CHILD HEALTH PSYCHOLOGY

A BIOPSYCHOSOCIAL PERSPECTIVE

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THE EXPERIENCE OF PAIN IN CHILDHOOD

9

Covered in this chapter

- The biopsychosocial approach to the experience of pain
- The pain experience in children and analgesic management of pain
- The prevalence of pain and disability in children
- Cognitive, behavioural and emotional factors in coping with pain
- The role of early life pain experience on subsequent pain
- Psychosocial interventions in acute and chronic pain

In this chapter, I explore the biopsychosocial experience of pain and how children cope with pain, from neonates and infants through to the experience of pain in adolescence. To begin with, I consider the prevalence of pain in children and the context of pain relief through pharmacological intervention. I then compare the characteristics of the experience of acute pain (e.g., dental pain or pain from an acute traumatic injury such as a car accident) with the characteristics of chronic pain experienced in chronic conditions (e.g., juvenile arthritis or sickle cell disease). In particular, I focus on how children cope with acute and chronic pain and how this may change over time, with age and experience, and consider both adaptive coping and maladaptive coping responses such as catastrophizing. Also considered are the assessment of pain, differences between children and adolescents in the expression of pain, and the role of sex differences in pain. I then draw on this knowledge to examine psychosocial interventions to reduce the experience of acute and chronic pain in children. Whilst reading this chapter, keep in mind the concepts of stress, coping, acute and chronic definitions and lifespan issues already covered in previous chapters. For those who like more of a

challenge, think about what parallels might exist between the research areas of pain and stress, between coping under conditions of acute and chronic stress and adaptation in acute and chronic pain, and where the pain experience in childhood fits with the theory of allostasis and concept of allostatic load across the life course (to be fair, I did say for those who like more of a challenge).

THE BIOPSYCHOSOCIAL APPROACH TO THE EXPERIENCE OF PAIN

DEFINITIONS, THEORIES AND MODELS: FROM 'BELFRY' TO 'GATE' AND BEYOND

Before we can explore the labyrinth of research pathways which support and inform the experience of pain, we first need to define exactly what is meant by the experience of pain. It is important to be able to distinguish between terms such as 'nociception', 'pain', 'acute pain', 'chronic pain' and 'recurrent pain'. These are defined in Box 9.1.

The description of pain in its most basic form, as understood in the days of philosopher René Descartes (1664), was pain as a physical response (this was at least the working theory of the philosophers and physiologists of the time, although I suspect that the average man or woman in the street was well aware that their pain experience was influenced by a range of psychosocial factors even though the word 'psychosocial' had not been coined). Descartes (1984) used the classic metaphor of a bell in a bell-tower, the rope from the bell being the nerves of the spinal cord linking the site of the noxious stimuli directly up to the brain or 'bell-tower' in which the experience of pain was registered. Descartes' ideas informed 'specificity theory' (led by key figures in the field such as Muller and von Frey in the nineteenth century), which views pain as being the product of one-way communication between pain receptors in the skin and the pain centre located in the brain via specific pain receptors (Melzack and Wall, 2008): in other words, a direct sensory modality for pain from specific tissue sites in the skin to the brain. However, specificity theory failed to account for differences in pain across individuals or to provide an explanation for various types of clinical pain (Melzack and Wall, 2008). Later theories in the late nineteenth and early part of the twentieth century were based on 'pattern theory' (the key figure being Goldschneider), which views different sensory modalities (e.g., touch, heat) as being capable of contributing to a pattern of overall intensity or 'summation' which triggers the pain experience (for a full account and evaluation of these theories, see Melzack and Wall, 2008). Both these theories are still prevalent within the medical model of pain but, as Melzack and Wall (2008) point out, although both make important contributions to the understanding of pain, they fail to account for affective, motivational (termed 'sensory motivational' and 'motivational affective') and cognitive processes which

BOX 9.1

What is pain? Some useful terms and definitions

Nociception: 'the neural mechanism by which an individual detects the presence of a potentially tissue-harming stimulus. There is no implication of (or requirement for) awareness of this stimulus' (Jaggar, 2005: 3).

Pain is 'a complex, multidimensional phenomenon' (Schechter et al., 2003: 15), defined as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage' (International Association for the Study of Pain). Jaggar (2005: 3) notes that 'perception of sensory events is a requirement, but actual tissue damage is not'.

Acute pain: 'the term generally ascribed to pain associated with a brief episode of tissue injury or inflammation, such as that caused by surgery, burns, or a fracture. In most cases, the intensity of pain diminishes steadily with time over a period of days to weeks' (Schechter et al., 2003: 14). Acute pain is pain that lasts less than 12 weeks (British Pain Society).

Chronic pain: 'conditions of persistent or of nearly constant pain over a period of 3 months or longer' (Schechter et al., 2003: 15). It is pain which lasts longer than 12 weeks or if the pain is following trauma or surgery then 'after the time that healing would have been thought to have occurred' (British Pain Society). Chronic pain conditions include chronic arthritis and sickle cell disease.

Recurrent pain: pain which is intermittent across time and can be intense but is not persistent or constant. It can occur in the absence of psychopathology or 'signs of a specific organic disease' (Schechter et al., 2003: 15). Recurrent pain examples include headache, abdominal pain, chest pain and limb pains. Occurrence is common in school children (occurrence rate = 5–10 per cent; Schechter et al., 2003: 15).

Neuropathic pain: persistent pain 'in the central or peripheral nervous system in the absence of on-going tissue injury' (Schechter et al., 2003: 15).

Somatoform pain disorder: 'persistent pain as a manifestation of psychiatric disease' (previously, psychogenic pain or hypochondriasis; Schechter et al., 2003: 15).

influence the pain experience. Interestingly, they put in the limelight the frequently overlooked philosopher and psychologist Henry Rutgers Marshall who, ahead of his time in the late nineteenth century, argued against these two dominant theories, in his own 'affect theory', for the inclusion of 'emotional quality' as a central component of the pain experience.

Building on these biological theories and early ideas of affective aspects of pain, Melzack and Wall (1965) revolutionized pain theory, and subsequently the clinical practice of treating pain, with their 'gate control theory' of pain, which was followed by Melzack's later concept of the 'neuromatrix' (Melzack, 1999a). Figure 9.1 shows

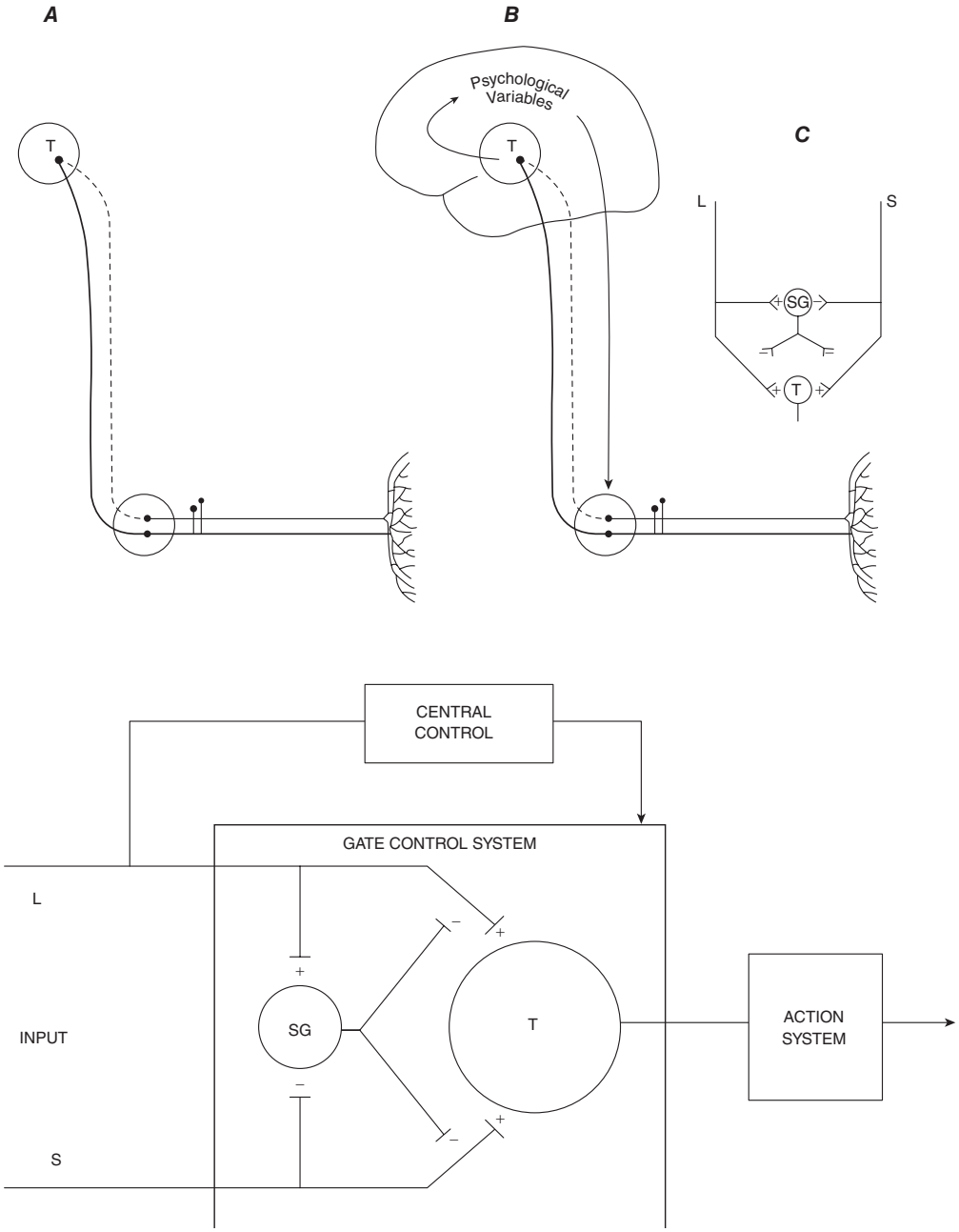


FIGURE 9.1 Evolution of the 'gate control theory'

Source: Melzack (1999a).

the original 1965 schematic diagram of 'gate control theory' (pictured along the bottom of the diagram) as well as the earlier and more basic diagram of Noordenbos's (A), and Melzack's (B) and Wall's (C) later sketches, which progressively inspired it (Melzack, 2001).

