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THE POWER OF MUSIC

An Exploration of the Evidence

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15. Music and Physical and Mental Health

There is increasing evidence suggesting that mind-body interactions play an important role in good physical health. Psychological factors play a causal role in the onset, course and speed of recovery in many illnesses, and non-medical interventions can sometimes be as effective as medical ones (Pelletier, 1992). Emotions impact on health and can play a role in clinical outcomes (Yael et al., 2000). They may also indirectly influence health-related behaviours (Diefenbach et al., 2008). Trudel-Fitzgerald and colleagues (2019) suggest that psychological wellbeing is associated with lower disease and mortality risk, while Diržytė and Perminas (2021) studied 1001 healthy and unhealthy Lithuanian adults, and showed that those who were physically healthy had significantly higher scores on measures of wellbeing. This does not unequivocally demonstrate causality, although overall, there is strong evidence that positive emotions are associated with better health and health behaviours.

The role of stress in ill health has increasingly been acknowledged. From an evolutionary perspective, the capacity to respond to environmental threats is important for survival. In mammals, responses to threats include changes in the delivery of oxygen and glucose to the heart and the large skeletal muscles, providing physiological support for fight or flight. Each of these carries the risk of injury and subsequent infection, so immune system responses may also be included in adaptive responses to help prevent infections from taking hold. While such threats are rare in the modern world, the human physiological system continues to respond in the same way. Threats that do not require physical action (for instance, work pressures) can still have physical consequences, including changes in the immune system. Segerstrom and Miller (2004)

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reviewed hundreds of studies and demonstrated that psychological challenges could modify immune responses. They found that acute stressors lasting for minutes were associated with changes in immunity. Brief naturalistic stressors (for instance, taking an examination) tended to suppress cellular immunity while preserving humoral immunity, while chronic stressors are associated with the suppression of cellular and humoral immunity. Picard and McEwen (2018) proposed that chronic psychological stress induces metabolic and neuroendocrine mediators that cause structural and functional changes in mitochondria, leading to mitochondrial allostatic load which, in turn, affects the brain, endocrine and immune systems. These play a role in psychosomatic processes, suggesting shared underlying mechanisms. Many health problems occur as a result of long-term stress, including depression, cancer, anger and cardiovascular disease (Davidson et al., 2003, Steptoe et al., 2001). Mroczek and colleagues (2015), in a diary study with 181 men aged 58 to 88 years old, showed that a decrease in positive emotions in response to daily stressors increased the risk of mortality.

The Role of Music in Psychological and Physical Health

For many years, research has focused on trying to understand how and to what extent music can impact physical health (MacDonald et al., 2012). As we saw in Chapter 14, the impact of music on psychological wellbeing and subsequently good health is largely, although not exclusively, through the emotions it evokes (Juslin and Sloboda, 2010). Music stimulates the cortical and subcortical neural networks in the brain which are associated with activity in the autonomic nervous system (Panksepp and Bernatzky, 2002). Responses related to emotion include changes in dopamine, serotonin, cortisol, endorphin and oxytocin levels (van Eck et al., 1996). These can all affect physical health. Evidence from observational and experimental animal studies supports this (Kubzansky, 2009). The physiological effects of music include changes in heart rate, respiration, blood pressure, skin conductivity, skin temperature, muscle tension and various biochemical responses (Kreutz and Lotze, 2008). Finn and Fancourt (2018), in a review, found that listening to music mainly displayed effects through stress responses, irrespective of musical genre, self-selection of music or duration of

listening. Also in a review, Chanda and Levitin (2013) showed that music improved health and wellbeing through the engagement of the neurochemical systems for reward, motivation, pleasure, stress and arousal, immunity and social affiliation.

