA dehydrogenase deficiency (MCAD), which can very rarely result in sudden death in infants, but is increasingly identified in the UK from routine biochemical screening (Guthrie test) as the test for this disorder is being introduced more widely.

After 1 month of age, in most instances of sudden and unexplained death, no cause is identified and the death is classified as sudden infant death syndrome (SIDS). The vast majority of such deaths, even when occurring several times in the same family, are due to natural causes.

Rarely, the death may be due to suffocation or other forms of non-accidental injury. In 2003, in the UK, three mothers imprisoned after the loss of more than one infant had their convictions overturned.

This followed concern about the standard of proof required from medical expert witnesses in the absence of eye witness evidence of harmful conduct and about the quality of the procedures adopted during the investigation of the deaths.

Since then, new procedures have been recommended in order to prevent unwarranted incrimination of parents whilst also protecting other infants and children in the family from risk of injury.
Causes of life-threatening events

common
- Infections - respiratory syncytial virus (RSV), pertussis
- Seizures
- Gastro-oesophageal reflux (present in one-third of normal infants)
- Upper airways obstruction - natural or imposed
- No cause identified

Uncommon
- Cardiac arrhythmia
- Breath-holding
- Anaemia
- Heavy wrapping/heat stress
- Central hypoventilation syndrome
- Cyanotic spells from intrapulmonary shunting

investigations to be considered in apparent life-threatening events

- Blood glucose (as soon as possible)
- Blood gas (as soon as possible)
- Oxygen saturation monitoring
- Cardiorespiratory monitoring
- EEG
- Oesophageal pH monitoring
- Barium swallow
- Full blood count
- Urea and electrolytes, liver function tests
- Lactate
- Urine (collect and freeze first sample)
- metabolic studies
- microscopy and culture
- toxicology
- ECG - for QTc conduction pathway abnormality
- Chest X-ray
- Lumbar puncture
Sudden infant death syndrome

This is defined as the sudden and unexpected death of an infant or young child for which no adequate cause is found after a thorough postmortem examination. There is marked variation in the incidence of SIDS in different countries, suggesting that environmental factors are important.


The infant

- Age 1-6 months, peak at 12 weeks
- Low birthweight and preterm (but 60% are normal birthweight term infants)
- Sex (boys 60%)
- Multiple births

The parents

- Low income*
- Poor or overcrowded housing
- Maternal age (mother aged <20 years has three times the risk of a mother aged 25-29 years, but 80% of affected mothers are >20 years old)*
- Single unsupported mother (twice the rate of supported mothers)
- High maternal parity*
- Maternal smoking during pregnancy (1-9 cigarettes/day doubles the risk; >20/day increases the risk fivefold)*
- Parental smoking after baby's birth

The environment

- The infant sleeps lying prone
- The infant is overheated from high room temperature and too many clothes and covers, particularly when ill

*most common
In the UK, the incidence of SIDS has fallen dramatically during the last few years coinciding with a national 'Back to Sleep' campaign.

This advocates that:
- infants should be put to sleep on their back (not their front or side)
- overheating by heavy wrapping and high room temperature should be avoided
- infants should be placed in the 'feet to foot' position
- parents should not smoke near their infants
- parents should seek medical advice promptly if their infant becomes unwell
- parents should have the baby in their bedroom for the first 6 months of life
- parents should avoid bringing the baby into their bed when they are tired or have taken alcohol, sedative medicines or drugs
- parents should avoid sleeping with their infant on a sofa, settee or armchair

**Following the sudden death of a child**
The sudden death of a child is one of the most distressing events that can happen to a family.
If close family members are absent, arrangements should be made for them to come, if this is possible.
The family should be spoken to sympathetically and in private.
Routine samples to be taken immediately after sudden unexpected deaths in infancy

<table>
<thead>
<tr>
<th>Sample</th>
<th>Send to</th>
<th>Handling</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood (serum) 1–2 ml</td>
<td>Clinical chemistry</td>
<td>Spin, store serum at −20°C</td>
<td>Toxicology</td>
</tr>
<tr>
<td>Blood cultures – aerobic and anaerobic 1 ml</td>
<td>Microbiology</td>
<td>If insufficient blood, aerobic only</td>
<td>Culture and sensitivity</td>
</tr>
<tr>
<td>Blood from Guthrie card</td>
<td>Clinical chemistry</td>
<td>Normal (fill in card; do not put into plastic bag)</td>
<td>Inherited metabolic diseases</td>
</tr>
<tr>
<td>Blood (Lithium heparin) 1–2 ml</td>
<td>Cytogenetics</td>
<td>Normal – keep unseparated</td>
<td>Chromosomes (if dysmorphic)</td>
</tr>
<tr>
<td>Cerebrospinal fluid (CSF) (a few drops)</td>
<td>Microbiology</td>
<td>Normal</td>
<td>Microscopy, culture and sensitivity</td>
</tr>
<tr>
<td>Nasopharyngeal aspirate</td>
<td>Virology</td>
<td>Normal</td>
<td>Viral cultures, immunofluorescence and DNA amplification techniques*</td>
</tr>
<tr>
<td>Nasopharyngeal aspirate</td>
<td>Microbiology</td>
<td>Normal</td>
<td>Culture and sensitivity</td>
</tr>
<tr>
<td>Swabs from any identifiable lesions</td>
<td>Microbiology</td>
<td>Normal</td>
<td>Culture and sensitivity</td>
</tr>
<tr>
<td>Urine (if available)</td>
<td>Clinical chemistry</td>
<td>Spin, store supernatant at −20°C</td>
<td>Toxicology, inherited metabolic diseases</td>
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</table>
The Avon clinico-pathological classification of sudden unexpected deaths in infancy

<table>
<thead>
<tr>
<th>Classification</th>
<th>0</th>
<th>I A</th>
<th>I B</th>
<th>II A</th>
<th>II B</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributory or potentially 'causal' factors</td>
<td>Information not collected</td>
<td>Information collected, but no factors identified</td>
<td>Factor present, but not likely to have contributed to ill health or to death</td>
<td>Factor present, and may have contributed to ill health or possibly to death</td>
<td>Factor present, and certainly contributed to ill health and probably contributed to death</td>
<td>Factor present, and provides a complete and sufficient cause of death</td>
</tr>
<tr>
<td>History (note 1)</td>
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<tr>
<td>Death-scene examination (note 2)</td>
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<tr>
<td>Pathology (note 3)</td>
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<tr>
<td>Other (specify)</td>
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<tr>
<td>Other evidence of neglect or abuse?</td>
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<td>Overall classification (note 4)</td>
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</tbody>
</table>
Summary of tasks of individual agencies and professionals

Accident and emergency staff

! Ensure that your Trust has access at all times to a consultant pediatrician with special responsibility for SUDI (the ‘SUDI pediatrician’); this will almost always involve an on-call rota of a number of such paediatricians, usually across more than one Trust.

Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Attempt resuscitation until it is clear that it cannot be successful.

! Call the on-call pediatrician and/or the SUDI pediatrician (according to the agreed local arrangement).

! Keep careful records, including the history given by the parents and notes on the initial physical examination, plus detailed records of all interventions and procedures carried out in the A&E department, including the sites of attempted venous and arterial access.

! As soon as death has been confirmed, inform the coroner (or coroner’s officer) and ensure that any further action has the coroner’s approval.

! Look after the parents sensitively, offer mementos and keep them informed.
Ambulance staff

! Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Attempt resuscitation unless it is clear that the baby has been dead for some time.

! Keep the parents informed.

! Take the baby to the most suitable A&E department (not to the mortuary).

Chief Executive of NHS Trusts (including Primary Care Trusts in England and Local Health Boards in Wales)

! Ensure there is a local agreement, in line with the recommendations of this report, between the coroner, police and your NHS Trust on the principles of how unexpected deaths in infancy should be handled.

! Ensure that your Trust has agreed access at all times to a consultant pediatrician with special responsibility for SUDI, and that this responsibility is included in the job description. This will involve two or more such paediatricians arranging an ‘on-call’ rota for this purpose, usually covering more than one NHS Trust.

! Ensure appropriate multi-professional training is provided and funded for all relevant.

Ensure that pathology investigations in SUDI post-mortem examinations on infants dying in your Trust can be carried out at the request of a coroner (either within your Trust or, with agreement, within another Trust that has appropriate facilitie
Coroner

! Ensure that the investigation of unexpected infant deaths has a proper balance between medical and forensic requirements.

! Agree standard procedures in advance, in line with the recommendations of this report, with the relevant local NHS Trusts and the police so that specific approval on each occasion is not needed.

! Ask to be provided with a full history as obtained at the home visit.

! Ensure that the post mortem is carried out by a pathologist with appropriate and recent paediatric training and expertise, (working with a forensic pathologist when maltreatment is suspected), if necessary ensuring the infant is transported to an appropriate specialist centre for that purpose.

! Make a copy of the post-mortem report available to the SUDI pediatrician and (if there are no suspicious circumstances) give permission for him or her to discuss it with the parents.

Authorise, and ensure that parents are informed, that tissue blocks and slides are to be taken at post-mortem examination and retained indefinitely as part of the pathology record.

! Ensure that parents are informed about any further bodily material that has been retained after the initial post-mortem examination, for how long it is likely to be required and the purpose of this retention.

! Within the scope of the Coroners Rules, stipulate and authorise the period for which such further bodily material should be retained.

! Ensure the body is released for burial or cremation as soon as possible.

! Save those where there are clear natural causes immediately recognisable at post mortem (and a certificate of the cause of death can therefore be issued immediately), hold an inquest following every sudden unexpected infant death and schedule the inquest as expeditiously as possible.

! At inquest, take account of the report of the multi-agency case discussion meeting; summon all the relevant local professionals to attend the inquest if no multi-agency meeting has taken place.

! Avoid the term “unascertained” as the final registered cause of death; if the death meets the international criteria for sudden infant death syndrome (SIDS) that is the term that should be the registered cause of death.
**Coroner’s officer**

Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

Visit the family as necessary, treating them with sensitivity, and keeping them fully informed about all the procedures that are taking place, and helping them with the practical arrangements.

Explain to the parents what takes place in an inquest and let them know that they can take a friend, and ask questions at the inquest.

**General practitioner (GP)**

Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

If called to the scene of death, send the baby to the A&E department rather than to the mortuary.

Visit the parents at home as soon as convenient.

If necessary, advise on suppression of lactation.
Make the GP notes available to the SUDI pediatrician and attend the case discussion meeting.

With the health visitor, ensure that the family receives adequate support, both now and for a future pregnancy.
Health visitor

! Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Visit the family at home as soon as convenient.

! Facilitate the visit by the SUDI pediatrician.

! Make the health visiting notes available to the SUDI pediatrician and attend the case discussion.

! With the GP, ensure that the family receives adequate support, both now and for a future pregnancy.