In terms of metaphors, then, it took 300 years to move from the metaphor of the belfry to one of a gate (albeit, an electrical circuitry 'gate' rather than the more colourful metaphor this perhaps conjures up today). So what does this now well-accepted 'gate control theory' of pain tell us? At the core of this theory is the idea that the experience of pain is more than merely sensory perception. It simultaneously involves both a biological feedforward action and a psychophysiological feedback action, the product of which determines the degree that the 'gate' is open and hence the amount of pain perceived. The first of these, the feedforward action, operates from the pain receptors located in the skin and bodily organs linking to a series of 'gates' in the substantia gelatinosa (SG) which lies within the dorsal horn throughout the spinal column. The SG initiates the production of substance P which activates the T fibres, thus 'opening' the 'gate'; the degree to which the gates are open depending on the combined amount of excitatory and inhibitory information being transmitted across three types of nerve fibres: (i) the A delta fibres (associated with sharp pain); (ii) the C fibres (associated with dull, throbbing pain); and (iii) the A beta fibres which respond to touch and gentle pressure. These impulses are then transmitted to the pain centres of the brain. The A delta fibres and C fibres (both 'S' in Melzack and Wall's original 1965 diagram) relay pain information on this feedforward part of the system, opening the gate, whilst activation of the A beta fibres ('L' in Melzack and Wall's original 1965 diagram) has the opposite effect of closing the gate via a feedback mechanism which loops from the brain directly back to the gate mechanism. This explains why gently rubbing the site of injury reduces the experience of pain, since the A beta fibres transmit information more quickly than the C fibres (Morrison and Bennett, 2012). Simultaneously, our cognitive and emotional response systems are activated in the brain (central control box), and these activate nerves that relay information down through the spinal column to the gates receiving feedforward impulses. The thalamus and cortex of the brain detect A fibre nociception and are associated with planning and action (e.g., motivating an individual to get away from the pain), whereas the limbic system, hypothalamus and autonomic nervous system detect C fibre activation and enable an emotional response to the pain. Operating via the release of hormones such as endorphins (naturally occurring pain relievers), this psychophysiological feedback can open the gates further or close the gates depending on the characteristics of the emotions and cognitions; for example, anxiety may add to the degree that the gate is open, whereas relaxation may contribute to closing the gate (Morrison and Bennett, 2012). Endorphins (natural pain relievers) act to reduce the effectiveness of substance P (neurotransmitter which enables pain to be transmitted across nerves; Kalat, 2001) at the level of the brain and SG in the spinal cord (Morrison and Bennett, 2012). Pharmacological pain medication can act to close the gate by interrupting both feedback and feedforward mechanisms. A modern representation of this feedforward and feedback system is shown in Figure 9.2 which illustrates the ascending and descending pain pathways from the spinal cord to the brain. It is in these descending pain pathways that the psychological factors of affect, motivation and cognition

are able to act to moderate the sensory perception of pain or, in Melzack's own words, the 'brain processes can select, filter and modulate pain signals' (Melzack, 1999a: S122). Melzack considered the gate control theory as revolutionary in prioritizing the central nervous system (CNS) as 'an essential component' in the experience of pain.

Melzack (1999a) added to this 'gate control theory' of pain in order to explain more complex pain experiences which the original theory was unable to accommodate, such as cases of phantom limb pain in which patients who had had a limb amputated still experienced significant chronic pain in the non-existent limb. Of course, the limb was no longer able to transmit the sensory information generating the pain, so what Melzack cleverly deduced was that the neural networks responsible for the pain experience were still in existence in the brain, acting as stimuli to produce the pain, even though the route for the sensory stimuli to produce the patterns no longer existed. Effectively, the brain processes are acting 'in the absence of any inputs' (Melzack, 1999a: S123). Melzack referred to the 'body-self' as an individual's distinct awareness of themselves in relation to their environment, and this body-self involves numerous dimensions (e.g., sensory, affective, evaluative, and postural) with underlying brain processes that are genetically 'built-in' but capable of

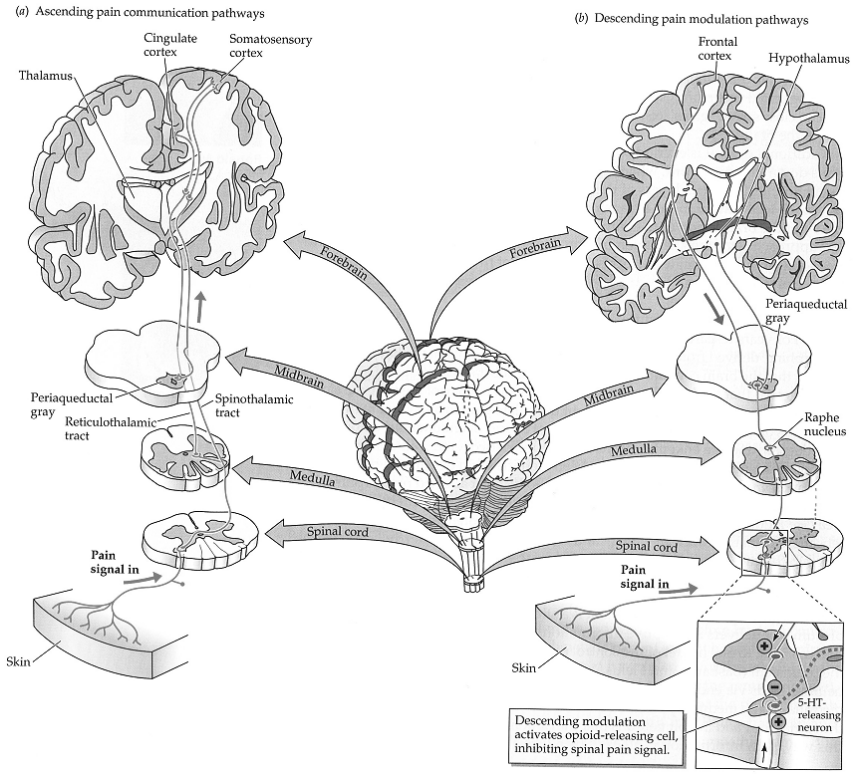


FIGURE 9.2 Ascending and descending pain pathways

Source: Rozenzweig et al. (2002: 240).

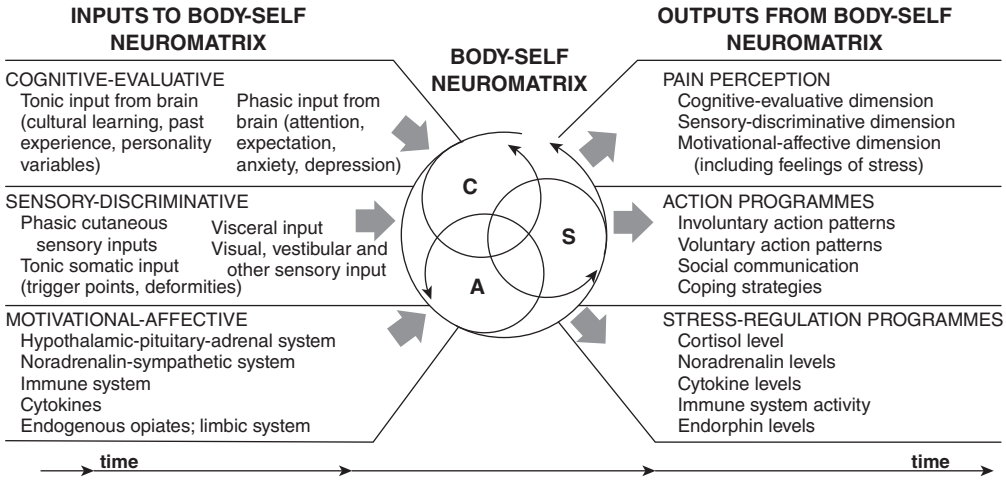


FIGURE 9.3 The body-self neuromatrix

Source: Melzack (2001: 1382, fig. 1).

modification via experience (Melzack, 1999b: S123). The 'neuromatrix', then, was defined as 'the anatomical substrate of the body-self' (Melzack, 1999b: 881) and is composed of 'a large, widespread network of neurons that consists of loops between the thalamus and cortex and limbic system' (Melzack, 2001: 1379). Melzack did not stop there; he further defined the individual pattern of nerve impulses in the neuromatrix as the 'neurosignature', (Melzack 1999a: S123, S125) and this neurosignature from the body-self neuromatrix projects into the 'sentient neural hub' (Melzack 2001: 1379) in the brain at which point awareness of the pain experience occurs. Figure 9.3 shows Melzack's illustration of the neuromatrix with body-self inputs and outputs.

The neuromatrix not only further places psychological factors associated with affective, motivational and cognitive components firmly within the pain experience, but it opens up the floodgates (no pun intended) for understanding how the powerful effects of these psychological components may influence the sensory experience of pain. It also provides an explanation for chronic pain conditions where there is no identifiable physical damage or sensory input (e.g., phantom limb pain, chronic musculoskeletal pain, fibromyalgia, or complex regional pain syndrome), but where the pain gates appear to be permanently 'open' or in a state of constant heightened 'vigilance' (Melzack, 2005). Importantly, these theories widen the scope for development of non-pharmacological psychosocial interventions to modulate the pain experience.

To move from this general understanding of pain theories and models to the experience of pain in children, the concept of the neurosignature of the neuromatrix is particularly pertinent since, in the early years of life, this neuromatrix or patterning of response is only just forming. Genetic make-up is an important underlying influence on the neuromatrix, but it also becomes shaped and defined by the psychosocial environment and by previous pain experience (Melzack, 1999a, 2001). As with stress, understanding pain experience in

childhood provides not only a useful theoretical and clinical insight into managing pain in children but also informs the nature of the pain experience from a life-course perspective. Before we continue with relating these theories to pain in children, there is one more aspect of this biopsychosocial approach to pain that we need to piece together and that is the relationship between pain and stress at both the sensory and the psychosocial level.

LINKING PAIN AND STRESS

Just as the experience of illness is stressful, pain is also stressful and activates stress response pathways. The term 'pain stress' has even been used in the literature on pain (Di Gioia et al., 2011). We have already mentioned the activation of emotional responses in pain, via the limbic system, involving the hypothalamus and autonomic nervous system, which is part of the stress response system associated with the hypothalamic-pituitary-adrenal (HPA) axis and central nervous system. It is this second part of the stress response system that is particularly implicated in pain, but it is worth remembering that the more immediate adrenalin-producing 'flight, fight or fright' response of the sympathetic adrenomedullary (SAM) system, associated with peripheral nervous system response, is also activated. This dual action stress response system is described in Chapter 2 and referred to throughout this book.