Neuroscientific and clinical studies of music in the recent past have substantially increased our understanding of how music supports therapy. Music is able to influence complex neurobiological processes in the brain and, through this, can play an important role in therapy (Lin et al., 2011). Altenmüller and Schlaug (2015) argue that the power of music to support mental and physical health lies in its potential to support and facilitate neurorehabilitation. They point out that music provides emotional, sensorimotor and cognitive experiences involving listening, watching, feeling, moving, coordinating, remembering and expecting musical elements. It is frequently accompanied by strong emotions which in themselves can lead to physical reactions: for instance, tears in the eyes or shivers down the spine. A large number of cortical and subcortical regions of the brain are involved in all musical activities (Altenmüller and McPherson, 2007; Tramo, 2001). Primary and secondary regions in the cerebral cortex are involved in all sensory perception including music, but music also impacts on multisensory and motor integration in the frontal, parietal and temporo-occipital brain regions. The frontal lobe is involved in controlling attention, planning and motor preparation, in integrating auditory and motor information, and in imitation and empathy. The multisensory integration regions in the parietal lobe and temporo-occipital areas integrate sensory inputs from auditory, visual and somatosensory systems into a combined sensory impression. The multisensory brain activation of these different systems is typical when we engage with music through listening to it or actively making it. The cerebellum is important in motor coordination and tasks which require timing. It is activated during the processing of rhythm or keeping time rhythmically—for instance, in tapping in time with an external stimulus. In addition, the emotional network in the brain (which includes the cingulate gyrus and the older parts of the brain such as the amygdala, hippocampus and midbrain) is crucial to the way that music is perceived emotionally and, subsequently, leading to motivation to engage with music. As we have seen in earlier chapters, engaging in musical activities changes the brain. This has

contributed to demonstrating the extent of neural plasticity (Bangert and Altenmuller, 2003; Hyde et al., 2009; Wan and Schlaug, 2010). As a result of this plasticity, music can assist in restoring damaged sensorimotor brain networks, and have an impact on neurohormonal status and cognitive and emotional processes. Overall, a wide range of sensorimotor, coordination and emotional problems can be improved with therapy that includes music. Overall, music has many functions, roles, and psychological and physical applications. Participating in making music can help to overcome issues relating to lung function, language, mobility and fine motor coordination. Music can help to decrease anxiety, enhance the immune system and alleviate depression (Schäfer and colleagues, 2013). It can offer support to those with a range of clinical problems, from Alzheimer's disease to those on the autism spectrum. Yap and colleagues (2017), in a review of 4,198 studies on the impact of drumming and percussion music in promoting personal and interpersonal wellbeing, found benefits for physical, psychological and social health. Perceived health benefits identified by those singing in choirs include stress reduction, therapeutic benefit in relation to long-standing psychological and social problems, and the exercising of the body through the physical exertion involved (especially the lungs) and the disciplining of the skeletal-muscular system through the adoption of good posture (Clift, 2012).

Although the healing powers of music have been acknowledged for centuries, it was only after the 2nd World War that the American Services recognised the power of music as capable of helping those with physical and psychological injuries. This represented a major shift in the relationship between music and medicine, and led to the development of modern music therapy (Rorke, 1996). Since then, music therapists have worked with a wide range of people across the lifespan, and have developed many different strategies to support health and wellbeing. As we have seen, listening to and making music engages multisensory and motor networks in the brain, inducing change and fostering links between them. These functions, alongside the ability of music to tap into human emotion and reward systems, can be used to facilitate and enhance therapeutic approaches which support the rehabilitation and restoration of neurological functions and other neurological disorders (Altenmüller and Schlaug, 2015). Music therapy contributes to the

treatment of a range of long-term psychiatric conditions including anxiety, schizophrenia, sleep disorders, depression and dementia (Boss et al., 2015; Wang and Agius, 2018). Kamioka and colleagues (2014) summarised evidence from 21 studies, including those focused on mental and behavioural disorders and diseases of the nervous, respiratory, endocrine, nutritional, metabolic and circulatory systems, as well as pregnancy, childbirth and the puerperium, while Stige and colleagues (2010) focused on how music helped those struggling with illness, disability, social and cultural disadvantage, or injustice. Clinical studies have shown that music therapy can be used to treat depression, autism, schizophrenia and dementia, as well as problems of agitation, anxiety, sleeplessness and substance misuse. It can also delay age-related decline in speech perception (Parbery-Clark et al., 2011), non-verbal memory and executive processes (Hanna-Pladdy and MacKay, 2011). Detailed examples of music therapy research will be presented later in the chapter.