Midwife (if still involved with the mother and baby)

Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

Visit the family at home as soon as convenient.

If necessary, advise on suppression of lactation.

Make the midwifery notes available to the SUDI pediatrician, and attend the case conference.

! Ensure that a prominent note is made in the mother’s obstetric records to alert staff dealing with a future pregnancy.
On-call consultant pediatrician

! Ensure that your Trust has access at all times to a consultant pediatrician with special responsibility for SUDI; this will almost always involve an on-call rota of a number of such paediatricians, usually across more than one Trust.

! Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Agree in advance the division of responsibility between the on-call pediatrician and the SUDI pediatrician in the event of an unexpected infant death.

! Whenever possible, be available yourself or ensure that the SUDI pediatrician is available to go to the A&E department soon after a baby has been brought in unexpectedly dead when you are on call.

! Consult with the supervising police officer on the approach to the investigation

! Ensure the SUDI pediatrician has the opportunity to visit the family’s home, or do so yourself, preferably within 24 hours of the death, to talk with parents and examine the environment in which the baby died.

! Collate all relevant medical and social records for the SUDI pediatrician.

! Prepare a report for the pathologist prior to the post-mortem, including information on the details of resuscitation procedures.

! Facilitate the arrangement of a case discussion meeting by the SUDI pediatrician (to be convened as soon as results of post-mortem tests are available) and if appropriate help the SUDI pediatrician prepare a report of the meeting for the coroner. This meeting should usually be chaired by the SUDI pediatrician.

! Maintain good communication with the police or the SUDI pediatrician at every stage.

! Offer to talk with the parents again whenever they wish, or ensure that the SUDI pediatrician does so
SUDI pediatrician

! Advise the Strategic Health Authority on the commissioning of services relevant to care and investigation after SUDI.

! Ensure that a pediatrician with special responsibility for SUDI (and appropriate training and experience) is available at all times within your Trust. This will involve establishing an on-call rota with several paediatricians, usually in more than one Trust. Such responsibilities should be recognised in job descriptions.

! Ensure the development and implementation of a local agreement (in line with the recommendations of this report) between the coroners, police and NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Agree in advance the division of responsibility between the on-call pediatrician and the SUDI pediatrician in the event of an unexpected infant death.

! Respond to notifications of SUDI when you are on call by promptly attending whenever possible and providing immediate telephone advice and information to healthcare staff, police and other staff directly involved.

! Take the medical lead: in the instigation and running of the multi-agency protocol for care and investigation after SUDI in communication with other healthcare professionals in the communication with other agencies, notably the police, the coroner’s office and the social services department.
the coroner’s office and the social services department.

! Ensure all necessary multi-agency strategy discussions take place.

! Arrange to visit the family at home (preferably with a member of the police child protection team and a member of the primary healthcare team) as soon as possible after the death to talk with the family, and to examine the environment in which the infant collapsed or died (which may not be in the family home).

! Collate all relevant medical records (in collaboration with the local on-call consultant pediatrician).

! Provide a report for the pathologist prior to the post mortem.

! Ensure the family are fully informed and given appropriate support at all stages.

! Coordinate, organise and chair the local case discussion meeting as soon as the full results of the post-mortem investigations are available, usually 2–3 months after the death, and usually held in the primary care setting.

! Prepare a written summary of the local case discussion meeting and ensure it is distributed to all relevant professionals, including the coroner.

! Offer to meet the family to explain the outcome of the local case discussion meeting, including the cause of the infant’s death, and send the family a full written report, in accessible language.

! Liaise with the coroner whenever necessary in the organisation and conduct of the inquest.
Pathologist

! Only undertake post-mortem examinations on SUDI cases if you have appropriate and recent expertise and training in this field.

! If you are instructed as a forensic pathologist, but without appropriate expertise in paediatric pathology, ensure that a pathologist with appropriate and recent paediatric training and expertise is also involved.

! Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Ensure that an adequate history (preferably including a detailed account of the precise circumstances of the death from a home visit) is available before starting the post-mortem.

! Ensure that a full skeletal survey is carried out before starting the post-mortem examination. This should be reported by a radiologist with recent experience and training in paediatric radiology (preferably before the post-mortem examination is conducted).

! Follow the recommended protocol for SUDI post-mortems.

! The phrase “unexplained pending further investigation” should be used initially unless a clear and sufficient natural or unnatural cause for the death has been identified.

! Inform the coroner (and ensure the family is informed) about what bodily material has been retained.

! Inform the coroner (and ensure the family is informed) if retention of whole organs is necessary for further investigation, and whether the organ (e.g. the brain) can be returned to the body in a week or so after fixation and sampling.

! When criminal proceedings are likely, ensure that retention of adequate tissue or organ samples (e.g. the whole brain) is discussed with the coroner and that, if such retention is considered necessary, the sample is made an exhibit so that its retention is covered by The Criminal Justice Act 2003.

! Agree to the release of the body for funeral as soon as possible, consistent with conducting an appropriate and thorough examination.

! Ensure that your findings are explained to the parents (with the coroner’s permission), usually by the SUDI pediatrician.

! Attend the local case discussion meeting
Police

! Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Investigate the possibility that the death may have been unnatural, but keep in mind that most SUDI arise from natural causes.

! Avoid the attendance of uniformed officers at the home if possible.

! Ensure that any officer involved has specialist training and experience (officers from child protection team or with family liaison unit training may be appropriate).

! Liaise with the pediatrician and other agencies from the outset and confer about possible causes of death.

! Always treat the family with sensitivity.

Social services

! Familiarise yourself with the local agreement between the coroner, police and local NHS Trusts on the principles of how unexpected deaths in infancy should be handled.

! Review the child protection register and any other records relating to the baby who has died and to other members of the family and the household.

! Provide a family and social history and make any relevant records available for the strategy discussions and the local case discussion meeting.

! Attend the case discussion meeting (if social services are involved with family).

! Take appropriate action if causes for concern are raised in the strategy discussions or case discussion meeting.

! Carry out a risk assessment whenever appropriate for any surviving or subsequent in children.
Ethics
Ethics

Situations arise in paediatric practice in which the course of action that should be followed is unclear.

Knowledge of the ethical theories and principles which underpin medical practice is helpful in understanding the issues involved. It is important to justify decisions to investigate or treat in accordance with these principles, and in language that is clear to all concerned

Definitions of the principles of medical ethics

These are:

• non-maleficence - do no harm (psychological and/or physical)

• beneficence - positive obligation to do good (these two principles have been part of medical ethics since the Hippocratic Oath)

• justice - fairness for all, equity and equality of care

• respect for autonomy - respect for individuals' rights to make informed and thought-out decisions for themselves in accordance with their capabilities

• truth-telling and confidentiality - important aspects of autonomy that support trust, essential in the doctor-patient relationship

• duty - the moral obligation to act irrespective of the consequences in accordance with moral laws which are universal, apply equally to all and which respect persons as autonomous beings

• utility - the obligation to do the greatest good for the greatest number

• rights - justifiable moral claims, e.g. the right to life, respect, education, which impose moral obligations upon others
Application of ethical principles to paediatrics

Non-maleficence

Children are more vulnerable to harm. This includes their suffering from fear of procedures, which they may be too young to express verbally. Doctors may do harm from lack of skill or knowledge, especially if they do not treat children frequently.

Beneficence

The child's interest is paramount. In the UK, this is enshrined in the Children Act 1989 and the UN Convention on the Rights of the Child. This may sometimes conflict with parental autonomy, such as the emergency treatment of a child where the parent is not immediately available or when details are given to social workers in suspected child abuse.

Justice

This involves ensuring a comprehensive child health service, including the prevention of illness and equal access to health care even when poverty, language barriers and parental disability are present.

Autonomy

Children have restricted but developing rights in law. Parents are trusted to make decisions on their child's behalf because they will usually act in the child's best interests, but there may be circumstances, e.g. child abuse, in which this is not the case.

Truth-telling

It is more difficult with children than adults to be sure that they understand what is happening to them. For example, it is easy to reassure children falsely that procedures will not hurt; when they find this is untrue, trust will be lost for future occasions.
Consent

Valid consent is required for all medical interventions other than emergencies or when urgent intervention is necessary to prevent serious risk of present or future harm. It provides the ethical and legal authority for action which would otherwise be a common assault or interfere with the right of individuals to decide what should be done to them (autonomous choice).

To be valid, consent must be sufficiently informed, and freely given by a person who is competent to do so.

Clinicians have a duty to provide sufficient information to enable a reasonable person to make the decision and must answer all questions honestly.

Information has to be given in language that is clear and understandable.

**In UK law, the legal age of consent to medical treatment is 16 years.**

The right of children below this age to give consent depends on their competence rather than their age.

They may consent to medical examination and treatment provided they can demonstrate that they have the maturity and judgement to understand and appraise the nature and implications of the proposed treatment, including the risks and alternative courses of action. **This is known as Gillick competence.**

When a child lacks the maturity and judgement to give consent, this capacity is given to a person having parental responsibility - usually a natural parent, or to a court.

In practice, problems occur only when there is disagreement between the child and the parents and clinicians over treatment, e.g. contraception for under 16-year-olds.

When a girl less than 16 years of age requests contraception without parental knowledge, a professional can provide it if satisfied that she cannot be persuaded to inform her parents, that she is likely to have sex with or without contraception and that receiving contraception is in her best interests. **These are known as the Fraser guidelines.**
Despite these provisos, legal judgments have not supported children who refuse treatment that parents and clinicians feel to be in their best interests, especially if its purpose is to save life or prevent serious harm, e.g. heart transplantation for acute cardiomyopathy in an intelligent 15-year-old.

Where disputes cannot be resolved by negotiation or mediation, or there is doubt over the legality of what is proposed, legal advice should be sought. Whatever the outcome children should have their views heard and be given reasons as to why they are being over-ridden.

**Informed Consent**

Every human being of adult years and sound mind has a right to determine what shall be done to their own body.

Therefore, a doctor who treats the competent adult against his wishes will face an action for battery and trespass.

states that persons over the age of 16 years are assumed to have capacity unless assessed to be lacking capacity.

In determining capacity, both the English Court and the mental capacity act MCA4 used the ‘functional approach’ that persons are incapable to consent if they fail to:

(a) understand the information relevant to the decision

[when presented using ‘simple language, visual aids or any other means’]

(b) retain that information;

(c) use or weigh it as part of the process of making the decision.
Consent of persons with parental responsibility

The law governing parental responsibility (PR) has recently been revised.

- A married couple who have children together both automatically have PR and neither loses it if they divorce.
- Where the parents are not married, mothers automatically have PR.
- The unmarried father has PR if:
  - for births registered after 1 Dec 2003, his name is registered on the birth certificate
  - before that date, fathers can re-register their names on the birth certificate; sign an authorised PR agreement; obtain a PR or residence order from the court
  - he later marries the mother.
- Others, can acquire PR by:
  - being appointed as a guardian by the court or by the parents after their death
  - adopting the child.