Melzack (1999a) himself specifically acknowledged the role of stress in pain, via activation of the SAM system and stimulation of the locus coeruleus in the brainstem and via activation of the HPA axis and stimulation of the hypothalamus in the brain, setting off a cascade of endocrine responses resulting in the production of cortisol. In fact, Melzack (1999a) highlights the importance of the stress response system in pain, pointing out that: 'By recognising the role of the stress system in pain processes, we discover that the scope of the puzzle of pain is vastly expanded and new pieces of the puzzle provide valuable clues in our quest to understand chronic pain' (1999a: S124).

Melzack argued that when an individual incurs physical injury or insult, they do not just experience pain but at the same time the body's stress response system is activated (see Chapter 2) as a result of disruption to the 'homeostatic regulation systems' in the brain (Melzack, 1999a: S123). Both pain and stress are biological response systems and their interplay is implicated in a number of chronic pain conditions. As with pain, activation of the stress response, whether by physical injury, infection, pathology or psychological insult, creates an attempt by the brain to try to redress the homeostatic balance through 'neural, hormonal and behavioural activity' (Melzack, 1999: S124).

In particular, Melzack (1999a, b, 2001) highlights the stress hormone, cortisol, as central to the link between pain and stress. As discussed in Chapter 2, cortisol is essential to life and is no more apparent than after injury when survival depends on its production in order to mobilize energy. However, continued release of cortisol over a prolonged period of time can lead to disruption of the immune system with associated alteration in cytokine profile, resulting in hypercortisolaemic states (chronically high cortisol) seen in Th2 over-activation and may subsequently lead to hypocortisolaemic states (chronically low levels of cortisol) seen in Th1 under-activation. Such states are associated with the deleterious effects of muscle weakness and destruction of bone and tissue. Examples of this are seen in inflammatory

chronic pain syndromes characterized by hypocortisolaemic states, such as rheumatoid arthritis, and have also been observed in musculoskeletal conditions (Turner-Cobb et al., 2010). Melzack (1999a) also links sex differences in pain to increases in cortisol via oestrogen, which induces cytokine release, and an increase in chronic pain conditions with age, due to the over-production of cortisol damaging the hippocampus and setting off a vicious spiral which further reduces the ability of the brain to control cortisol release.

Receiving increasing attention in pain research is the focus of the social context of pain and the interaction of this context with individual factors and what these bring to the pain experience. The social context can include relationships, social support, family environment, and previous experience with pain, and individual factors include demographic variables such as age and sex (for an excellent review, see Gatchel et al., 2007). In modern conceptualizations and application of the biopsychosocial perspective to pain, the focus is shifting to consider these factors not only as integral to the model but as being involved as precursors of the pain experience. In other words, it is not just that psychosocial factors are involved in the feedback from the brain to pain perception, but that they are already in place, ready and waiting, as the individual brings these to the situation before the pain experience hits, thus having a huge influence on the outcome. When considering pain in children, we are considering a neural network under development, the early social context beginning to play out on the experience of pain and the experience of pain shaping future responses. That the social context is so influential in the pain experience means that there is enormous potential for psychosocial intervention to influence the psychobiological experience of pain.

Hence, it is essential to consider a life-course perspective when attempting to understand the biopsychosocial model of pain, as well as the effect of stress across the life course. Early trauma may influence the subsequent experience of pain, and the way that a child responds to chronic stress may, in part, determine future pain experience through the early setting or programming of hormonal, neural and behavioural stress response systems which may trigger and determine subsequent psychological and physical responses to pain. In other words, the body-self neuromatrix, which is a product of both sensory and psychological activation and determines an individual's experience of pain, operates in a co-dependent manner with the psychobiological stress response systems of the body. If this sounds familiar, and the theory of allostasis and notion of allostatic load come to mind as useful concepts in explaining the parallel ideas and interacting relationships between pain and stress, then you have been paying attention (if not, go back and read Chapter 2 before proceeding).

THE PAIN EXPERIENCE IN CHILDREN AND ANALGESIC MANAGEMENT OF PAIN

PAIN IN CHILDREN

The theories and models outlined above were developed based on pain in adults rather than pain experienced by children. But what is known specifically about the pain experience of

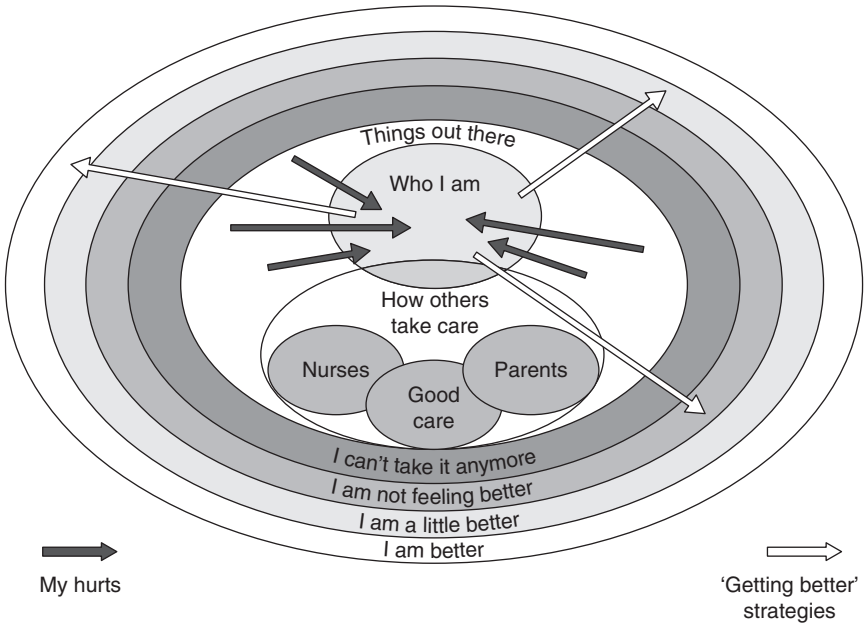
children and how do these theories hold up when examining paediatric pain? A number of different versions of the biopsychosocial model of pain have been applied in order to understand the experience of acute and chronic pain across the different ages of childhood and into adolescence. A number of different methodologies have been used to assess the experience of pain in children and how children cope with pain. Methods of assessment of pain from illness, injury, or surgery include interviews (e.g., the Pain Experience Interview; McGrath et al., 2000); observation (direct or indirect via video, e.g., Vervoort et al., 2009); and questionnaires and pain-rating charts/visual analogue scales – for example, the Pain Experience Questionnaire (PEQ; Hermann et al., 2008); the Bath Adolescent Pain Questionnaire (BAPQ; Eccleston et al., 2005), the Chronic Pain Acceptance Questionnaire for Adolescents (CPAQ-A; McCracken et al., 2010), and the Fear of Pain Questionnaire for Children (FOPQ-C; Simons et al., 2011) – with children, their parents, and/or medical staff.

Various methods of induction of pain in the laboratory have used heat stimulation or cold-pressor tasks to assess responses to pain, tolerance and coping responses in healthy and clinical populations. In the studies referred to throughout this chapter, you will see a range of assessment methods included. Questionnaire assessment is the most frequently used, particularly for older children and adolescents, but, of course, for younger children, particularly preverbal, if assessment is direct rather than via parents and medical staff, then observation and interview are necessary. Excellent reviews of pain assessment and coping in children can be found in Gaffney et al. (2003), Eccleston et al. (2006), Hermann et al. (2007) and Huguet et al. (2010). For a more general discussion of biopsychosocial methodologies in child health research, refer back to Chapter 3.

An excellent example that articulates the pain experience of younger children is provided in an innovative qualitative study by Woodgate and Kristjanson (1996), who assessed the experience of acute pain in 11 children aged 2.5–6.5 years, hospitalized for abdominal, chest, plastic or reconstructive surgery. They used a variety of assessment methods, including extensive observation and interview (with children, parents and staff), to understand the pain experience in children. Whilst the language the children used to describe their pain reflected differences in age (e.g., older children using terms such as 'stabbing, jumping in and out', compared to simpler words such as 'owie' in the younger children), they note that there was a commonality to their pain experience, and it was the experience of pain itself which was the overriding factor in shaping their experience of hospitalization (Woodgate and Kristjanson, 1996). On the basis of these findings, Woodgate and Kristjanson put forward a model of acute pain experience in young children known as 'Getting better from my hurts', which identifies influences on their pain experience and the consequences of this experience, as shown in Figure 9.4. Pain described by the children was categorized as either pain that the children were experiencing at the time or potential pain which had the 'threat of hurting' (1996: 238). The pain experience was influenced by aspects of the child themselves, how others take care of them (including parents and nurses), and aspects of the non-social environment termed 'things out there' which included both pleasant and unpleasant symbols. Three types of coping strategy were used to deal with the pain experience: (i) 'hiding away'; (ii) 'fighting it'; and (iii) 'making it good', descriptions and examples of which are given in Figure 9.4.

'Things out there' = pleasant or unpleasant symbols in the child's non-social environment that directly or indirectly influence their pain experience

- Examples of pleasant/good symbols: sight of favourite soft toy, feel of comforting blanket
- Examples of unpleasant symbols: sight of needles/surgical gloves, sound of removal of surgical drain



'My hurts' = Central problem identified by the children
Process of getting better involves three conditions:

(i) 'Who I am'
(ii) 'How others take care'
(iii) 'Things out there'

'Getting better' strategies	Description and examples
1. 'Hiding away'	Withdrawing and distancing: not answering questions, avoiding eye contact, being quiet
2. 'Fighting it'	Resistance to or attack on pain: tensing, pulling away, hitting, slapping or grabbing pain source, grimacing, crying, being angry
3. 'Making it good'	Protection and comfort: guarded body movements, rubbing, patting, asking for help, distraction, fixed or serious facial expressions

FIGURE 9.4 'Getting better from my hurts': the young child's pain experience

Source: Woodgate and Kristjanson (1996: 238).