Recently, there have been developments in what has become known as 'music medicine', where music is used to promote good health and support patients, particularly in reducing anxiety and pain. Performing-arts medicine has a similar focus, with musicians going into hospitals to entertain and engage patients of all ages in music-making to promote their recovery and psychological wellbeing following treatment. As we saw in Chapter 14, there has been considerable interest in the way that music can promote wellbeing in everyday life, through listening to or actively making music. The boundaries between these different areas of work have become blurred and continue to change over time. For instance, work with Alzheimer sufferers in care homes was initiated by music therapists, but as its effectiveness was demonstrated and its practice spread, it has tended to be delivered by community musicians. They differ in the way that they apply music in therapy, perhaps including musical composition, discussion of song lyrics or participation in joint singing or musical games. There is no consensus as to which specific approaches are more effective. Listening is the one constant among all applications. This suggests that music itself is therapeutic.

Music has been used in a range of medical contexts (Le Roux et al., 2007; Spintge, 2012). Listening to music can reduce the amount of sedative drugs required in hospital (Conrad et al., 2007) and support

recovery after surgery, in particular reducing the need for pain medication (Nelson et al., 2017; Vollert et al., 2003), in some cases by up to 50 percent (Spintge 2012; Spintge and Droh, 1992). This is particularly the case when patients select the music themselves (Mitchell and McDonald, 2006a; 2006b; 2012). Music can support improvement in speech impairment following strokes (Kaser et al., 2017), support the rehabilitation of motor movements in a range of conditions, and improve the quality, range and speed of movement. There are benefits for stroke patients (Särkämö et al., 2008) and those with neurodegenerative disorders, such as Parkinson's disease and dementia (Spaulding et al., 2013; Verghese et al., 2003). Detailed examples of research in medical contexts will be presented later in this chapter.

Music, Stress and the Immune System

Stress is a major worldwide health issue leading to exhaustion, burnout, anxiety, a weak immune system and possibly organ damage. Creative-arts interventions, including those based on musical activities, have been suggested as ways to prevent stress and improve its management. In a review of 37 studies on creative-arts interventions, Martin and colleagues (2018) concluded that they were relatively effective in reducing stress. Kreutz and colleagues (2012) developed a psychoneuroendocrine approach to explore how musical activity was related to psychological and physical health, using cortisol levels as a psychophysiological measure of stress. Listening to particular types of music has been shown to lead to significant reductions in cortisol, including classical choral (Kreutz et al., 2004), meditative (Möckel, 1994) and folk music (Fukui and Yamashita, 2003). However, not all music has this effect. Significant increases in cortisol have been noted in listeners exposed to technomusic, along with increased heart rate, systolic blood pressure and emotional state (Gerra et al., 1998). Increases in cortisol have also been found in those listening to upbeat pop and rock music (Brownley et al., 1995).

Singing and other participatory musical activities can bring about positive changes in cortisol levels. Beck and colleagues (2000) observed decreases of cortisol of 30 percent on average in members of a professional choir during a rehearsal, although there was a 37 percent increase during a performance. In an experimental study, Bittman and

colleagues (2005) exposed participants to a one-hour stress-induced protocol, followed by a novel recreational music-making programme which successfully modulated stress. Music also has an effect on cortisol levels in the context of tango dancing. Murcia and colleagues (2009) observed that the presence of music during dance led to decreases in cortisol levels, although there was no impact on the presence or absence of a dance partner. Keeler (2015) explored the neurochemistry and social flow of group singing in four participants from a vocal jazz ensemble, who sang together in two separate performances: one pre-composed, the other improvised. Group singing reduced stress and arousal, and induced social flow in both conditions.