If the child is adopted or has another legal guardian then the adoptive parent/legal guardian gains parental responsibility and can give consent for medical procedures or investigations.
Consent of minors

This debate intensifies in cases where mature minors consent to treatment without their parents’ knowledge or in situations that involve the minors withholding their consent to life-saving treatment.

Positive consent

‘The consent of a minor who has attained the age of sixteen years to any ... treatment which shall be as effective as it would be if he were of full age;

and where a minor has given an effective consent to any treatment it shall not be necessary to obtain any consent for it from his parent or guardian.

Gillick or Fraser competent

This term is used to define a young person who understands the treatment offered and the benefits and possible side-effects and is deemed competent to retain the information and make a rational decision.

child below the age of 16 if need medical treatment the parental right terminates if and when the child achieves a sufficient understanding and intelligence to enable him to understand fully what is proposed’.
Negative consent

competent minors and those over the age of 16 years have the right to refuse treatment as well as to consent to it

elegantly divided the cases dealing with mature minors’ refusal of treatment into three categories:

• refusal of nutrition or medications by adolescents with mental health problems

• refusal of life-saving major surgery because, in the patient’s view, it carries unacceptable and far-reaching implications on their lives

• refusal of blood products
Teenager pregnancy

The UK has the highest rate of teenage pregnancy in western Europe.

Teenage girls may present with complaints such as abdominal pain, fatigue, breast tenderness or appetite changes rather than late or missed menstrual period.

Becoming a teenage mother can be a positive life choice and is influenced by culture.

There may be considerable support from the extended family, and this may work well. However, in those where the pregnancy was unintended or who are emotionally deprived and want to be a mother to be loved, or who are unsupported and live in poverty, there may be many adverse consequences for the mother and child. Children of teenage mothers have a higher infant mortality, a higher rate of childhood accidents, illness and admission to hospital, being taken into care, low educational achievement, sexual abuse, and mental health problems.

Deprivation, from the mother's lack of financial and emotional support and the paucity of her own education and life experiences, is the strongest risk factor. Protective factors are having a supportive family, religious belief and a stable, long-term relationship with the partner.


**Confidentiality**

Children are owed the same duty of confidentiality as adults irrespective of their legal capacity. In general, personal information about them should not be shared without their consent or agreement unless it is necessary for their health or to protect them from serious harm, e.g. in actual or suspected child abuse.

**Best interests**

It is a general ethical and legal maxim that the best interests of the child are paramount.

Doctors therefore have a duty to save life, restore health and prevent disease by treatments that confer maximum benefit and minimal harm and which respect the autonomy of the child as far as possible.

Parents have the ethical and legal duty to make decisions on behalf of their child, provided that they act in their best interests.

Disputes may arise over what constitutes best interest and who should decide them; these may require legal intervention especially when the withholding or withdrawing of life-sustaining treatment may be involved.

Courts have generally been supportive of the position that in some circumstances the burdens of providing life-sustaining treatment outweigh its benefits.

In contrast to normal adult medical ethics, in paediatrics the autonomy of the patient either is not present at all (as in babies and young infants) or is often not sufficiently developed to be respected if the child's decision conflicts with what appropriate other people consider to be in that child's best interests.
The decisions about the child's medical care are generally entrusted to his parents. Why the parents? They are given the privilege and responsibility of making decisions on behalf of their children largely because they are most likely to protect and promote the interests of their children.

The normal assumption in paediatric practice is that doctors should work closely with parents and give advice that parents may or may not accept. Wherever possible, a mutually trusting and respectful working relationship should be developed and maintained, both because it will be in the best interests of the child and because it will tend to lead to far better experiences of medical care for all involved.

Also, consider whether your decision would have been the same about performing an extra venepuncture for a special blood test for an ethically approved research project.
The ethics of research in paediatrics

Research involving children is important in promoting children's health and well-being and may provide an evidence base for practice. Children differ from adults in their anatomy, physiology, disease patterns and responses to therapy, but many drugs in current use have not been tested on them. However, children are perhaps more vulnerable to the harm which may be produced by research and should be protected against it.

Distinction is often made between therapeutic research, where there is an intention to benefit the individual subject, and non-therapeutic research, which carries a wider societal benefit but without intent to benefit individuals. However, research that fails to benefit individuals may be ethical provided that it involves an acceptable level of risk.

Where a child suffers from a particular disease, e.g. acute lymphoblastic leukaemia, randomised clinical trials may be used to compare treatment regimens. The ethical justification for such trials is that there is no good reason to believe that one of the treatments would be better than the other - 'therapeutic equipoise' - and that the standard treatment used for comparative purposes is the best currently available.

The situation is different when an investigation, e.g. blood test, X-ray or intervention, is proposed for normal children as part of a control group in a trial or for the purpose of establishing a normal range.

Both can be ethically justified provided that the procedure in question carries no more risk than generally encountered and accepted in everyday life.
Whatever the nature of the research a number of criteria must be met:

- Appropriate research should be first carried out in adults or older children.
- The project should have a sound scientific basis and be well designed.
- The researchers should be competent to carry it out in the time specified.
- Sufficient information should be given in a form comprehensible to the child and family to enable them to give valid consent to participation, e.g. by provision of information sheets in an appropriate form and language or by the use of independent translators.
- Parents must have the option to withdraw their child from the research at any stage without prejudice.
- The project must be reviewed and approved by an independent scientific and ethical process (Research Ethics Committee).
The child in society

Most medical encounters with children involve an individual child presenting to a doctor with a symptom, such as diarrhoea.

After taking a history, examining the child and performing any necessary investigations, the doctor arrives at a diagnosis or differential diagnosis and makes a management plan.

This disease-oriented approach plays an important part in ensuring the immediate and long-term well-being of an individual. However, the nature of the child's illness needs to be seen within the wider context of the society in which he or she lives.

This will affect the likely cause (if the diarrhoea is likely to be from a viral illness or contaminated water supply), the severity of the child's illness (the organism likely to be responsible and the child's nutritional status) and management options (who will take care of the child when ill, is preprepared oral rehydration therapy available, is hospital treatment possible and what facilities can it offer?). In order to be a truly effective clinician, the doctor must be able to place the child's clinical problems within the context of the family and of the society in which they live.

The way in which the environment impacts on a child is exemplified by the contrast between the major child health problems in developed and developing countries. In developed countries they are a range of complex, often previously fatal, chronic disorders and behavioural, emotional or developmental problems.

By contrast, in developing countries the predominant problems are infection and malnutrition.
Contrast between main child health problems in developed and developing countries

Developed countries

- Severe, often previously fatal chronic disorders - malignant disease, cystic fibrosis
- Provision of paediatric and neonatal intensive care, organ transplantation and other specialist services
- Behavioural and emotional disorders - attention deficit disorder, anorexia nervosa
- Neurodevelopmental disorders - language delay, reading difficulties, clumsiness, cerebral palsy
- Road traffic and other accidents
- Lack of family cohesion
- Socioeconomic disadvantage among the 'have-nots' - lack of money, unemployment, inadequate housing and education
- Inequality of access to health services
- Excessive consumption - obesity
- Drug and alcohol abuse, smoking, teenage pregnancies

Developing countries

- Infection - respiratory tract, diarrhoea, malaria, tuberculosis, HIV
- Malnutrition - marasmus, kwashiorkor, severe iron deficiency anaemia
- Developmental and learning problems of organic pathology - Down's syndrome, congenital anomalies
- Sanitation, water supply, food hygiene, housing and education
- Poverty and unemployment
- Health care - not available or poor quality
- High birth rate - children constitute high proportion of population
The child’s world

It is clear from the difference in the major child health problems in developed and developing countries that children's health is profoundly influenced by their social, cultural and physical environment.

This can be considered in terms of the child himself, the family and immediate social environment, the local social fabric and the national and international environment.

Our ability to intervene as clinicians needs to be seen within this context of complex interrelating influences on health.

The child

The child's world will be affected by gender, genes, physical health, temperament and development. It will also vary markedly with age; the life of an infant or toddler is mainly determined by the home environment, and that of the young child by school and friends, whereas the teenager will be aware of and influenced by events not only nationally but also internationally, e.g. in music, sport, fashion or politics.

Immediate social environment

Family structure

Although the 'two biological parent family' remains the norm, there are many variations in family structure. In the UK this has changed markedly over the last 30 years.

One in four children now live in a single-parent household.

There are 1.4 million single parents in England and Wales. Disadvantages of single parenthood include a higher level of unemployment, poor housing and financial hardship.

These social adversities may affect parenting resources, e.g. vigilance about safety, adequacy of nutrition, take-up of preventive services such as immunisation and regular screening, and ability to cope with an acutely sick child at home.

The increase in the number of parents who change partners and the accompanying rise in reconstituted families (1 in 10 children live in a stepfamily) mean that children are having to cope with a range of new and complex parental and sibling relationships.

This may result in emotional, behavioural and social difficulties.
The trend towards smaller families provides an increased standard of living. With many parents now leaving home in order to work, there is a greater demand for professional child care.

This may be in the form of child-minding or preschool nurseries. Increasing attention is being paid to the quality of day-care facilities in terms of supervision of the children and improving the opportunities they provide for social interaction and learning.

Approximately 3% of children under 16 years old in the UK live away from their original family home; 50,000 of these are 'looked after' by social services, and the remainder live in temporary housing.

Refugees are often placed in temporary housing and may be moved repeatedly into areas unfamiliar to them.

They often encounter additional problems as a result of communication difficulties, poverty, fragmentation of families, loss of family members causing post-traumatic stress syndrome, racism and uncertainty regarding the safety of friends and family.

Raising children under these circumstances is fraught with difficulties.
Parenting styles

Parenting that is warm and receptive to the child, whilst imposing reasonable and consistent boundaries, will promote the development of an autonomous and self-reliant adult. Some parents are either excessively authoritarian or permissive.

Children's emotional development may be damaged by parents who neglect or abuse their children.

The child's temperament is also important, especially when there is a mismatch with the parenting style of the parents; for example, a child with a very determined temperament may be in constant conflict with an authoritarian parent and this may result in tantrums and other behavioural problems.

Siblings have a marked influence on the family dynamics.

The arrival of a new baby may engender a feeling of insecurity in older brothers and sisters and result in attention-seeking behavior.

How siblings affect each other appears to be determined by the emotional quality of their relationships with each other and also with other members of the family, including their parents.

The role of grandparents and other family members varies widely and is influenced by the family's culture; in some, they are the main caregivers, while in others they play only a peripheral role, exacerbated by geographical separation.
Cultural attitudes to child-rearing

The way in which children are brought up evolves within a community over generations.

An example is the use of physical punishment by parents to discipline their children.