These authors emphasize the importance of the 'subtleness' (p. 240) of the pain responses observed in young children. The strategies of 'hiding away' (p. 238) and 'making it good' (p. 238), observed after a painful treatment, were expressed in quiet or serious behaviours, in contrast to the more noisy and overt pain responses associated with 'fighting it' (p. 239) in anticipation of, or during, a procedure. The emotions of 'fear, anxiety, anger, and sadness' (p. 240) were all observed as part of the pain experience and

negatively influenced the children's pain (Woodgate and Kristjanson, 1996). This model of acute pain experience in young children shows the importance of the caregiver environment; in this case, the medical and nursing care, as well as that of the parents.

As this study by Woodgate and Kristjanson (1996) highlights, the distinguishing psychosocial characteristic associated with the pain experience for children is inevitably this caretaking role, whether provided by parents, family, those delivering care in the hospital setting or the school environment. These are the contextual social situations under the spotlight when considering the experience of pain throughout childhood including adolescence. Home, school and, when necessary, hospital are the environments which make up a child's world, and the actions of parents, teachers and peers, nurses and medical staff within them are vital to the outcome in a child's experience of acute and chronic pain. We return to this important theme later in the chapter.

Although the study mentioned above looked at young children, from toddler age up to school age, you may be wondering at what age infants start to feel pain. Before considering how the complex psychosocial interactions of the social context develop and play out in childhood and adolescence, we first need to go back a little further and consider how pain is experienced in infancy, from the developmental stage of the neonate ('neonate' is defined as from birth to 4 weeks old and is synonymous with the lay term 'newborn'; for more on this and related terms, see Chapter 4). Contrary to beliefs which existed prior to the 1970s, and continue to this day, that infants do not experience pain at least up until a month old, there is considerable evidence that young infants and children feel pain and respond to it and they also remember pain experienced (Schechter et al., 2003). In fact, Schechter et al. (2003: 13) point out that 'all the nerve pathways essential for the transmission and perception of pain are present and functioning by 24 weeks of gestation.' Take note that this is by 24 weeks 'of gestation', not 24 weeks after birth. So to answer the question about when children feel pain, there is evidence that, as neonates, children can certainly feel pain. In the context of the discussion above about setting the pattern of pain response, particularly in light of Melzack's (1999a) neuromatrix theory of pain, our interest here is in how the pain response develops throughout childhood and the psychosocial context in which the pain experience is shaped. In animal research, the effect of newborns not receiving analgesic pain medication has been found to lead to a 'rewiring' of sensory pain receptors in the spinal cord and to an increase in pain perception when they encounter future pain stimuli (Schechter et al., 2003). Similarly, they report that in newborn human infants who are not given pain relief during circumcision, a greater pain response has been seen to subsequent pain experiences such as immunization (Schechter et al., 2003). They argue that early experience of pain sensitizes the stress response system, leading to high levels of stress hormones which not only have psychological sequelae of distress and anxiety but also have deleterious physical effects (e.g., increases in heart rate, blood pressure and immuno-suppression) likely to compromise postoperative recovery. In other words, the pain experience is applicable to children of all ages, and applies as much to neonates as to adolescents, although it may be expressed in different ways. Common consensus is that children are particularly vulnerable to the consequences of pain if under-treated (Schechter et al., 2003).

PHARMACOLOGICAL PAIN MANAGEMENT: ANALGESICS AND ANAESTHESIA

Since we now know that neonates can feel pain right from the day they are born, the management of the pain experience is essential at least from birth onwards. Later on, we consider psychosocial interventions in pain management, but first we need to consider pharmacological pain management in children. As Schechter et al. (2003: 14) emphasize, 'for humanitarian, physiologic, and psychologic reasons, pain control should be considered an integral part of the compassionate medical care of children.' Many of the concepts that we have looked at so far in previous chapters of this book, such as hospitalization, treatments for leukaemia, and research ethics, have repeatedly pointed to the era of the 1960s or thereabouts as a turning point for the development of theories and improvement in treatment for children. In line with this, the 1970s are seen as the turning point for pain management in children. However, the documented lack of pain treatment and management in children, particularly with regard to the use of analgesic pain medication and anaesthesia, provides a chilling read, some aspects of which continued well into the 1980s.

Schechter et al. (2003) describe three categories of pain: (i) that of neonatal pain; (ii) postoperative pain; and (iii) pain associated with chronic disease. They document common cases in the 1980s of neonates undergoing lumbar punctures or having a chest tube inserted with minimal anaesthesia or children receiving minimal analgesia following cardiac surgery, an appendectomy, or a fractured femur (Schechter et al., 2003). They also report that, in the mid-1980s, children were not routinely sedated for aspiration of bone marrow or biopsies. Schechter et al. (2003) conclude that the most significant improvements in pain management have been postoperatively, during the hospital stay, especially for children of school age. However, there has been less of an improvement for postoperative pain management in younger children (particularly preverbal) and in children receiving day-case surgery (e.g., Gillies et al., 2001). Schechter et al (2003) point to neonatal and infant pain as being less well managed in comparison with management of pain experienced in older children, partly due to the false historical belief that neonates did not experience pain. In the context of chronic disease during childhood (e.g., sickle cell disease, HIV/AIDS, or cancer), despite developments, pain management is viewed as 'less adequate' compared to that of postoperative pain (p. 6). Although significant advances have been made, particularly for procedural pain in cancer, disease-related pain management across a variety of conditions is still described as problematic (Schechter et al., 2003). For example, work by Van Cleve et al. (2004) reported a lack of attention to pain in children with cancer who were largely cared for at home during the first year following diagnosis. A review published in this area 6 years later (Shepherd et al., 2010) still called for greater acknowledgement of the pain experienced in paediatric cancer patients in order to enable appropriate nursing care. Thus, the under-treatment of pain is still a substantial issue in pain management for children, despite an increase in knowledge about children's experience of pain. There are many reasons for this, which involve the concerns and sometimes misunderstandings of both parents and medical staff. This key issue in the management of paediatric pain is addressed by Friedrichsdorf and Kang (2007) in their review of how pain is managed

in children with life-limiting conditions. They point out that, despite concern and a desire to relieve suffering, an aggressive approach to treating pain is often met with 'reluctance' by parents and medical staff. Friedrichsdorf and Kang (2007) summarize the 'myths and obstacles' reported in the literature regarding the use of opioids for managing pain in children as shown in Table 9.1. These myths and obstacles particularly highlight parental fear and practitioner education as important targets for addressing this issue.

So we know that the pain experience is a complex interaction between biological and psychosocial factors. We also know that, from a sensory perspective, children are just as capable of feeling pain as adults. I have outlined the importance of managing pain in children and the significance of treating pain in children on a number of levels. These levels include a minimizing of pain for purposes of reducing suffering in the short term, but also in order to reduce any future impact that the early pain experience may have. In terms of establishing the self-neuromatrix pattern, inadequate treatment of pain in early childhood may increase the experience of pain in later childhood or adolescence and lay the early foundations for chronic pain in adulthood. As Schechter et al. (2003) point out, although chronic and recurrent pain in children does not carry with it the economic burden of work absenteeism that is seen in adult pain conditions, pain and disability in children results in school absenteeism which may lead to social problems and future economic limitations, as well as the likelihood of adult pain, disability and dysfunction.

THE PREVALENCE OF PAIN AND DISABILITY IN CHILDREN

So how much of a problem are pain and pain-related disability in childhood? The prevalence of pain in children is difficult to assess, and pain of all types is often under-reported or under-recorded. Van Dijk and colleagues (2006) point to the fact that, whilst chronic pain prevalence is well documented in adults, we know a lot less about the incidence,

TABLE 9.1 Myths and obstacles associated with reluctance to use opioids for paediatric pain control

Parental concerns	Health-care practitioner concerns
• Fear of giving up • Misconceptions of opioids as 'too strong for children' • Fear of side-effects • Worry that their child will become 'addicted' to pain medications • Cultural or religious beliefs	• Lack of sufficient education regarding managing pain • Misconceptions about frequency and severity of side-effects, such as respiratory depression • Worries that opioids will shorten life expectancy • Concerns that escalating opioid doses will increase the likelihood of tolerance, and thus make pain control more difficult as the disease progresses

Source: Friedrichsdorf and Kang (2007).

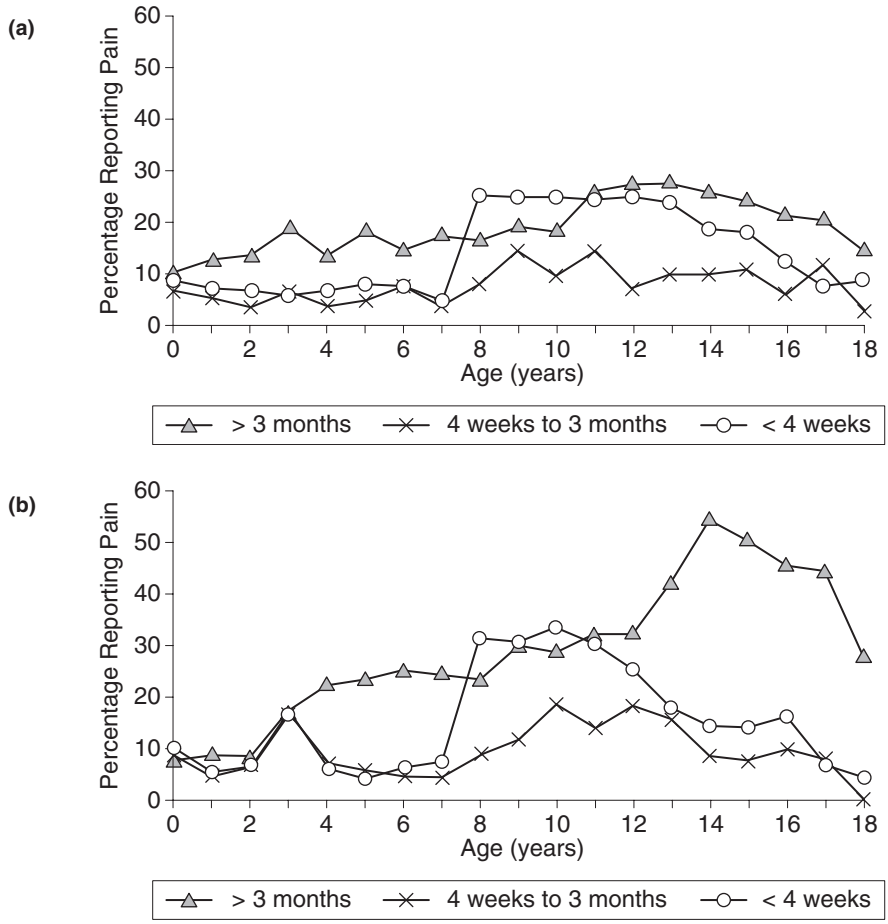


FIGURE 9.5 Age-specific prevalence rates of pain in (a) boys and (b) girls (0–18 years) shown separately. Lines represent pain of different duration. Data were based on one pain report per child
Source: Perquin et al. (2000: 55, fig. 1).

prevalence and pain experiences across various types of pain in children (for descriptions of prevalence and incidence, see Chapter 7). A large epidemiological study in The Netherlands of over 5,000 children aged 0–18 years reported pain in the past 3 months in over half the sample (54 per cent) and chronic or recurrent pain (most commonly limb pain, headache, abdominal pain or back pain) in over 25 per cent of participants (Perquin et al., 2000). As shown in Figure 9.5, prevalence was influenced by age and sex: for both girls and boys, the prevalence of chronic and recurrent pain increased with age; for girls, there was a leap in chronic/recurrent pain between the ages of 12 and 14 years, attributed to the onset of puberty and menstruation; and chronic/recurrent pain was significantly higher overall in girls than in boys (Perquin et al., 2000).