Some research has focused on the impact of music on the immune system. Making and listening to music can have a positive impact on the immune system (Chida et al., 2008; Wilkinson and Marmot, 2003). To assess immunity, samples of secretory immunoglobulin A in saliva are measured. This is used as an indicator of the local immune system in the upper respiratory tract, the first line of defence against bacterial and viral infections. There have been reported increases in secretory immunoglobulin A, suggesting enhanced immune system activity, after singing (Beck et al., 2000; 2006; Kuhn, 2002; Kreutz et al., 2004). No such increases have been found in those listening to choral music (Kuhn, 2002). A study exploring active drumming or singing compared with watching a live performance also found a more pronounced effect on the immune system in those actively participating in making music. In contrast, McCraty and colleagues (1996) found that listening to relaxing music that created a positive emotional state led to increases in secretory immunoglobulin A concentrations, while rock or new-age music had no effect. Similarly, Hirokawa and Ohira (2003) examined the impact of listening to more or less relaxing music on immune functions, neuroendocrine responses and the emotional state of eighteen Japanese college students after they had carried out a stressful task. The findings were inconclusive in relation to the impact on the immune system. In a review of 63 studies on the effects of music on neurotransmitters, hormones, cytokines, lymphocytes, vital signs and immunoglobulins, as well as psychological assessments, Fancourt and colleagues (2014) indicated that there was a pivotal role for stress pathways in linking music and immune responses, although there were a range of methodological difficulties in the existing research.

Active Music-Making and the Promotion of General Good Health

There has been relatively little research focusing on the general physical-health benefits of participation in musical activities. Early reviews of research with adult singers concluded that there could be health and wellbeing benefits of participating in a choir (Clift et al., 2008; Stacey et al., 2002), although subsequent reviews have been more cautious (Clift, 2012). Perceived benefits include:

- physical relaxation and release of physical tension;
- emotional release and reduction of feelings of stress;
- a sense of happiness, positive mood, joy, elation and feeling high;
- a sense of greater personal, emotional and physical wellbeing;
- an increased sense of arousal and energy;
- stimulation of cognitive capacities, attention, concentration, memory and learning;
- an increased sense of self-confidence and self-esteem;
- a sense of therapeutic benefit in relation to long-standing psychological and social problems;
- a sense of exercising systems of the body through the physical exertion involved, especially the lungs;
- a sense of disciplining the skeletomuscular system through the adoption of good posture; and
- being engaged in a valued, meaningful, worthwhile activity that gives a sense of purpose and motivation.

In the UK, Hillman (2002) surveyed 75 participants who had participated in a community singing project since reaching the statutory retirement age. The long-term benefit attributed to participation in music was a lack of deterioration in physical health. Reagon and colleagues (2016) reviewed 18 papers studying the effect of group singing on health-related quality of life. The patients included were suffering from chronic respiratory disease, neurological conditions or mental ill-health. The findings showed some evidence for improved quality of life, while

participants reported directly on their enhanced confidence, mood and levels of social support. Also focusing on choral singing, Więch and colleagues (2020) assessed the nutritional status and quality of life of 200 healthy adults aged 19 to 70 years old. Those involved in singing had significantly lower body weight and body mass index in comparison with a control group. They also had significantly lower basal metabolic rate and metabolic age, and reported greater life quality. Drumming has been the focus of some research. For instance, Smith and colleagues (2014) examined the impact of djembe-drumming in a comparison of middle-aged experienced drummers and a younger novice group who each participated in 40-minute sessions, preceded and followed by measurements of blood pressure, blood lactate, stress, anxiety and ongoing measures of heart rate. Drumming decreased stress and anxiety in both age groups, and blood pressure in the older participants. Assessment of lactate and heart rate suggested that drumming can be considered as low- to moderate-intensity exercise.

One strand of research has investigated the impact of creative song-writing. For instance, Baker and MacDonald (2014) studied 13 students and 13 retirees who engaged in song-writing activities. Each participant created a song parody, original lyrics and an original song describing a positive, negative or neutral experience. Positive outcomes included listening to personal creations, exploring self, the relationship with the therapist, the way that being fully immersed altered perception of time, and the experience of balancing ability and effort. The younger participants were more likely to continue to use their songs for further therapeutic benefit.

The role of attendance at cultural events on health and wellbeing has been studied. For instance, in Poland, Węziak-Białowolska and Białowolski (2016) used data from the biennial longitudinal Polish household study which represented the Polish population over the age of 18, and found a positive association between cultural attendance and self-reported health, although no causal link was established. In Norway, Cuypers and colleagues (2011) examined the association between cultural activity and perceived health, anxiety, depression and satisfaction with life in 50,797 adult participants. Data on cultural activities (receptive and creative), perceived health, anxiety, depression and satisfaction with life were collected. The findings showed that participation in receptive and creative cultural activities was significantly

associated with good health, life satisfaction, and low anxiety and depression. For men, attending receptive, rather than creative, cultural activities was more strongly associated with all health-related outcomes. Similarly, in the UK, Fancourt and Steptoe (2018) compared data from 2,548 adults aged over 55 years old—drawn from the *English longitudinal study of ag*[*i*]*ng* modelling change over a ten-year period—in relation to membership of different community groups, while controlling for potential confounding variables. Membership of two types of community groups was associated with enhanced wellbeing: attending education, arts or music classes, and church or religious group membership.