This is seen as acceptable or even desirable by a high proportion of parents in the UK and the USA, where there is strong public opinion against making 'reasonable chastisement' by parents illegal.

However, such legislative measures have been adopted in countries such as Sweden, where they have been largely successful in changing cultural practice.

Peers

Peers exert a major influence on children.

Peer relationships and activities provide a 'sense of group belonging' and have potentially long-term benefits for the child.

Relationships can also go wrong, e.g. persistent bullying, which may result in or contribute to psychosomatic symptoms, misery and even, in extreme cases, suicide.
Socioeconomic status/social class

Poverty is a key determinant of health and well-being of children. Healthcare problems in which the UK prevalence rates are increased by poverty and deprivation include:

- low-birthweight infants
- injuries
- hospital admissions
- asthma
- behavioural problems
- special educational needs
- child abuse.

Socioeconomic status is usually described by a comparison between the family income and the national median income. For example, taking poverty as below 50% of the national median income after adjustment for household size and composition, 20% of children in the UK in 2003/4 were poor (2.5 million children).

Low socioeconomic status is often associated with multiple disadvantages, e.g. food of inadequate quantity and nutritional value, substandard housing or homelessness, lack of 'good enough' parenting and poor access to health care and educational facilities.

Poor housing may restrict opportunities for play and this may adversely affect the child's development.

In general, higher levels of maternal education benefit children's development; maternal low intelligence and mental illness have an adverse effect. There are marked differences in living experiences between ethnic groups: 42% of Muslim children experience overcrowding compared to the 12% average, whereas 50% of Afro-Caribbean children live in single-parent households compared to 15% of white children and less than 10% of those from the Indian subcontinent. In 1992, in England and Wales, 12% of births were to mothers born outside the UK; in 2002 it was nearly 18%.
Percentage of children living in 'relative' poverty (households with income below 50% of national median).
Local social fabric

Neighbourhood

Cohesive communities and amicable neighbourhoods are positive influences on children. Racial tension and other social adversities, such as gang violence and drugs, will adversely affect the emotional and social development of children, as well as their physical health. Parental concern about safety may create tensions in balancing their children's freedom with overprotection and restriction of their lifestyles.

•Lifestyle issues concerning children include:

•Poor nutrition - the National Diet and Nutrition Survey in 2000 in the UK found that 4 out of 5 teenagers ate a diet predominantly consisting of chips, white bread, crisps, biscuits, ketchup and fizzy drinks; 16% of 15-18-year-old females were on a diet and 1 in 5 ate no fruit at all, with some living in inner city estates saying that they had easier access to illegal drugs than to fresh fruit and vegetables! In order to improve children's nutrition in the UK, healthy eating is being vigorously promoted, free daily fruit portions are provided in primary schools and the nutritional content of school meals is being improved.

•Obesity - there has been a large increase in the proportions of overweight and obese children in the developed world over the past few years; it is estimated that 6.5% of 9-year-olds and 15% of 15-year-olds in the UK are clinically obese (BMI >90th centile). The figures are nearer 25% for 15-year-olds in the USA. This is as a result of a combination of reduced physical exercise and increased intake of calorie dense foods.

•Sexual health - the UK has the highest teenage pregnancy rate in western Europe: twice that of Germany, three times that of France and six times that of the Netherlands. There has been a marked increase in sexually transmitted diseases amongst 16-19-year-olds.
• Smoking and alcohol - in the UK 12% of girls aged 11-15 years smoke regularly compared to 9% of boys, rising to 30% in 16-19-year-olds. One in four children of the same age regularly drink alcohol, with binge-drinking becoming increasingly problematic.

• Drug abuse - nearly 30% of 15-year-olds have had personal experience of using drugs in England and Wales. These lifestyle issues follow a complex interaction between attitudes and practices in the home and in the community. Their prevalence tends to be greater in deprived communities.

Health service delivery

The variation in the quality of health care is an important component in preventing morbidity and mortality in children. In all countries, health services for children are increasingly provided within primary care. Some aspects of specialist paediatric care are also increasingly provided within the child's home, local community or local hospital through shared care arrangements and specialist community nursing and medical teams. However, access to and the range of these services varies widely.

Schools

Schools provide a powerful influence on children's emotional and intellectual development and their subsequent lives. Differences in the quality of schools in different areas can accentuate inequalities already present in society. Good education also provides the opportunity for children brought up in poverty to improve their social circumstances.

To educate a girl is to educate a whole family. And what is true of families is also true of communities and, ultimately, whole countries. Study after study has taught us that there is no tool for development more effective than the education of girls. No other policy is as likely to raise economic productivity, lower infant and maternal mortality, improve nutrition and promote health - including helping to prevent the spread of HIV/AIDS. No other policy is as powerful in increasing the chances of education for the next generation. (Kofi Annan, Secretary General UN, 2004)
Travel

The increasing ease of travel can broaden children's horizons and opportunities.

Especially in rural areas, the ease and availability of transport allow greater access to medical care and influence the pattern of provision of both primary and specialist medical services.

However, a consequence of the increasing use of motor vehicles is the large number of injuries sustained by children from road traffic accidents, mainly as pedestrians.

Attention to accident prevention, such as calming traffic in residential areas and separating cars from pedestrians and cyclists, is helping to reduce the number of children injured.

The widespread use of cars also contributes to a reduction in children's levels of exercise.

Whereas 80% of children in the UK went to school by foot or bicycle in 1971, this has dropped to less than 10%.
National and international environment

Economic wealth

There is a relationship between a country's gross national product and child health; some examples of this are shown.

• the higher the childhood mortality
• the higher the proportion of newborn infants with low birthweight
• the lower the immunisation rate. However, even in countries with a high gross national product, many children live in financially deprived circumstances.

Worldwide, there has been an enormous improvement in children's health over the last 50 years. It is estimated that the proportion of children who die before reaching 5 years of age is now less than half the level of 1960. The largest reductions in under-fives mortality are primarily related to improvements in living conditions such as improved sanitation and housing, and access to food and water.

These have dramatically reduced fatalities from infectious disease.

More recent contributions to this reduction, but of less relative impact over a long timescale, have included increased availability and uptake of immunisation and major medical improvements in perinatal and infant care. In all countries difficult choices need to be made about the allocation of scarce resources. Should a developing country provide expensive drugs and care for the small number of children with malignant disease or allocate its resources to preventive programmes for many children? In developed countries, difficult decisions also have to be faced in deciding the affordability of very expensive procedures, such as heart or liver transplantation, and certain drugs, such as the genetically engineered enzyme replacement therapy for Gaucher's disease. The public are becoming more engaged in these debates.
Marked reduction in mortality of children aged 0-14 years between 1843 and 2003. In 1900, 15% of babies born in England died by 1 year of age and 23% by 14 years of age; in 2003 the figures were 0.6% and 0.64%, respectively.
Media

The media has a powerful influence on children. It can be positive and educational. However, the impact of television, video and film can be negative owing to reduced opportunities for social interaction and active learning, lack of physical exercise as well as exposure to undesirable influences, such as violence, sex and cultural stereotypes, e.g. an expectation that teenage girls should be slim. The extent to which the aggressive tendencies of children may be exacerbated or encouraged by exposure to violence in films and television is an unresolved issue of widely held concern.

Children and war: worldwide, devastating effect of war on children in the last decade

• Mortality - >2 million children died
• Morbidity - >6 million children disabled, mainly paraplegia and sensory deficits
• Loss of home and refugee status - 20 million children homeless and living as refugees
• Orphans - 1 million children orphaned
• Psychological trauma - 10 million children estimated to have post-traumatic stress syndrome; rape and sexual humiliation of females widely used as a strategy of conflict
• Children as soldiers - estimated 300 000 child soldiers in more than 30 conflicts worldwide
• Disruption of healthcare system - immunisation and child health surveillance programmes interrupted or disbanded Anti-personnel mines - 8000-10 000 killed or maimed each year
The internet is enabling parents and children to become better informed about their children's medical problems. This is especially beneficial for the many rare conditions encountered in paediatrics. Parents and children can now access the latest information from around the world and can also communicate directly with other affected children or families. A disadvantage is that it may result in the dissemination of information which is incorrect or presented from a biased viewpoint, and may result in requests for inappropriate investigations or treatment and demands for 'new interventions', even before their safety and efficacy have been established.

War and natural disasters

Children are especially vulnerable when there is war, civil unrest or natural disasters.

Not only are they at greater risk from infectious diseases and malnutrition but they may lose their caregivers and other members of their families and are likely to have been exposed to highly traumatic events. Their lives will have been uprooted, socially and culturally, especially if they are forced to flee from their homes and become refugees.
Evidence-based paediatrics
Evidence-based paediatrics

Clinicians have always sought to base their decisions on the best available evidence. However, such decisions have often been made intuitively, given as clinical opinion, which is difficult to generalise, scrutinise or challenge. Evidence-based practice provides a systematic approach to enable clinicians to efficiently use the best available evidence, usually from research, to help them solve their clinical problems.

The difference between this approach and old-style clinical practice is that clinicians need to know how to turn their clinical problems into questions that can be answered by the research literature, to search the literature efficiently, and to analyse the evidence, using epidemiological and biostatistical rules.

Sometimes, the best available evidence will be a high-quality, systematic review of randomised controlled trials, which are directly applicable to a particular patient.

For other questions, lack of more valid studies may mean that one has to base one's decision on previous experience with a small number of similar patients.

The important factor is that, for any decision, clinicians know the strength of the evidence, and therefore the degree of uncertainty.

As this approach requires clinicians to be explicit about the evidence they use, others involved in the decisions (patients, parents, managers and other clinicians) can debate and judge the evidence for themselves.
Why practise evidence-based paediatrics?

There are many examples from the past where, through lack of evidence, clinicians have harmed children, e.g.:

- Blindness from retinopathy of prematurity. In the 1950s, following anecdotal reports, many neonatal units started nursing all premature infants in additional ambient oxygen, irrespective of need. This reduced mortality, but as no properly conducted trials were performed of this new therapy, it took several years for it to be realised that it was also responsible for many thousands of babies becoming blind from retinopathy of prematurity.

- Advice that babies should sleep lying on their front (prone), which increases the risk of sudden infant death syndrome (SIDS). Medical advice given during the 1970s and 1980s, to put babies to sleep prone, appears to have been based on physiological studies in preterm babies, which showed better oxygenation when nursed prone. Furthermore, autopsies on some infants who died of SIDS showed milk in the trachea, which was assumed to have been aspirated and this was thought to be more likely if they were lying on their back. However, an accumulation of more valid evidence from cohort and case-control studies showed that nursing term infants prone was associated with an increased risk of SIDS.

Evidence-based medicine allows clinicians to be explicit about the probability (or risk) of important outcomes. For example, in discussing with parents the prognosis of a child who has had a febrile convulsion, one can state that 'the risk of developing epilepsy is 1 in 100' instead of using vague terms, such as 'he/she is unlikely to develop epilepsy'.