Data from another European study, this time using a sample of over 700 German children who were aged 10–18 years, show a similar increase in pain with age and similar pain locations (Roth-Isigkeit et al., 2004). In this study, pain in the past 3 months was reported by 85.3 per cent of the sample, chronic pain lasting more than 3 months was reported by almost half (45.5 per cent) of the sample, and recurrent pain in one-third of the sample (33.7 per cent). There were no sex differences found for pain duration or frequency in this study (Roth-Isigkeit et al., 2004). These pain figures are higher than for the Dutch sample, but bear in mind that the German sample consisted of older children and both found an increase of pain prevalence with age. Similar results have been found for acute pain in a Canadian study of the prevalence of acute, recurrent and chronic pain in a sample of 495 school children aged 9–13 years (van Dijk et al., 2006). These researchers report 96 per cent of children as having experienced acute pain in the past month, 57 per cent reporting recurrent pain and only 6 per cent reporting either currently having or having previously had a chronic illness. The most frequent acute pain was from headache (reported by 78 per cent of the sample). In addition to this period prevalence, a sex difference was found with significantly higher lifetime prevalence for acute pain (from accident/injury, stitches and bee stings) in boys compared to girls (van Dijk et al., 2006).

Finally, a recent German study looked specifically at children (n = 2,249) who fell into the category of severe impairment from chronic pain due to tension headache, migraine, functional abdominal pain or musculoskeletal pain and often with more than one type of pain (Zernikow et al., 2012). Almost a quarter of the German sample also had a diagnosis of clinical depression and almost one-fifth a diagnosis of clinical anxiety. Sex differences

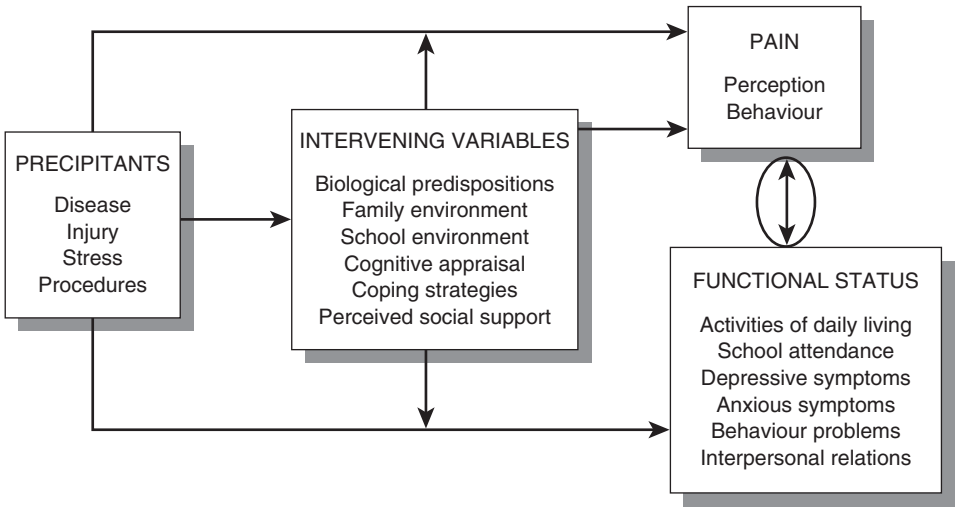


FIGURE 9.6 A hypothesized multidimensional biobehavioural model of paediatric pain

Source: Vetter (2012: 148, fig. 11.1); adapted from Varni et al. (1996); originally published in Varni et al. (1989). Reproduced with the kind permission of Springer Science+Business Media B.V.

were also observed, with girls over 13 years being more likely than boys to attend specialist pain centres (i.e., tertiary care services; Zernikow et al., 2012). These prevalence rates are variable, partly due to differences in methodology and definitions used between studies, particularly for reported chronic pain, and whilst sex differences exist, these are ambiguous at least until the age of puberty. Further data from Roth-Isigkeit and colleagues (2005) indicate that the extent of chronic pain experienced is, for some children and adolescents, sufficient to restrict activities of daily living related to varying levels of social and physical disability. Taken together, the evidence suggests that pain and pain-related restrictions or disability are significant problems for children and adolescents.

ROLE OF THE FAMILY, SCHOOL AND HOSPITAL IN PAEDIATRIC PAIN

Using the biopsychosocial approach to pain experience and management, we have established that pharmacological treatments are important in diminishing the sensory feedforward aspect of pain perception. Just as analgesic treatments have revolutionized pain treatment in the past 50 years, so too have the influence and acceptance of psychosocial aspects of pain in conjunction with these treatments. As flagged up earlier in this chapter, the biopsychosocial models of pain in children have emphasized the role of the family and school environment in influencing acute and chronic pain experiences. The biobehavioural model of paediatric pain first proposed by Varni and co-workers (1989) can be applied across acute pain, such as that from an injury or medical procedure, or chronic pain such as juvenile arthritis or sickle cell disease, and also includes stress as a precipitant of pain (Varni et al., 1996). The version of Varni et al.'s model shown in Figure 9.6 is from Vetter (2012), who adapted it to include important findings relating to the influence of the 'school environment' in chronic pain, for which evidence has accumulated and positioned the school environment, particularly in older children and adolescents, as key in relation to pain experience in chronic illness.

This model illustrates the interplay between precipitants such as stress, intervening variables, such as family and school environment, and functional status, including mood, behaviour and relationships, and pain. Note the bidirectional communication between pain and functional status in the adapted version of Varni et al.'s model shown in Figure 9.6. It is worth noting in relation to functional status or disability and school attendance, that a direct relationship between these variables and pain intensity is not always evident, implying that disability is a 'complex construct' involving the interplay of a number of psychosocial factors, particularly that of anxiety (Gauntlett-Gilbert and Eccleston, 2007; Cohen et al., 2010).

SPECIFIC CONSIDERATIONS IN ADOLESCENT PAIN

Given the prevalence of pain reported above and our focus in this section on the family and school environment, one important topic, which is beginning to receive increasing attention in pain research, is the influence of the adolescent peer environment on pain

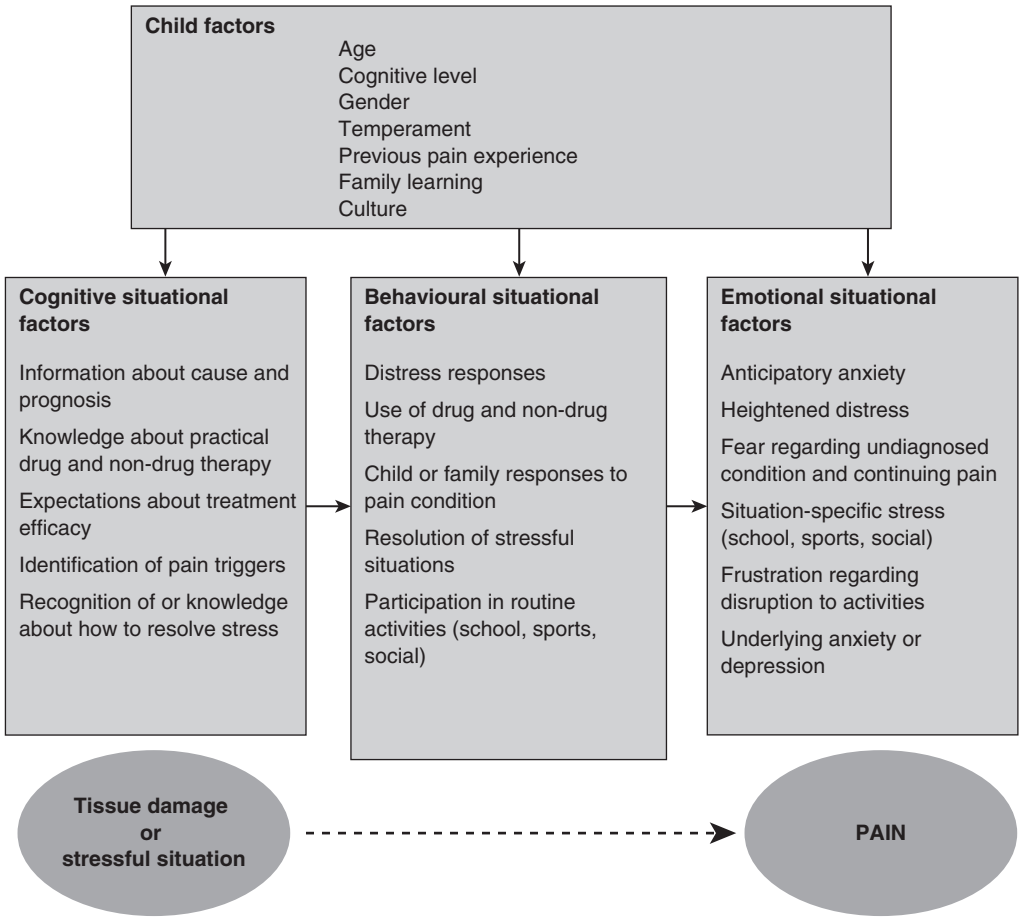


FIGURE 9.7 Situational and child factors that modify pain and disability

Source: Adapted in format from McGrath, P.A., and Hillier, L.M. (2003).

experience. In adolescence, the influence of peers or 'peer pressure' takes over to varying degrees from the parental influence seen in younger children. The role of autonomy in adolescence was discussed particularly in Chapter 7, when I considered the mismatch between the characteristics of diabetes management. In relation to pain, the need for autonomy in adolescence means that parental advice is often rejected in favour of peer advice in managing pain, whether that is in relation to the expression of pain, pain behaviours or pain medication. Depending on the degree of pain, whether acute and requiring over-the-counter (OTC) medicine, or chronic and part of ongoing pain management, this switch from family/parental locus of control to peer influence is vital in managing pain appropriately. For example, Hatchette and colleagues (2008) found that

sex differences in how adolescents (aged 12–15 years) express pain to their peers and peer attitudes were found to influence the perception of ease of access to, and use of, OTC medications. In using the biopsychosocial model to identify the factors that contribute to pain and disability, and hence which factors may be most effective targets for psychosocial interventions to reduce pain in children, McGrath and Hillier (2003) very usefully conceptualize situational (cognitive, behavioural and emotional) factors and child factors as illustrated in Figure 9.7. Taken as a whole, these are the contextual factors that influence the pain experience.