Music, Health and the Older Generation

There are general health benefits of participating in making music for older people, including lower mortality rates (Johansson et al., 2001). Music-making contributes to perceived good health, quality of life and mental wellbeing (Coffman and Adamek, 1999; 2001; Kahn, 1998; Wise et al., 1992), while playing the piano exercises the heart as much as a brisk walk (Parr, 1985), although studies on the impact of lung function have had mixed outcomes (Clift, 2012). In the USA, Cohen and colleagues (2006; 2007) carried out studies with 166 participants with an average age of 80 who participated in 30 singing workshops and ten performances over a one-year period. The choir group reported a higher overall rating of physical health, fewer visits to the doctor, less medication use, fewer falls, and fewer other health problems in comparison with a control group, who had carried on with their usual activities and did not participate in the choir. There was evidence of higher morale, a reduction in loneliness and increased activity, while the comparison group experienced a significant decline in activities. Cohen and colleagues argued that sense of control, as well as social engagement, were the most likely mechanisms responsible for the positive outcomes. Coulton and colleagues (2015) studied the value of community singing on the mental-health-related quality of life of older people with 258 participants in five centres in the UK. Group singing was compared with usual activities in those aged 60 years or over. Significant differences were observed in mental-health-related quality of life, anxiety and depression in favour of group singing. Similarly,

Zanini and Leao (2006) studied a therapeutic choir for the elderly and found that singing provided a means of self-expression and fulfilment, and instilled self-confidence in the participants' expectations about the future.

Depression in older adults has increased recently, and will continue to rise as the number and proportion of older adults in the population rises worldwide. Dunphy and colleagues (2019) carried out a review of how art, dance movement, drama and music could help to alleviate depression in the elderly, and established common mechanisms of change. These included:

- physical changes, such as muscle strength;
- neurochemical effects, such as endorphin release;
- intrapersonal change, such as enhanced self-concept, sense of agency and mastery;
- improved processing and communication of emotions;
- the provision of opportunities for creative expression and aesthetic pleasure;
- cognitive stimulation, including memory; and
- social benefits, such as increased social skills and connection.

Each of these were considered to contribute to a reduction in depression. Alzheimer's patients can benefit from engagement with music, as it encourages reminiscence and improves moods and behaviour, although it does not have any long-term impact on underlying cognitive deterioration (Creech et al., 2014). Despite this, some activities are preserved and are relatively resistant to decline. One such activity is engagement with music (Sacks, 2007). Baird and Thompson (2019) point out that musical skills can be preserved in some people with Alzheimer's and dementia, including memory for familiar music and the ability to produce music by singing or playing an instrument. They studied a 77-year-old woman with severe Alzheimer's disease and her husband's use of music in her care. Her behaviour and verbal communication were observed when she read a newspaper article or familiar song lyrics, or sang familiar song lyrics, or listened to the original version of the familiar song. Over time, there was a gradual

deterioration in her expressive language abilities, whereas her musical skills were comparatively preserved.