Explicit analysis of evidence has also become more important with the increasing delivery of health care by teams rather than individuals. Each team member needs to understand the rationale for decisions and the probability of different outcomes in order to make their own clinical decisions and to provide consistent information to patients and parents.
Application of evidence-based medicine to clinical problems

Clinical problem

Frame question

What evidence is needed to reach your decision? Clinical problems are often complex and the different elements (etiology, diagnosis, therapy, prognosis) need to be tackled as separate questions. Most clinical questions can be structured into these three components:

Patient population
A population similar to your patient

Intervention
E.g., giving antibiotics compared with not giving antibiotics

Clinical outcome
The most important outcomes, good or bad

Search for the evidence

Search the research literature. Use search filters for efficiency. For randomized clinical trials and systematic reviews of interventions, go to Cochrane Library. If there is nothing which addresses your question, or if your question is about prognosis or diagnosis, you need to use an online database such as MEDLINE.

Appraise the evidence

Appraise the validity (closeness to the truth) and usefulness (relevance to your patient) of the evidence.
In intervention studies, there is a hierarchy of validity:
- A systematic view of randomized controlled trials (RCTs)
- Individual RCTs
- Cohort studies
- Case–control studies
- Case reports or anecdotal experience of respected authorities
If your question is about a diagnostic test or observation, you need a study that has made an independent, blind comparison with an adequate reference standard based on patients with a similar spectrum of disease to your patient. If about prognosis, you need a study that follows a group of patients similar to your patient (cohort), over an adequate period of time, to see what happens to them.

Make a decision

In cooperate the evidence into clinical or policy decision depend on validity and relevance of evidence. The probability of outcome and the value assigned them to patient, the clinician and wide society

Evaluate your performance

Ensure the evidence based decision are translated into practice and measure the wider effective of implantation on health care
Examples of the range of evidence available in paediatrics

1. Clear evidence of benefit

Surfactant therapy in preterm infants

This evidence was rapidly produced and introduced into practice as:

• respiratory distress syndrome is a common cause of death and morbidity in a neonatal intensive care unit

• there is a clearly understood disease mechanism for respiratory distress syndrome, i.e. surfactant deficiency

• the effect of surfactant treatment was immediately obvious at the cot-side - ventilator settings usually have to be reduced shortly after administration

• potential benefits and side-effects could be clearly defined and identified

• neonatologists are a relatively small group of doctors who meet regularly - national and international studies could be organised and their results quickly disseminated

• there was widespread financial support and involvement from the pharmaceutical industry.

2. Clear evidence, but need to balance benefits and harms

Antibiotic treatment for children with otitis media

there is a balance of risk and benefits.

3. No clear evidence

Bulk forming laxatives for constipation

Bulk forming laxatives, such as methylcellulose or ispaghula husk, are used in children with constipation. However, this is not based on clear evidence. There are no systematic reviews and no randomised controlled studies of these agents in children.
Some possible reasons for the lack of evidence on the use of these laxatives in this common condition are:

• constipation is not a life-threatening disorder

• the causes are multifactorial and the disease mechanism is not clearly defined

• there is a belief that there are likely to be few side-effects to the use of bulk forming laxatives and clinicians are prepared to prescribe them without clear evidence

• there is limited support for studies from the pharmaceutical industry

• the research agenda is not
Example of evidence-based practice in solving a clinical problem – the management of acute otitis media

Clinical problem:
Should you treat a 3-year-old boy with otitis media with antibiotics?

Population
Children with acute otitis media

Intervention
Antibiotics compared with none

Outcomes
Pain
- Hearing loss
- Adverse drug side-effects
- Other complications

Frame question
Search for the evidence

Cochrane Library – 22 meta-analyses, one corresponding best to this child

Appraise the evidence

Reduced risk
- Pain at 24 hours
- Pain at 2–7 days
- Deafness at 3 months
- Perforation
- Contralateral otitis media
- Vomiting, diarrhoea or rash
- Late recurrences

Increased risk

Odds ratio

You explain to the patient the antibiotics
- Would reduce the risk of pain
- Would increase risk of minor side effect

The decision of or not to treat depend on patient's value about pain and side effect
One approach to give antibiotic ask them to wait 2 days and use only if child is still unwell
To what extent is paediatric practice based on sound evidence?

there are two paediatric specialities in which there is a considerable body of reliable, high-quality evidence underpinning clinical practice, namely paediatric oncology and, to a lesser extent, neonatology.

Management protocols of virtually all children with cancer are part of multicentre trials designed to identify which treatment gives the best possible results. The trials are national or, increasingly, international, and include short- and long-term follow-up.

In general, the evidence base for paediatrics is poorer than in adult medicine.

Reasons for this include:

• The relatively small number of children with significant illness requiring investigation and treatment. To overcome this, multicentre trials are required, which are more difficult to organise and expensive.

• Additional ethical limitations

  • subjectioning children to additional investigations or giving a new treatment is severely limited by the inability of the child to give consent. Some parents are concerned that participating in a trial could mean that their child could receive treatment that turns out to be inferior to the standard treatment and could have unknown side-effects.

  • there is concern over the ability of parents to give truly informed consent immediately after the acute onset of serious illness, e.g. the birth of a preterm infant, meningococcal septicaemia or meningitis.

• Limited investment by the pharmaceutical industry in drug trials, as drug use in children is insufficient to justify the cost and ethical difficulties of conducting trials. As a result, approximately 50% of drug treatments in children are unlicensed ('off label').
The consequence is that there is less of a culture of randomised controlled trials in paediatrics compared with adult medicine.

For evidence-based practice to become more widespread, clinicians must recognise the need to ask questions, particularly about procedures or interventions which are common practice.

However, evidence-based medicine is not cookbook medicine. Incontrovertible evidence is rare, and clinical decisions complex, which is why clinical care is provided by clinicians and not technicians.

Evidence-based health care cannot change this, but is an essential tool to help clinicians make rational, informed decisions together with their patients.

In addition, evidence-based paediatrics provides a way for clinicians to articulate their priorities for research and thereby set a research agenda which is relevant to service needs.
Childhood

Behavior and psychiatric disorder
Problems of the preschool years

Feeding problems in infancy and childhood

Most children at some point will be 'picky eaters' - a phase which will usually pass spontaneously. Infants and children may also, however, refuse to feed if they find the experience painful or frightening.

Reasons contributing to this may include:
- Unpleasant physical experiences associated with eating, e.g: gastro-oesophageal reflux,
- Oral candidiasis, stricture post-oesophageal atresia repair
- Oral motor dysfunction
- Children who have required early nasogastric tube feeds
- Maternal depression
- Being forced to eat by caregiver
- Developmental conflict with caregiver
- Emotional and social deprivation

Non-organic faltering growth is a diagnosis of exclusion.

Evaluation of feeding disorders
- Complete history including detailed social history

  Mealtime history
  - What is the parent most concerned about?
  - Nutrition? refer to growth chart
  - Discipline and parenting?

  family history of eating problems
  - parenting style
  - what do others say?
  - is it part of a broader problem?

  How much food is eaten between meals?
  - food diary to record child's intake over number of days

- Complete physical examination - need to exclude physiological, anatomical and neurological abnormalities
- Assess emotional state and developmental level
- Observe feeding interaction
- Help parents to understand that infants and children may have different styles of eating and food preferences
Management of feeding disorders

- Eliminate and/or treat physical cause
- Multidisciplinary approach including paediatrician, GP, health visitor, speech therapist, dietician and/or psychologist
- Child's behaviour may need modification
- If there is also faltering growth, exclude medical disorders and maltreatment

Advice

- As long as offered wholesome food, children are remarkably good at eating a constant and appropriate quantity of food when allowed a free choice as it is impossible to force a child to eat, avoid confrontation at mealtimes
- Develop a relaxed atmosphere
- Use favourite foods as a reward
- Reduce eating between meals if necessary, though many young children prefer small, frequent snacks

Pica (the ingestion of inedible material such as dirt and rubbish) may be normal in toddlers but persistent ingestion is found in children with learning difficulties and in psychotic and socially deprived children. Lead poisoning is a theoretical risk from pica.
Sleep disorder

Child not settling at night

Reluctance to settle at night and persistent waking during the night are common problems in young children, with one in five 2-year-olds waking at least five times per week.

Factors contributing to sleep difficulties

- Adverse temperamental characteristics in child
- Perinatal problems
- Maternal anxiety
- Poor accommodation
- Physical illness
- Medication, e.g. theophyllines
- Timing of feeds
- Co-sleeping with parents
- Too much sleep in the late afternoon
- Displaced sleep/wake cycle - not waking child in morning because did not settle until late on the previous night
- Separation anxiety
- Overstimulated or overwrought in evening Kept awake by siblings or noisy neighbours or TV in the bedroom
- Erratic parental practices: no bedtime or routine to cue child into sleep readiness, sudden removal from play to go to bed without prior warning
- Use of bedroom as punishment
- Dislike of darkness and silence - night light and playing story tapes can be helpful
Management of a child not settling at night

A behavioural strategy is usually successful but often needs to be combined with some respite for the parents.
Many cases will respond to common-sense advice: creating a bedtime and a bedtime routine which cues the child to what is required telling the child to lie quietly in bed until he falls asleep, recognising that children cannot fall asleep to order (although that is what everyone tells them to do).

More refractory cases may merit a couple of nights of respite sedation (trimeprazine) to enable parents to catch up on lost sleep themselves.

Unlicenced melatonin, however, is sometimes used to reduce both the time to sleep onset and the number of episodes of night wakening. Its use in children with coexisting neurodevelopmental pathology has been well described.

Medication, such as sedating antihistamines, are usually unhelpful in this situation.

Once they are feeling more on top of things, they can impose a graded pattern of lengthening period between tucking their child up in bed and coming back after a few minutes to visit him, but leaving the room before the child falls asleep. The object is to provide the opportunity for the child to learn how to fall sleep alone, a skill he has no yet developed.
Nightmares

are most common between the ages of 3 and 5 years with an incidence of between 25% and 50%.

The child who awakens during them is usually alert and can recall the dream and frightening images.

They are usually self-limiting and may be related to obvious frightening or stressful events.

In severe cases the involvement of a psychologist or psychiatrist may be needed.
Temper tantrums

These are common in the pre-school child and generally occur when the child is angry or has hurt themselves. Usually they are typified by screaming and/or crying, often in association with collapsing to the floor. It is rare for the child to injure themselves during such episodes. If necessary the child should be restrained from behind by folding one's arms around the child's body. It is important to minimize any additional attention to the child and to respond and praise only when behaviour is back to normal.