COGNITIVE, BEHAVIOURAL AND EMOTIONAL FACTORS IN COPING WITH PAIN

In order to explore the vast literature that has developed in support of the biopsychosocial approach to managing pain, I now consider some of these contextual, situational and child factors, using the pain classifications of acute, chronic and recurrent pain given at the beginning of the chapter.

EXPERIMENTAL PAIN IN HEALTHY CHILDREN

A prequel, if you like, to considering pain states is the application of pain in the experimental setting with healthy individuals. A significant amount of pain research is conducted in this way in adults, although for obvious ethical and moral reasons less so with children. Work that has been done, particularly in the US and Canada, gives a useful baseline understanding of pain in the otherwise healthy context. For example, Lu and colleagues (2007) used a series of tasks to induce pressure, thermal heat, and cold (using the cold pressor test) in a sample of children and adolescents aged 8–18 years and assessed how they coped with the pain. The cold pressor test is a standard laboratory pain endurance (tolerance) and intensity test which involves participants submerging their forearm in a bucket of icy water for as many seconds or minutes as possible. Based on the pain intensity that the participants were able to endure, Lu et al. (2007) found the coping strategies of positive self-statements and behavioural distraction to be associated with 'pain resistance' as lower pain intensity was reported when using these techniques. Strategies of seeking emotional support and internalizing/catastrophizing were labelled as 'pain-prone' since the use of these was associated with a lower pain tolerance and greater reporting of pain intensity (Lu et al., 2007). In a similar study using just the cold pressor test, in a slightly younger sample of 7–14-year-olds, Piira and colleagues (2006) used visual images described in word form as attentional strategies. These strategies composed either external distraction (e.g., scene of playing ball in a park) or internal sensory-focusing (e.g., relating to water temperature or feeling cold). The control group received no visual images at all. Whilst pain tolerance was greatest for both intervention groups compared to the control group, an age difference emerged in

which the youngest children (7–9 years) performed best in the external distraction condition, whereas the older children (10–14 years) performed just as well using either intervention (Piira et al., 2006). This demonstrates the importance of age in selecting the most effective type of distraction intervention.

ACUTE PAIN IN CHILDREN

Research examining acute pain in children has focused on three main areas: (i) routine medical vaccinations, injury and unplanned procedures, including emergency department admissions; (ii) dental anxiety and orthodontic pain; and (iii) the largest of these areas, postoperative pain. The use of secondary control coping has been found to be particularly beneficial in this context, with children using these coping strategies reporting less pain compared to those who used primary control coping strategies or relinquished control coping (Langer et al., 2005). An interesting study by Crandall and colleagues (2007) of adolescents aged 11–17 years, who had received an acute blunt traumatic injury (associated in the majority with injury following accidents), describes the 'struggle for internal control' that these adolescents experienced in dealing with their pain, reported in interview 1–11 days after the accident. Internal control is defined by the authors as 'behavioural and cognitive actions used to control and endure their pain' (2007: 229) and characterized by a passive, inward focus (e.g., staying still, not crying or screaming) which contrasts with 'loss of control' (p. 229) in which their distress was outward and overt (e.g., distress, resisting medical intervention, crying, screaming). They found that adolescents used internal control in order to 'maintain independence and self-control over their pain' (p. 233) and point out that the use of such behaviours is consistent with the autonomy of adolescence, but may mask the pain being experienced by these patients. They also point to the vital importance of the presence of both family and peers for support in managing their pain. Crandall et al.'s (2007) conceptual model of internal control is shown in Figure 9.8.

Studies of acute pain from dental and orthodontic treatment have also reported the common use of cognitive coping strategies, both internal coping strategies (e.g., 'I tell myself it will be over soon') and external coping strategies (e.g., 'I like it when the nurse holds my hand'), with internal strategies being the most frequently used in pre-adolescent children (Versloot et al., 2004; Van Meurs et al., 2005). It is the younger adolescent children (11–13 years) compared to older adolescents (age 14–17 years) who appear to experience more pain during orthodontic treatment (Brown and Moerenhout, 1991). In postoperative pain, Crandall and colleagues (2009) point to the importance of ameliorating anxiety preoperatively to reduce pain after surgery. They report evidence of significant relationships between prior anxiety and postoperative pain in their sample of children aged 7–13 years undergoing tonsillectomy. Amongst other factors, they stress the importance of previous surgical experience as an influencing factor in postoperative pain. In adolescents, evidence for links between preoperative expectations of pain and anxiety and postoperative pain experienced has also been found (Logan and Rose, 2005).

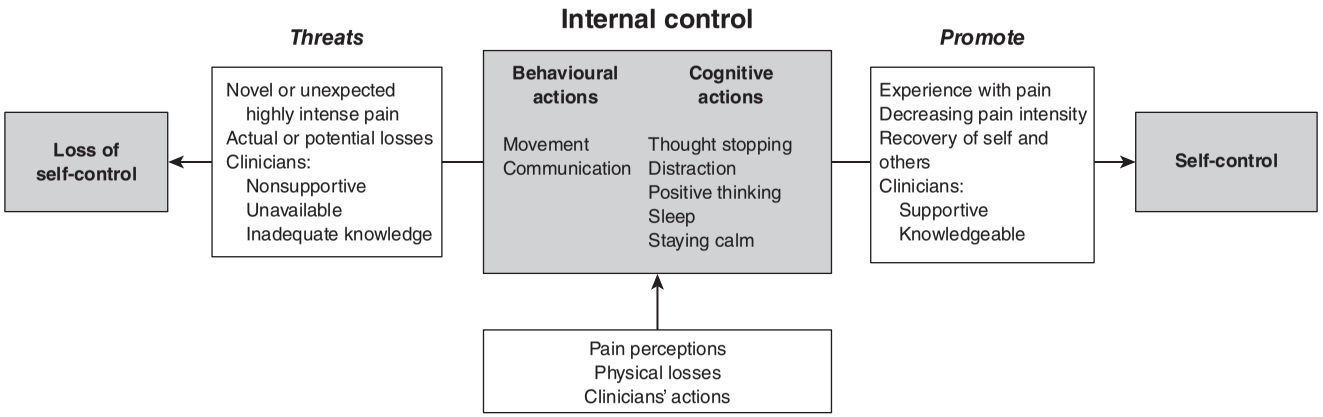


FIGURE 9.8 Conceptual model of 'internal control' of pain experiences in adolescents following acute blunt traumatic injury

Source: Crandall et al. (2007).

CHRONIC PAIN IN CHILDREN

Two of the most prevalent and well-researched chronic pain conditions in children are those of (i) juvenile chronic arthritis (JCA) and (ii) sickle cell disease (SCD).

Chronic pain in juvenile chronic arthritis

Juvenile chronic arthritis (JCA) is characterized by pain and stiffness in the joints (often in more than one part of the body at a time) which is 'unpredictable' and fluctuates with flare-ups and periods of remission, although for a subgroup the pain may be unremitting (Schanberg et al., 1997). Pain is seen as controlling the lives of children with JCA whose social life and future goals may become limited (Sallfors et al., 2002). The lived experience of children and adolescents with JCA has been described as 'oscillating between hope and despair', characterized by a 'disturbed order', 'dependency', 'ambivalence', and 'uncertainty' (Sallfors et al., 2002: 498). The use of coping strategies akin to secondary control coping strategies, relating to 'pain control and rational thinking' (e.g., reinterpreting pain sensations), has been linked to a lower intensity of pain and the experience of pain in fewer parts of the body in a sample of 56, 6–20-year-olds (mean age 12.4 years) with JCA (Schanberg et al., 1997: 183). More recently, Thastum and colleagues (2005) reported associations between level of pain in juvenile arthritis and pain-related health beliefs, particularly those beliefs relating to disability and harm about their pain problem. Thastum et al. (2005) also found associations between level of pain and the coping subscale of catastrophizing. The concept of catastrophization is an exaggerated, negative cognitive-affective state characterized by 'magnification, rumination and helplessness', frequently applied in the adult pain literature (Sullivan et al., 2001: 53; Buenaver et al., 2007).

In other chronic and recurrent arthritic pain conditions in children, compared to healthy controls (9–15 years), the greater use of pain catastrophizing, coupled with less expression and interpersonal communication of their pain experience, has also been reported (Vervoort et al., 2008). In a later study of children aged 7–15 years with juvenile arthritis, Thastum and Herlin (2011) found further evidence of dysfunctional health beliefs predicting greater pain over a longitudinal period of 2 years, indicating both the stability and course of pain belief in influencing pain outcome over time. Age and gender effects have also been seen in older adolescents (aged 16 plus) with JCA, boys reporting a greater ability to control and reduce their pain than girls (Sallfors et al., 2003). Similarly, perceptions of self-worth have also been linked to pain experience in adolescents aged 13–18 years with musculoskeletal pain (Guite et al., 2007).

Chronic pain in sickle cell disease

Sickle cell disease (SCD) is an inherited disorder of the haemoglobin, causing the red blood cells to develop abnormally (resembling 'sickles') and restricting the amount of oxygen they can carry and transport to the lungs (NHS, 2012). The sickle red blood cells cause a thickening of the blood and result in blockages in the blood vessels and a vaso-occlusive

crisis (sickle cell crisis) which lasts on average between 5 and 7 days, but can be as short as a few minutes or as long as several months, causing episodes of intense pain (Barakat et al., 2007; Hollins et al., 2012; NHS, 2012). Complications include chronic anaemia, stroke, acute chest syndrome, vulnerability to infection, pulmonary hypertension and delayed puberty and small stature (Barakat et al., 2007; NHS, 2012). The pain caused by SCD can have a significant and daily impact on everyday functioning and social relationships, particularly for adolescents, and prevalence is greatest in those of African descent (Hollins et al., 2012).