Analysing a tantrum

Antecedents
- what happened in the minutes before the episode

Behaviour
- exactly what the episode consisted of

Consequences
- what happened as a result

Tantrums: management strategies
- Affection and attention
- Distraction
- Avoiding antecedents
- Ignoring:
  - Time out from positive reinforcement:
  - Walk away, returning when quietens down
  - Separate from siblings Put on a 'naughty chair' for a short time
  - Cuddling tightly
  - Star chart

All Effective but can be difficult No surrender
Breath-holding attacks

These episodes typically occur after a frustrating or painful experience.

The child cries inconsolably, holds his breath and then becomes pale or cyanosed. In the most serious cases loss of consciousness may ensue and there may be stiffening of the limbs or brief clonic movements.

Clearly it may be difficult to distinguish from a generalized seizure; however, the fact that after a breath-holding attack the child will take a deep breath and immediately regain consciousness may facilitate differentiation. Typical onset is between 6 and 18 months.

No specific treatment is needed and the episodes diminish with age.
Problems of middle childhood

- School refuse
- Sleep disorder
- Nocturnal enuresis
- Faecal soiling
- Tics
- Recurrent unexplained somatic symptoms (somatisation CFS)

School refusal

This problem refers to the child's irrational fear about school attendance and most commonly is seen at the beginning of schooling or in association with a change of school or move to secondary school.

Typically the child is reluctant to leave home in the morning and they may develop headache or abdominal pain.

Boys and girls are equally affected and there is no relationship to social class.

Neither is there any relationship with intellectual or academic ability.

The youngest in a family of several children is more likely to be affected and parents are often older than would otherwise be expected.

It can affect a school child of any age, but young teenagers at about the time of transition from primary to secondary school are more likely to develop school refusal.

Parents are aware of refusal to attend school (unlike truancy).

It is important to convince child and parents that the problem is a pathological emotional reaction to leaving home and/or going to school and not some undiagnosed physical disorder.

It is also important to convince them that, despite any anxiety/mood disorder, return to school will substantially improve matters.

Early return to school is the treatment of choice. However, referral to mental health services for children will be required if return to normal school attendance cannot be achieved in a reasonable period of time.
Factors contributing to school refusal include:

- Separation anxiety
- Specific phobia about an aspect of school attendance, e.g. travelling to school, mixing with other children, games, lessons, etc.
- A more generalized psychiatric disturbance such as depression or low self-esteem
- Bullying

Characteristics of school refusers

- Good academic achievements
- Conformist at school
- Oppositional at home

Treatment of school refusal

- Avoid unnecessary investigation of minor somatic symptoms
- Advise and support parents and school about the condition
- Treat any underlying emotional disorder
- Plan and facilitate an early and graded return to school at a pace tolerable for the child with all involved (child, family, teachers, educational psychologist and educational welfare officers)
- Help the parents make it more rewarding for the child to return to school than stay at home
- Address bullying or educational difficulties if present

In chronic cases a gradual reintegration back into school is required, possibly with a concurrent specific behavioural programme and targeted family therapy. Overall two-thirds of children will return to school regularly. Those who do badly are often adolescents from disturbed family backgrounds.
Sleep problems in the school-aged child

To understand sleep disorders a basic knowledge of the sleep cycle is necessary.

Sleep stages

Sleep consists of several stages that cycle throughout the night.

One complete cycle lasts 90-100 minutes.

<table>
<thead>
<tr>
<th>Sleep stage</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Slow wave sleep (SWS) or non-rapid eye movement (NREM)</td>
<td>Transition state between sleep and wakefulness. Eyes begin to roll slightly. Mostly high-amplitude, low-frequency theta waves. Brief periods of alpha waves — similar to those when awake. Lasts only a few minutes.</td>
</tr>
<tr>
<td>2 SWS or NREM</td>
<td>Peak of brain waves higher and higher. Sleep spindles. Lasts only a few minutes.</td>
</tr>
<tr>
<td>3 SWS or NREM</td>
<td>Also called delta sleep or deep sleep. Very slow delta waves account for 20–50% of brain waves.</td>
</tr>
<tr>
<td>4 SWS or NREM</td>
<td>Also called delta sleep or deep sleep. Over 50% of brain waves are delta waves. Last and deepest of sleep stages before REM sleep.</td>
</tr>
<tr>
<td>5 REM</td>
<td>Frequent bursts of rapid eye movement and occasional muscular twitches. Heart rate increases. Rapid shallow respirations. Most vivid dreaming during this phase.</td>
</tr>
</tbody>
</table>
Night terrors

This condition is one of the parasomnias, a category that includes sleepwalking and sleep talking, commonly seen in children between the ages of 4 and 7 years (+ve F.H.). Typically the child wakes from deep or stage 4 sleep and not during rapid eye movement sleep, cries or screams inconsolably apparently terrified, hallucinating and unresponsive to those around them. During these episodes, there is intense fear and autonomic arousal (tachycardia, sweating).

Usually such episodes last less than 15 minutes and the child goes back to sleep, with no recollection of the events in the morning.

It is unusual to find any underlying reason or stresses contributing to the problem. Begins during early childhood and resolves spontaneously during Adolescence.

Treatment for night terrors consists of education and reassurance.

If the night terrors occur in unusually long clusters, a brief course of low-dose benzodiazepine therapy or a tricyclic antidepressant administered at bedtime may interrupt the clusters.

Nightmares

These are common, occur during REM sleep at 3-5yrs (with anexity history but no fam. History) and the child remembers the dream either immediately or in the morning.

rarely requiring professional attention unless they occur frequently or are stereotyped in content, indicating a morbid preoccupation.

Reassuring the child will usually suffice.

Sleepwalking

This occurs during stages 3 or 4 of sleep and is most often seen in those between 8 and 14 years.
Tics
A tic is a quick, sudden, coordinated movement which is apparently purposeful, recurs in the same part of the child's body and can often be reproduced by the child on request.
It is not entirely involuntary in that it can be purposefully suppressed to some extent.
These occur transiently in 10% of children and are much more commonly seen in boys. About 1 in 10 children develop a tic at some stage. Onset is usually around the age of 7 years, typically around the face and head - blinking, frowning, head-flicking, sniffing, throat clearing and grunting being the commonest, these simple, transient childhood tics are seen most commonly clear up over the next few months, though they may recur from time to time.
Less commonly, the child has chronic tic disorder which may be multiple, motor tics and vocal tics such as shooting, yelping or swearing, is known as Gilles de la Tourette syndrome may occur in childhood characterized by complex tics occurring in association with coprolalia (obscene words and swearing) and echolalia (repetition of sounds or words).

Factors predisposing to tics
- Positive family history
- Stress (including parental)
- Neurodevelopmental delay

Treatment
- Simple tics clear up over the next few months, though they may recur from time to time, they should be treated with reassurance accordingly and behavioural or family therapy if appropriate
- Tourette's syndrome these conditions tend to be persistent in the medium term, requiring medication (such as clonidine, haloperidol, sulpiride, pimozide) and specialist supervision

Outcome
- Simple tics - complete remission
- Tourette's syndrome - 50% have symptoms into adult life
Enuresis
This is defined as the involuntary passage of formed urine in the absence of physical abnormality after the age of 5 years.

May be
- Primary enuresis from beginning
- Secondary enuresis (relapse after a period of dryness).

Diurnal enuresis
is much more common among girls and those who are psychiatrically disturbed. Daytime and secondary enuresis are described latter on

Nocturnal enuresis
is much more common than diurnal enuresis, can affect up to 6% of 5-year-olds and 3% of 10-year-olds children boys outnumber girls by nearly 2 to 1 with two-thirds of children with enuresis having an affected first-degree relative. Although most children with nocturnal enuresis are not psychiatrically ill, up to 25% will have signs of psychiatric disturbance.

Aetiology
- Positive family history in 70%
- Developmental delay
- Psychiatric disturbance
- Small bladder capacity
- Recent stressful life events (secondary enuresis)
- Large family size
- Social disadvantage
Most children with enuresis are psychologically normal and the treatment of secondary enuresis still relies mainly on the symptomatic approach described below, although any underlying stress or emotional disorder must be addressed.

If the child is distressed by the wetting or it is leading to distress within the family, then treatment should be considered. An interested and sympathetic health care professional can certainly help to support the family and between 5 and 7 years the strategy of explanation, reassurance, star charts and praise or small rewards for dry nights is usually all that is necessary.
An enuresis alarm may be used in older children (7+).

For children with primary nocturnal enuresis, treatment with enuresis alarms reduces the number of wet nights.

Desmopressin (DDAVP) and tricyclic drugs reduce the number of wet nights by 1 to 2 per week during treatment, although the effect is not sustained after treatment is finished.
Dry bed training with an alarm results in an additional reduction of wet nights over alarms alone (although a viable strategy, it is not normally employed in children under 7).
Drugs and more complex behavioural techniques including alarm or buzzer are usually reserved for children over 6 or 7 years of age.
Treatment
Exclude physical basis (history, examination, urine culture, +I- imaging)

A urine sample should always be tested for glucose and protein and checked for infection.

Organic causes of enuresis are uncommon but include:
- urinary tract infection
- faecal retention severe enough to reduce bladder volume and cause bladder neck dysfunction
- polyuria from osmotic diuresis, e.g. diabetes mellitus, or renal concentrating disorders, e.g. chronic renal failure.

Look for underlying stresses
Most children with enuresis are psychologically normal although any underlying stress or emotional disorder must be addressed.

The management of nocturnal enuresis is straightforward but needs to be painstaking to succeed.

After the age of 4 years, enuresis resolves spontaneously in only 5% of affected children each year.

In practice, treatment is rarely undertaken before 6 years of age but if the child is distressed by the wetting or it is leading to distress within the family, then treatment should be considered.

An interested and sympathetic health care professional can certainly help to support the family and between 5 and 7 years the strategy of
- Explanation
- Reassurance
- star charts and praise or small rewards for dry nights is usually all that is necessary.
- Enuresis alarm (7 years and older)
- Drugs (short-term control only) desmopressin, tricyclic antidepressants

It must be remembered that child sexual abuse may present with enuresis and/or encopresis.
1. Explanation
The first step is to explain to both child and parent that the problem is common and beyond conscious control. The parents should stop punitive procedures, as these are counterproductive.

2. Star chart
The child earns praise and a star each morning if his bed is dry. Wet beds are treated in a matter-of-fact way and the child is not blamed for them.

3. Enuresis alarm
If a child does not respond to a star chart, it may be supplemented with an enuresis alarm. This is a sensor, usually placed in the child's pants, which sounds an alarm when it becomes wet. In order to be effective, the alarm must wake the child, who gets out of bed, goes to pass urine, returns and helps to remake a wet bed before going back to sleep. It is not necessary to reset the alarm that night. Parental help can be enlisted in the night using a baby alarm to transmit the noise of the alarm to the parents' bedroom.

The alarm method takes several weeks to achieve dryness but is effective in most cases so long as the child is motivated and the procedure is fully explained. About one-third relapse after a few months, in which case repeat treatment with the alarm usually produces lasting dryness.