Earlier work in children and adolescents with SCD focused on the negative aspects of cognitive, emotional and behavioural factors, such as stress, negative mood, negative thinking, and passive adherence (e.g., Gil et al., 1993, 2003). Barakat et al. (2007) found evidence for negative thinking to act as a mediator of pain intensity on depression and of the interference of pain with daily activities on the outcome of anxiety. More recent work has focused on the positive factors associated with resilience and adjustment in SCD, such as better quality of life, levels of hope, adaptive behaviour, and optimism (e.g., Pence et al., 2007; Ziadni et al., 2011). In particular, Pence et al. (2007) found that more optimistic adolescents (13–17 years) were better able to control their pain severity through more accurate medication use.

Demographic factors of age, sex and socioeconomic status have also been linked to pain in SCD. For example, whilst coping patterns have been found to stay relatively consistent in younger children (7–12 years) over a period of several months, for adolescents (13–18 years) these coping factors were more variable, which highlights both the opportunity for intervention and the instability of pain coping in older children (Gil et al., 1993). Barakat et al. (2007) report lower socioeconomic status, as defined by family income, to be linked to greater pain. This aspect of change across time for children with SCD is important. Hollins et al. (2012) point out that, whilst pain in SCD is episodic in childhood, it often becomes increasingly chronic throughout adolescence, and pain responses may begin to show the characteristic patterns of chronic pain which are seen in later adulthood. Evidence also points to the toll that having a child with SCD can take on parents, and the importance of maternal adjustment (Thompson et al., 1994), as well as to the reciprocal nature of relationships between the coping responses of the child and family functioning (Mitchell et al., 2007).

Chronic pain in other conditions

Other studies of chronic pain have considered not one specific condition but a variety of conditions, particularly when a specific condition, other than chronic pain itself, is not possible to diagnose. In adolescents (aged 12–17 years) with chronic pain conditions, including migraine, neuropathic pain, musculoskeletal pain, abdominal pain and diffuse pain, a pain-coping profile of avoidant coping (typical of isolation and social withdrawal) or dependent coping (such as catastrophizing) has been associated with greater somatic symptoms, anxiety, depression and disability, indicating that they were less able to cope with their pain (Claar et al., 2008). Similarly, Martin and colleagues (2007) found that

children with chronic abdominal, headache, neuropathic or musculoskeletal pain who had higher levels of anxiety sensitivity (fear of anxiety-related sensations such as increased heart rate) were also more afraid of pain and, consequently, this linked to a higher level of pain disability.

Both age and sex differences in coping responses in chronic pain appear to emerge in children, with 8–12-year-olds showing differences in preference for the use of social support (girls' preference) over behavioural distraction (boys' preference), and adolescents (aged 13–18 years) showing greater use of positive self-talk than children (Lynch et al., 2007). Sex differences have also been found in how adolescents remember their experience of pain. An innovative study by Hechler et al. (2009) asked adolescents (aged 12–18 years) to report not just their current level of pain during an interview, but also to recall their memory of pain intensity in the previous time periods of 24 hours, 7 days, and 4 weeks. Adolescent girls were found to report higher pain intensity than boys within the time frame of 7 days and also 4 weeks, despite having similar medical diagnoses and being similar on other diagnostic criteria. The authors suggest that this may be due to expectations in gender role and point to the importance of pain memory in designing intervention programmes as remembered pain may influence future pain (Hechler et al., 2009).

RECURRENT PAIN

The most common form of recurrent pain in children is that of abdominal pain with prevalence as high as 25 per cent in 9–12-year-olds (see Dufton et al., 2011), representing a significant childhood problem with the potential for setting patterns of chronic pain in later life. These children have high rates of functional disability and a significantly reduced social life (Dufton et al., 2011), putting them at a disadvantage in the transition to adolescence. Using an experimental paradigm which combined elements of stress testing and the cold pressor task for pain tolerance and intensity, Dufton et al. (2011) compared the performance of children with recurrent abdominal pain or clinical anxiety and healthy control children without pain. They report greater reactivity as measured by increases in heart rate to the stress and pain testing in the sample with abdominal pain or anxiety (Dufton et al., 2011). In relation to coping, secondary control coping (in the form of acceptance, distraction, or positive thinking) has also been shown to reduce pain more effectively than involuntary actions or disengagement coping (such as avoidance in the form of escape or denial in the form of inaction) in children with recurrent abdominal pain (Thomsen et al., 2002) and this benefit of secondary control coping was also confirmed in the Dufton et al. (2011) study.

THE ROLE OF PARENTS IN THE PAIN EXPERIENCE

The dual effect between pain experience in a child and the impact on the parent(s) is important both for the health of the parent and for the reciprocal impact that the parental response has on the child's pain experience and level of disability. I have already hinted at this in considering various types of pain conditions above, but there is a surprisingly small amount of literature reported in this area, particularly for the parental effect

on the child, compared to other aspects of the biopsychosocial pain experience and also compared to the amount of research on the parental effects and influence in chronic conditions more generally. Yet there is an emerging interest in this area. For an excellent brief review, see Palermo and Eccleston (2009) who highlight the importance of considering the parent in child and adolescent chronic pain. The way in which these interconnected relationships between parent and adolescent functioning operate is generating increasing interest. One model proposed by Vowles and colleagues (2010) includes both adolescent and caregiver psychosocial responses and pain management behaviours of the caregiver in relation to adolescent pain functioning, and on catastrophizing responses in both the adolescent and their parents.

The important influence of parental catastrophizing about their child's pain experience has also been demonstrated in healthy children and adolescents in a laboratory setting (Caes et al., 2011). Both maternal and paternal catastrophizing have been found to influence how the parent interacts with the child and also the level of pain reported, although sex differences between parents have also been noted. In particular, mothers appear to exhibit a greater degree of catastrophizing compared to fathers, and this difference was reflected in greater rumination rather than any differences in the components of magnification (exaggeration of the pain experience) and helplessness (Hechler et al., 2011).

THE ROLE OF EARLY LIFE PAIN EXPERIENCE ON SUBSEQUENT PAIN

Some of the most striking research to emerge in the area of pain in children, certainly for the lifespan perspective taken in this book, is that of the effect of early exposure to painful stimuli on subsequent pain experiences. To use the word 'striking' is perhaps an underestimation of the interest and excitement that this research topic ignites: this is a flag-waving, stand-on-your-chair level of interest; this really is important work, as not only does it relate to pain but it links to other key areas of interest in child health psychology, such as early life stress and adaptation. Whilst significant research has previously examined this phenomenon in animals, the application to human pain research is only just emerging. Recent work includes children who experienced pain early in life, either as hospitalized newborns (Hermann et al., 2006) or from burn injuries incurred between 6 and 24 months of age (Wollgarten-Hadamek et al., 2009). In these two studies, children were followed up at ages 9–14 years and 9–16 years respectively, and participated in standard experimental laboratory pain tasks, including thermal and mechanical stimulation techniques (Hermann et al., 2006; Wollgarten-Hadamek, et al., 2009).

In both studies, these school-age children, several years after the experience of early pain, showed elevated heat-pain thresholds and greater perceptual sensitization to thermal stimulation compared to controls. Hermann et al. (2006) report this as evidence of

'altered responsivity' to pain stimulation, with enhanced sensitization involving central pain pathways and elevation of pain thresholds associated with activation of the limbic system in pain feedback pathways. They theorize that this increased threshold 'masks' underlying sensitivity until sufficient pain input occurs, which explains why the children showed a higher pain threshold under low levels of stimulation, but when this became more intense the enhanced sensitization became evident (Hermann et al., 2006). A later study by Hermann's group examined the psychosocial context of this increased threshold/sensitivity in the 9–14-year-old children with neonatal intensive care unit (NICU) experience and found more catastrophizing in this group compared to controls. The mothers of the NICU children with more severe experiences exhibited more solicitous caretaking behaviour (i.e., showing special care and interest) in relation to their child's pain (Hohmeister et al., 2009). The mere presence of the mother was linked to an increase in heat-pain threshold in the child and less habituation to tonic heat. The authors highlight the dyadic result of neonatal pain experience on child cognition and the reinforcing effect of maternal behaviour. This simultaneous sensitization and inhibition is reminiscent of the PTSD models of stress associated with the third type of allostatic load discussed in Chapter 5.

PSYCHOSOCIAL INTERVENTIONS IN ACUTE AND CHRONIC PAIN

To summarize the evidence presented so far in this chapter, we know from at least as early as Melzack and Wall's (1965) proposed 'gate control theory' that psychosocial factors can influence an individual's experience of pain. This is just as true in children, for whom the situational context of the family and school has a key role within the biopsychosocial model. From pain in neonates through to adolescents, situational cognitive, behavioural and emotional factors, as well as child factors including demographics of age, sex, and previous pain experience, all make up the context of pain, which together with the sensory input determine the pain experience.

The group of coping responses that outperform all other coping responses are those of secondary control coping, and the type of coping associated with the most harmful or pain-perpetuating scenarios is that of catastrophizing, whether in the child or parent. Child factors relating to developmental stage of understanding and characteristic differences across age groups in dealing with pain, in particular the characteristic features of autonomy and control in adolescence, all have a major influence on the pain experience. Consequently, these biopsychosocial factors offer the potential for psychosocial intervention in the management of pain, alongside pharmacological treatment. We complete this chapter with a brief coverage of psychosocial interventions.

Psychosocial interventions to relieve pain, or alter the pain experience in children, have focused on acute pain (associated with medical procedures, vaccination and treatment in

paediatric intensive care), chronic or recurrent pain (including recurrent headache and musculoskeletal pain) and pain in life-limiting conditions, each with their different characteristics and pain profiles. Non-pharmacological psychosocial intervention in the form of distraction and comfort through maternal touch has been found to help relieve acute pain in neonates and infants during vaccinations and medical procedures, either at well-baby clinics or in the hospital environment (see Johnston et al., 2012). A number of studies have reported skin-to-skin contact between mothers and newborns to reduce physiological pain arousal and provide comfort during painful procedures in the neonatal intensive care unit (NICU), although similar techniques using 'touch and talk' therapy in infants and toddlers in the paediatric intensive care unit (PICU) have found effects for comfort immediately after treatment rather than during treatment (Johnston et al., 2012). Johnston et al. (2012) note that more intense psychological intervention is necessary to reduce stress during the procedure, but that maternal comfort is sufficient after the procedure to facilitate adaptation and recovery from the procedure. There is enormous scope for future work in these younger age groups with limited or preverbal skills.

More work has been conducted with children of preschool age and above. In an excellent review and recommendation document by Duff and colleagues (2012), the use of a range of cognitive behavioural therapy (CBT) techniques, including 'progressive muscle relaxation training, guided imagery, distraction, modelling, graded exposure and reinforcement scheduling' (2012: 1) are highlighted as effective in reducing distress associated with painful medical procedures in children and young people, with distraction and general CBT being the most effective. Duff et al. (2012) emphasize that, despite this evidence base, demonstrating the efficacy and effectiveness of such interventions, they are not taken up routinely in clinical care, and cite clear guidelines provided by the British Psychological Society for dealing with invasive or distressing procedures in children, across age groups from infants and toddlers up to older children and adolescents (Gaskell, 2010). These refer to techniques for use prior to the procedure, and include aspects referred to in the models described in this chapter and previous chapters on acute and chronic illness, such as the environment, providing information, involving parents, and giving 'appropriate' control, as well as providing pharmacological intervention. Coping strategies (touch, music and singing, breathing techniques, and relaxation) and ways to deal with distress during procedures are also provided in these guidelines (Gaskell, 2010).

There is a wealth of research on psychosocial interventions in children and adolescents with chronic or recurrent pain conditions, including randomized controlled trials, which are held up as the gold standard in research design. In these studies, focusing particularly on headache, abdominal pain and musculoskeletal pain (e.g., fibromyalgia), or combinations of pain types (e.g., sickle cell disease), behavioural relaxation and CBT-based coping skills in children have been found to be effective for reducing pain across all three categories of condition, but to be particularly effective for reducing headache pain, including migraine (Eccleston et al., 2009; Sieberg et al., 2012). Palermo et al. (2010) also include biofeedback as an effective technique for pain reduction in these chronic pain groups. Used alongside relaxation, biofeedback enables the individual to

receive information about their muscle tension through various means and this feedback provides useful guidance on how to relax further (see Morrison and Bennett, 2012). It is interesting that effective coping skills referred to in these interventions include the involvement of parents, trained to use operant strategies that reinforce their child's positive coping responses using reward systems (Eccleston et al., 2009; Palermo et al., 2009). Eccleston et al. (2009) point out that the effects of intervention on outcomes of mood and disability were more difficult to detect.

As mentioned above, one of the key distinguishing features between acute and chronic conditions is the dimension of time and, in interventions in chronic illness, the longer-term outcome beyond 3–6 months in relation to pain experience, functional status and disability is important and in need of further research. In line with our discussion of prior pain experience above, a further review specifically of childhood musculoskeletal pain, such as chronic regional pain syndrome (CRPS), by Clinch and Eccleston (2009) also stresses the importance of early intervention. Treatment time associated with administering such CBT-type interventions has been reported as averaging approximately 6 hours (Eccleston et al., 2009), which appears highly cost-effective given the advantages in pain reduction. Recent developments have also extended CBT approaches for managing chronic pain in children and adolescents to successful computerized versions and online web-based applications (Palermo et al., 2009; Velleman et al., 2010).

The intervention findings described above for chronic illness did not include cancer pain or pain in life-limiting conditions. To conclude this last section on interventions in pain, we consider the management of pain in life-limiting conditions. Friedrichsdorf and Kang (2007) provide a detailed list of CBT approaches, as well as complementary therapies, for use within this specific category of paediatric pain, as shown in Table 9.2, with clearly defined recommendations across each age group from infant to adolescent. These approaches are in line with the procedural BPS guidelines referred to above (Gaskell, 2010) and with the broader themes of coping discussed throughout this and previous chapters, the underlying aim of which is to restore physiological balance via reduction in pain and stress in order to reduce psychological distress and improve physical outcome.

In conclusion, psychosocial interventions to reduce pain have been shown to be effective across a range of acute, chronic, recurrent and life-limiting conditions, although to varying degrees. There is enormous potential for the development of a range and combination of cognitive behavioural therapy techniques tailored to specific conditions, and a need to assess systematically and scientifically both their efficacy under experimental conditions and their effectiveness in clinical practice. Helping children and adolescents draw on, develop, maintain and adapt effective coping mechanisms, within the context of family support, are at the heart of pain management and intervention. Pain is a complex, multidimensional phenomenon, and psychosocial interventions to reduce the sensory experience of pain provide a further example of the power of psychosocial factors to influence physical outcomes. In children, the impact and importance of these outcomes may be experienced not just during childhood but across the life course.

TABLE 9.2 Non-pharmacological approaches to paediatric pain management

Age	Pain behaviours	Cognitive-behavioural approaches	Complementary therapies
Infants	Avoiding eye contact Grimacing Difficulty sucking High-pitched crying Quivering chin Difficulty calming Wanting to be still Hiccupping Changes in breathing pattern	Use pacifier ('dummy') Swaddling Touch Distraction Music	Massage Sucrose solution Aromatherapy
Toddlers	Difficulty sleeping Loss of interest in play Increase in crying, irritability or restlessness Reduction in eating or drinking	Story-telling Blowing bubbles Toys Distraction Art and music therapy	Massage Warm/cool compress Aromatherapy
Preschool	Difficulty sleeping Loss of interest in play Quiet or curled Need to be held Says something hurts Reduction in eating or drinking	Distraction (cartoons) Offer favourite toy/object to hold Art and music therapy	Massage Reiki Emotive imagery Warm/cool compress Aromatherapy
School-age	Difficulty sleeping Moaning/crying Holding or protecting area of discomfort Loss of interest in play Decrease in activity level Complaining of pain Reduction in eating or drinking	Create a safe environment Dim lights, decrease noise, calm manner Power of suggestion Counting Art and music therapy Breathing techniques Visualization/guided imagery	Massage Reiki Progressive muscle relaxation Warm/cool compress Hypnosis (> 10 yrs) Acupuncture (>10 yrs) Aromatherapy Yoga/meditation/reflexology
Adolescent	Increasingly quiet Loss of interest in friends and family Decrease in activity level Increase in anger or irritability Changes in eating habits	Create a safe environment Dim lights, decrease noise, calm manner Distraction TV, video game, read a book, music Art and music therapy Breathing techniques Visualization/guided imagery	Massage Reiki Warm/cool compress Hypnosis Acupuncture Aromatherapy Yoga/meditation/reflexology

Source: Adapted from Friedrichsdorf and Kang (2007).

CHAPTER SUMMARY

In this chapter, we have examined the theories of pain experience, how children of different ages cope with pain, and the importance of the social context and role of the family in coping with pain. The experience of pain in neonates through to adolescents has emphasized the need for treating pain through a combination of pharmacological and psychosocial intervention. A range of acute, chronic, and recurrent pain experiences has been addressed, including surgical or postoperative pain, dental/orthodontic pain, pain following acute accidents, and pain associated with chronic illness, highlighting juvenile chronic arthritis and sickle cell disease. Changes in coping responses over time, with age and experience, have been addressed, and the response of catastrophizing has been contrasted with the more adaptive strategy of secondary control coping. I have also highlighted sex differences in pain and the impact of pain responses on level of disability.

This chapter links particularly well with the previous three chapters on acute and chronic illness and palliative care. As with these previous topics, the topic of pain experience and intervention underscores the life-course theme which runs throughout this book. Not only is the treatment of pain important for the child and their family during the pain experience, whether acute or chronic in nature, but how pain is dealt with in childhood has implications for lifelong psychophysiological responses to painful stimuli. This is another beautiful example not only of the biopsychosocial model in action, but also of its implications for the life-course trajectory in health and illness. In Chapter 10, I move on to consider the experience of illness not in the child themselves, but their experience of illness in a parent.

KEY CONCEPTS AND ISSUES

- Pain prevalence and intensity
- Acute, chronic, and recurrent pain
- The context of pain
- Catastrophizing versus secondary control coping
- Gate control theory, the body-self neuromatrix, and the neurosignature
- Pain stress
- The social context of pain
- Pain assessment
- Cold pressor test
- The under-treatment of pain in children
- Disability
- Pain resistance
- Internal control
- Anxiety sensitivity
- Role of parents, family, and school
- Cognitive behavioural therapy techniques and interventions in pain

FURTHER READING

For a very readable version of the original 'gate control theory' of pain and associated concepts (first published in 1982, following the advent of Melzack and Wall's (1965) revolutionary theory):

Melzack, R. and Wall, P.D. (2008) *The Challenge of Pain* (updated 2nd edn). London: Penguin Books.

One of the original papers on the neuromatrix:

Melzack, R. (1999) Pain: an overview. *Acta Anaesthesiologica Scandinavica*, 43(9): 880–4.

For one of the clearest accounts of the 'gate control theory' of pain with a modern-day clinical application, see:

Morrison, V. and Bennett, P. (2012) *An Introduction to Health Psychology*, 3rd edn. Harlow, Essex: Pearson Education.

One of the absolute best texts on child pain, including separate chapters on specific pain problems (sickle cell disease, cancer pain, headaches in children and adolescents, and pain and stress in the NICU), this is a must read, although be aware that the cost of the hardcover version would empty most student loan budgets (electronic library copies are available):

Schechter, N.L., Berde, C.B. and Yaster, M. (eds) (2003) *Pain in Infants, Children and Adolescents*. Philadelphia: Lippincott Williams & Wilkins.

An excellent text for everything you could want to know about pain, including in-depth coverage of pain pathways, mechanisms and processes with a lifespan perspective:

Holdcroft, A. and Jaggar, S. (eds) (2005) *Core Topics in Pain*. Cambridge: Cambridge University Press.

Practical, usable clinical guidelines from the British Psychological Society for age-relevant psychosocial interventions during acute medical procedures in children and adolescents:

Gaskell, S. (2010) Evidence-based guidelines for the management of invasive and/or distressing procedures with children. Position paper. Leicester: British Psychological Society (BPS).

USEFUL WEBSITES

The British Pain Society: www.britishpainsociety.org

The International Association for the Study of Pain: www.iasp-pain.org