4. Desmopressin
Short-term relief from bedwetting, e.g. for holidays or sleepovers, can be achieved by the use of the synthetic analogue of antidiuretic hormone, desmopressin, taken as tablets or sublingually.

This achieves a suppressant effect rather than a lasting cure.

5. Self-help groups, e.g. Enuresis Resource and Information Centre (ERIC)
These provide advice and assistance to parents and health professionals.
Encopresis and soiling

This is defined as the inappropriate passage of formed faeces, usually onto the underwear, after the age of 4 years. It is uncommon, with a prevalence of 1.8% among 8-year-old boys and 0.7% for girls.

Psychiatric disturbance is common and enuresis often coexists.

Broadly speaking, children with encopresis may be divided into those who retain faeces and develop subsequent overflow incontinence (retentive encopresis) and those who deposit faeces inappropriately on a regular basis (non-retentive).

Type of encopresis and common family characteristics

- Retentive - obsessional toilet-training practices
- Non-retentive - continuous, disorganized, chaotic families

Other risk factors for encopresis

- Poor parent-child relationship
- Emotional stresses (including sexual abuse)
- Past history of constipation/anal fissure

Treatment

- Exclude physical problems, e.g. Hirschsprung’s disease/hypothyroidism/hypercalcaemia
- Laxatives to clear bowel
- Education for parents and child
- Star chart
- Individual psychotherapy
- Family therapy

It is unusual for this problem to persist into adolescence
Somatic symptoms

may be a means of communicating emotional distress sources of stress should be identified, and ameliorated if possible in many children with unexplained recurrent abdominal pain or headaches, no significant sources of stress are identified.

Recurrent unexplained somatic symptoms/somatisation

Recurrent medically unexplained (functional somatic) symptoms are common in childhood and adolescence. In many cases they are aggravated by some kind of stress and they can be the expression of an anxiety or depressive disorder. Somatisation is the term used for the communication of emotional distress, troubled relationships and personal predicaments through bodily symptoms.

The prepubertal child may experience affective distress as recurrent abdominal pain (this symptom peaking at age 9 years) and headaches (peaking at age 12 years). With increasing age, limb pain, aching muscles, fatigue and neurological symptoms become moreprominent.

Recurrent central abdominal pain, often sharp and colicky, affects about 10% of school-age children.

Diagnosis

The history must attend to possible sources of stress and the child should be interviewed about school, friends and family, noting the general level of anxiety and ability to communicate.

This should be an integral part of the interview and not done as an afterthought when organic causes have been excluded.

A thorough physical examination is important to reassure the child and family that there is no underlying organic cause.

It also provides an opportunity to gain further information about the nature of the pain and the child’s reaction to it. When examining the child, it is sensible to ask him to point to where the pain is.

In general, the further the pain is from the umbilicus, the more likely it is being caused by organic pathology (Apley’s rule).
Differential Diagnoses and Co-morbidities and Investigation

Routine tests on all patients should include a blood test and a urine test for the following investigations:

**1st Line Investigations**
- FBC & film to exclude anaemia, iron deficiency and leukaemia
- ESR (or viscosity) (unlikely to be elevated in CFS/ME (77;78)) and CRP (c-reactive protein) (a high level could suggest autoimmune disease, e.g. Systemic Lupus Erythematosus, or chronic infection, e.g. Tuberculosis)
- Blood glucose for diabetes mellitus
- Blood biochemistry (Na, K, creatinine) to look for renal impairment or endocrine abnormality (e.g. Addison's)
- CK for evidence of muscle disease
- Thyroid function because early clinical signs of hypothyroidism
- Liver function (transaminases: AST, ALP and albumin) for hepatitis
- Urine tested for protein, glucose/sugar, to exclude renal disease, diabetes mellitus, tested for blood leukocytes and nitrates to exclude urinary tract infection
- Viral titres or other viral tests to impute or exclude current viral infection are not recommended apart from EBV IgM, IgG and EBNA.

**Second Line Investigations**
- Blood tests for antinuclear antibody, immunoglobulins, coeliac serology, Lyme disease, toxoplasma, brucellosis antibodies, copper & caeruloplasmin, cortisols & Synacthen test, B12, folate, ferritin, carbon monoxide (blood carboxyhaemoglobin)
- Urinalysis: organic acids (glc/ms), amino acids (by 2D lc), toxicology screen
- Imaging: Chest X-Ray
- Formal educational & psychometric assessment
- Formal psychiatric assessment multi-disciplinary approach (graded exercise programme), particularly using physiotherapy and occupational therapy and to encourage engagement with child and adolescent mental health services.

**Other Investigations**
These include HIV serology and MRI scan of the brain (to exclude tumour, multiple sclerosis).
Management of CFS/ME in children

Information and understanding is very important in the management of CFS/ME and this should cover the possible causes, nature and course of CFS/ME, return to education and self-help groups.2 Children and young people should be given advice about symptom control, sleep and activity.

It is important that young people and their families are supported and helped with this and not just told to "go to the gym" or "exercise more". Activity management is also called pacing, energy management, or when it is about exercise only - graded exercise. There are three stages - recognise the boom-bust pattern, find a baseline and then increase activity slowly.

Most children and young people will use a boom-bust strategy for managing their CFS/ME doing more on a good day and less on a bad day.

Taking a clear history of physical, cognitive and emotional activity and how it varies from day to day enables young people to understand what this means in practice.

They are then in a good position to start to monitor their activity and find their baseline.

Find the baseline: the baseline is the level of activity they can do on a good day and a bad day.

It includes all three types of activity and is usually half of what the young person can do on a good day.

Increase activity: once a young person has successfully found their baseline, they can then increase this but by no more than about 10-15% a week.

The young person should increase activities that will enable them to achieve their goals.

For example, if their primary goal is going back to school, they should work primarily on increasing cognitive activities. If it is to get fit, they should work on exercise.

Sleep advice is also very important. Too much sleep reduces the quality of sleep and changing the wake up time depending on how tired you are makes setting a routine impossible.

Children and young people can be encouraged to more than their peers.

This improves the quality of their sleep so they feel less tired in the morning. Wake up at the same time every day and ensure they sleep no
Referral to specialist services

The NICE guidelines recommend that referral to a specialist service should be offered:

- **Immediately** if the child or young person is severely affected (house bound);
- **at 3 months** if they are moderately affected (as in the example here); and
- **at 6 months** if they are mildly affected (essentially attending fulltime school but unable to do other activities).

The outcome in children and young people referred to specialist services is good with over 90% making a good or complete recovery.

Unfortunately at the moment, many parts of the country still do not have access to a specialist service.
Clinical Algorithm for Management of CFS/ME

Patient < 18 years with
- Debilitating fatigue not relieved by rest
- Other symptoms such as muscle pain, headache, sore throat;
  memory/sleep problems

- Thorough physical to include neurological exam, lymph
  node/liver/spleen/tonsil enlargement; palpation over nasal
  sinuses, tongue and standing BP & HR
- General health and past medical history
- Assessment of psychological well being
- Family history of chronic illness
- Listen to patient, explore all symptoms/ functional impairment

Abnormal findings probably not CFS/ME

Diagnose a generalised fatigue syndrome
- blood and urine tests for recommended investigations
- Viral tests to exclude current infection are not recommended
  apart from EBV IgM IgG and EBNA

Second line investigations for differential diagnosis

Abnormal
- CFS/ME
- Treat refer as appropriate

Not CFS/ME
- Likely CFS/ME but review results

Normal

Diagnose CFS/ME communicate reasons to family and document
- Reassess symptoms including psychological well being and functional impairment
- Shared management plan with family and
  other health professionals as appropriate
- Inform school/LEA with consent if more than
  15 days school missed or impairment will affect schooling
- Refer to psychologist/psychiatrist if significant
  morbidity and no local expertise or for specific behavioural interventions

Establish baseline with activity diary
- When stable agree gradual increases in activity

Continued stable / improving baseline

Deterioration/no improvement after 6 months or severe CFS/ME

Reassess management plan
- Consider specific behavioural interventions if patient well enough
- Consider referral to other health professionals
- Provide domiciliary visits if situation merits
- Only consider inpatient care for treatments
  not available on O/P basis

Regular review to:
- Assess progress with management plan
- Assess how patient / family coping
- Identify any new or more severe symptoms
- Provide advice on diet + sleep
- Symptomatic treatment of pain, sleep problems and depression referring as necessary.
Chronic pain syndrome

Chronic pain and recurrent pain probably affects at least 15% of teenagers at any one time; it is more common in girls than in boys with a peak incidence at 14 years of age. Although chronic headaches and abdominal pain are probably the most common presentation of chronic pain syndrome, musculoskeletal pain is also common.

In adults there is evidence of overlap with other illnesses such as CFS/ME.

A diagnosis of chronic pain syndrome is a diagnosis of exclusion.

Once all the investigations have been done, there are some features that will help the pediatrician make the diagnosis, such as the lack of response to medication. Children often say that the medication “takes the edge off but doesn’t stop the pain”.

The allodynia (hypersensitivity to touch) is also typical. Colour and skin changes are common in the reflexsympathetic dystrophy or complex regional pain syndrome group

Management

• Once again, information and understanding is very important in the management of chronic pain syndrome.

• The strategies used for CFS/ME (see above) for sleep and activities are also useful in managing chronic pain syndrome. In addition, the pediatrician may want to consider a trial of medication, such as amitriptylline or gabapentin.

• If symptoms do not resolve quickly, the child should be offered referral to a multidisciplinary pain team as there are many different treatment options available including desensitisation of the affected area, nerve blocks and cognitive behavior therapy type methods to control symptoms.
Childhood psychiatry
High risk for Childhood psychiatric illness

- inner city areas
- Physical disability
- Divorce and Marital discord
- Children adopted as later in childhood not in infancy.
- Any degree of learning disability
- Deprived areas in major cities
- Chronic illness
- Lack of emotional attachment
Attention deficit hyperactivity disorder (ADHD/HKD)

Diagnostic criteria

The core symptoms of ADHD and HKD comprise developmentally inappropriate

- **inattention** (difficulty in concentrating)
- **hyperactivity** (disorganised, excessive levels of activity)
- **impulsive** behavior.

In order to meet diagnostic criteria it is essential that symptoms:

- have their onset before the age of **seven** years (ADHD) or six years (HKD)
- have persisted for at least **six** months
- must be pervasive (present in **more than one setting, eg at home, at school, socially**)
- have caused significant functional impairment
- are not better accounted for by other mental disorders (eg pervasive developmental disorder,
- schizophrenia, other psychotic disorders, depression or anxiety

Common problems associated with ADHD in children

Non-compliant behavior  Motor tics
Sleep disturbance  Mood swings
Aggression  Unpopularity with peers
Temper tantrums  Clumsiness
Literacy and other learning problems  Immature language
Management

Comprehensive treatment program

By behavioral education program (modification)

Behavioral training is recommended in pre-school children for parent and teacher in school age children in pre-adolescent children with and comorbid symptoms of oppositional defiant disorder and/or aggressive behavior, behavioural programmes are recommended to treat the comorbid problems. in pre-adolescent children with and comorbid generalised anxiety behavioural programmes are recommended to treat the comorbid problems.

The initiation of pharmacological treatment (CNS stimulation) if severe and persist more than 6yr old age, for children with should only be undertaken by a specialist, in either child and adolescent psychiatry or paediatrics who has training in the use and monitoring of psychotropic medications (every 3-6 mo)

Also educational support and social service
Depression

the patient has at least five of the following symptoms:
1. depressed mood (irritability in some children)
2. loss of interest/pleasure
3. loss of appetite or overeating
4. sleep disorders
5. fatigue
6. feeling of worthlessness or guilt (patient may be delusional)
7. poor concentration
8. suicidal ideation or thoughts of death

<table>
<thead>
<tr>
<th>Depression</th>
<th>Risk profiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection</td>
<td>Identification in presenting children or young people</td>
</tr>
<tr>
<td>Recognition</td>
<td>Watchful waiting</td>
</tr>
<tr>
<td>Mild depression (including dysthymia)</td>
<td>Non-directive supportive therapy/group cognitive behavioural therapy/guided self help</td>
</tr>
<tr>
<td>Moderate to severe depression</td>
<td>Brief psychological therapy +/- fluoxetine</td>
</tr>
<tr>
<td>Depression unresponsive to treatment/recurrent depression/psychotic depression</td>
<td>Intensive psychological therapy +/- fluoxetine, sertraline, citalopram, augmentation with an antipsychotic</td>
</tr>
</tbody>
</table>
Features of depression in adolescents

More common than adults

- Apathy, an inability to enjoy oneself
- Separation anxiety
- Decline in school performance
- Social withdrawal
- Hypochondriacal ideas and complaints of pain

Less common than adults

- Loss of appetite and weight
- Loss of sleep
- Loss of libido
- Slowing of thought and movement
- Delusional ideas in chest, abdomen and head
- Irritable mood or frankly antisocial behavior

Diagnosing major depression

The main difficulty in diagnosing major depression is that the gravity of the depressive mood is often not apparent to the parents and the clinician.

The clinician should have a high index of suspicion of major depression in any child who presents with sullenness and irritability.
Guidelines for evaluating such a patient are as follows:

1. Assess suicidal ideation and ensure the patient’s safety.
2. Interview multiple sources (coaches, teachers) to determine the child’s function and symptoms.
3. Obtain a thorough family history for symptoms and diagnoses of mood disorders.
4. Rule out bipolar disorders (mania and hypomania).
5. Investigate primary or comorbid conditions (e.g., substance abuse).
6. Consider the role of life stressors in relationship to the symptoms.

Treatment

depends upon the relationship between low mood and causal circumstances. Adversity such as bullying should be reversed if possible. If this cannot be done, as in the case of impending parental divorce, then counselling using cognitive behavioural approaches where links are made between feelings, thoughts and behavior have been shown to help. If therapy is insufficient and the depression is severe, then an SSRI (selective serotonin reuptake inhibitor antidepressant), fluoxetine, is indicated. Suicidal teenagers need admission to a psychiatric in-patient unit.

SSRIs, other than fluoxetine, are not recommended in under 18 year-olds due to reported risks of increased suicidal ideation, self-harm, agitation, hostility and aggression.

If they are used, very close monitoring for these signs is required to ensure patient safety.
Schizophrenia

The diagnosis of schizophrenia is further subdivided by the primary symptom complex into the following types: paranoid, disorganized, catatonic, residual, and undifferentiated.

The treatment of schizophrenia consists of the use of Atypical antipsychotic agents (risperidone, colanzapine, clozapine in treatment resistant cases), psychotherapy, and educational interventions.

Diagnostic criteria for schizophrenia are two or more of the following present for a 1-month period:

1. delusions (erroneous beliefs) somatic (internal organs are replaced by others),
2. hallucinations
3. disorganized speech
4. catatonic behavior
5. negative symptoms, such as flat affect

Prognosis

• a sudden onset and older age onset of illness favourable prognosis than when the onset is insidious.
• A premorbid history of social withdrawal is predictive of more severe and long-lasting psychopathology.
• A family history of schizophrenia is commonly found in second-degree relatives and has little prognostic significance.
• MRI changes are associated with more severe symptoms and clinical course in people with schizophrenia.
• The presence of catatonic symptomatology is not associated with any particular clinical course.
Suicidal thoughts and attempts

Essential Elements of the Patient's History

- Assess suicide potential (ensure safety)
- Interview child alone
- Interview multiple sources
- Obtain family history for symptoms and disorders
- Rule out medical causes, including substance use
- Consider comorbidities
- Inquire about past mental health referrals

Risk factors

- male sex, broken home
- Immigrations state
- Live alone
- Positive f. history for suicide and alcohol
- Adolescence, conscious plan
- Available means (medications or firearms),
- Depression,
- Hopelessness, impulsiveness,
- Low frustration tolerance,
- Use of intoxicants,
- Sexual identity conflicts,
- Recent death of family member or friend
- Previous suicide attempts
Conduction disorder (antisocial behavioral)

Conduct Disorder

A child has conduct disorder if he or she has repetitively violated the rights of others and of society.

Children with this diagnosis have performed three or more of the following behaviors within the past year with at least one occurring in the previous 6 months:

1. Aggression toward people or animals (intimidation, initiation of fights; use of weapons; cruelty to people; cruelty to animals; rape; confrontational theft
2. Destruction of property (arson, vandalism)
3. Deceitfulness (nonconfrontational theft [house breaking, "conning"])
4. Serious violation of rules (curfew violation, running away, truancy before age 13)

RX

Therapy is best managed by mental health professionals. Consists of individual and/or family psychotherapy, judicious use of residential treatment centers, and treatment of comorbid conditions (substance abuse, ADHD, depression). Familial behavioral and social support (rehousing)
Oppositional deficit disorder (ODD)

is a chronic condition in which the patient is stubbornly rebellious toward all authority affected patients exhibit a consistent pattern during a 6-month period of at least four or more of the following behaviors:

1. frequently losing temper
2. often arguing with authority figures
3. defying rules
4. deliberately annoying adults
5. blaming others for his or her actions
6. becoming easily annoyed by others
7. being angry
8. being vindictive

RX

The role of the primary care provider is early recognition and directed toward treating comorbid disorders (ADHD, substance abuse, suicide ideation).

In addition, various psychotherapeutic modalities (individual, group, family) are employed to improve the child’s functioning referral to a mental health specialist therapy.
Anxiety disorders

The anxiety disorders are

- panic disorder
- separation anxiety disorder
- specific phobia
- social phobia
- OCD
- post-traumatic stress disorder
- acute stress disorder
- generalized anxiety disorder
Anorexia nervosa and Bulimia nervosa
# Characteristics of Anorexia Nervosa and Bulimia Nervosa

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Anorexia Nervosa</th>
<th>Bulimia Nervosa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intense preoccupation with food</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Weight loss</td>
<td>Severe</td>
<td>Fluctuates</td>
</tr>
<tr>
<td>Female</td>
<td>90%-95%</td>
<td>90%-95%</td>
</tr>
<tr>
<td>Family history</td>
<td>+ for anorexia nervosa</td>
<td>+ for depression</td>
</tr>
<tr>
<td>Methods of weight control</td>
<td>Severe food restrictions, emesis, exercise</td>
<td>Restriction and binges with self-induced vomiting and diuretic and/or laxative abuse</td>
</tr>
<tr>
<td>Guilt/shame</td>
<td>None</td>
<td>Yes</td>
</tr>
<tr>
<td>Denial</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>Personality</td>
<td>Withdrawal/asexual</td>
<td>Outgoing/heterosexual</td>
</tr>
<tr>
<td>Onset (age) Bimodal</td>
<td>(13-14 yr and 17-18 yr)</td>
<td>17-25 yr</td>
</tr>
</tbody>
</table>

- **Endocrinopathy:** Amenorrhea, increased growth hormone, TSH, osteoporosis, hypercarotenemia, hypothermia, hypokalemia
- **Cardiovascular:** Bradycardia, hypotension, arrhythmias, Ipecac toxicity, arrhythmias
- **Gastrointestinal:** Constipation, elevated hepatic enzymes, Gastric dilation and rupture, Mallory-Weiss syndrome, esophagitis, parotid, enlargement, dental enamel erosion
- **Psychiatric:** Depression, suicide, obsessional fears, social phobia, Impulsive behaviors, alcohol-drug addictions, depression, suicide
**anorexia nervosa features are:**

A determined attempt to lose weight or avoid weight gain, by either restricting food intake, self-induced vomiting, laxative abuse, excessive exercising or using a combination of these methods.

When body weight falls below a critical point (about 48 kg) pubertal development is halted and reversed so that menstruation ceases and the girl effectively becomes a prepubertal child.

This may spare her some of the challenges of adolescence, particularly those related to sexuality.

The discovery by a girl who has felt powerless that through self-starvation she can control her shape and development and thus increase her sense of self-worth and self-effectiveness.

Preoccupations and dreams of food and cooking which come to dominate mental life as a response to starvation.

The dramatic and visible effects of self-starvation on the girl which can unite some parents in caring for their daughter and save a discordant marriage from divorce, something which she may fear is imminent

A distorted perception of her body which increases with weight loss.

**This is one of the diagnostic criteria. According to ICD-10 all the following are required for a definite diagnosis of anorexia nervosa:**

- Quetelet's body mass index is 17.5 or less
- The weight loss is self-induced
- There is body-image distortion and a dread of fatness
- There is disturbance of the hypothalamic-pituitary-gonadal axis (manifest in women as
  - amenorrhoea and in men as a loss of sexual interest and potency)
- If the onset is prepubertal, the sequence of pubertal events is delayed or even arrested
**Management**

parental counselling to restore body weight some require hospitalisation; Both conditions are treated with psychotherapy, cognitive therapy and self-help groups.

Antidepressants can be useful in bulimia where fluoxetine is used (10 mg/day).

**Prognosis**

is variable, but has a mortality from suicide, malnutrition and infection
The prognosis in bulimia is variable.
Indication for referral to specialist mental health assessment is mandatory when there are signs suggestive of a major psychotic illness, major emotional illness, e.g.

- obsessional-compulsive disorder
- school refusal or eating disorders if persisted for more than 3 mo
- a suicide attempt
- disclosure of sexual abuse or for perpetrators of sexually abusive activity.
- conduct disorders
- poor family function
- significantly impairing maturation and development
- alcohol, solvents and opiates dependency
- poor coping with the psychological effects of chronic physical illness or handicap