Residents in Care Homes

Care homes support people with a range of difficulties who cannot live independently. With the increase in the older population, many care homes cater for those who need support or who may need additional care following a stroke or other serious illness. Many residents in such homes have dementia, a group of symptoms that typically includes problems with memory, thinking, problem-solving, language and perception. Dementia has a number of different causes, including Alzheimer's disease, vascular dementia and dementia with Lewy Body. Anyone with dementia, whatever its underpinnings, can benefit from engaging with music, as it encourages reminiscence and can improve moods and behaviour. Much of the research on the impact of music in relation to dementia has occurred in residential care or nursing homes (Elliott and Gardner, 2018). Active participation in making music has been found to have broadly positive effects. For instance, Biasutti and Mangiacotti (2018) compared outcomes for older people with mild to moderate cognitive impairment, who were either assigned to a group receiving cognitive music training for 12 twice-weekly 70-minute music sessions or acted as a control group who attended a similar number of gymnastic sessions. A neuropsychological test battery, administered at the beginning and end of treatment, showed a significant improvement for the music group in relation to general mental state, verbal fluency and a clock-drawing test, while the control group showed no significant improvements. In a later study, Biasutti and Mangiacotti (2021) studied the effectiveness of musical improvisation on depressed mood and general cognitive function in 45 elderly care residents. The findings revealed a significant improvement in cognition and a reduction in depression and cognition for the music group, while the control group showed no change in relation to depression and a deterioration in cognition. Also focusing on depression, Werner and colleagues (2017) examined the effect of interactive group music therapy, as opposed to recreational group singing, on symptoms in elderly nursing-home residents. A total of 117 participants from two German nursing

homes were allocated to 20 interactive group music therapy sessions of 40 minutes each twice a week, or recreational group singing on ten occasions for 90 minutes weekly. Levels of depressive symptoms were assessed at baseline and follow-up in the sixth and twelfth weeks. The level of depressive symptoms improved significantly more in those assigned to music therapy than recreational singing.

In Australia, Brancatisano and colleagues (2020) reported the outcomes of a music, mind and movement programme for 20 people in their eighties with mild to moderate dementia. The programme involved seven 45-minute weekly group sessions, and individual 15-minute booster sessions. Assessments of global cognition, mood, identity and fine motor skills were conducted at the start of the programme, immediately following the intervention and one month after its close. The majority of participants in the programme showed an improvement in overall cognition, attention and verbal fluency, while the majority of those in the control group showed a decline. Hämäläinen and colleagues (2021) focused on the impact of *yoik*, a traditional vocal music of the indigenous Sami people of Fennoscandia, with elderly and dementia residents in a care home. In-depth interviews with close relatives of participants and healthcare professionals revealed that they had observed positive effects when *yoik* was introduced, even in persons unfamiliar with the genre. Improvements in memory, orientation, depression and anxiety in both mild and moderate cases of Alzheimer's disease, and hallucinations, agitation, irritability and language disorders in those with moderate Alzheimer's disease have been found in patients after six weeks of music therapy. The effect on cognitive aspects was notable after only four music therapy sessions (Gallego and García, 2017)

Focusing on agitation and anxiety in older people with dementia, Cooke and colleagues (2010) investigated the impact of participation in a 40-minute group music-making programme involving facilitated engagement with singing songs and listening three times a week for eight weeks. Forty-seven participants with mild to moderate dementia from two care facilities in Australia participated. A sub-analysis of 24 participants who attended less than half of the music sessions found a significant increase in the frequency of verbal aggression over time. Participation in the music programme did not significantly reduce agitation and anxiety, although music and reading group activities gave

some participants a voice and increased their level of verbalisation. Also focusing on agitation and anxiety, Sung and colleagues (2012) set up a group music intervention using percussion instruments with familiar music to reduce the anxiety and agitation of 60 institutionalised older adults with dementia. The experimental group received a 30-minute music intervention using percussion instruments with familiar music in a group setting twice weekly for six weeks. In comparison with a normal-care control group, those in the music group had significantly lower levels of anxiety following the intervention, although there was no difference between the groups in the reduction of agitation. Aiming to reduce agitation, Vink and colleagues (2013) undertook a study of 94 residents with dementia who were allocated to either music therapy or recreational activities twice weekly for four months. Data from 77 residents showed a decrease in agitated behaviours from one hour before to four hours after each session. This decrease was greater in the music therapy group but disappeared completely after adjustment for general level of deterioration. There were no other reported benefits.

Castillejos and Godoy-Izquierdo (2021) explored the outcomes of a music intervention which was integrated into the therapeutic activities of institutionalised elderly people. Fifty residents in a care home were studied at baseline, postintervention, and after two weeks. The music intervention had a positive impact on physical health, cognitive functioning, emotional wellbeing, pain and happiness compared with stability in controls, although the benefits decreased progressively after the discontinuation of the music programme. Similarly, Paolantonio and colleagues (2020) examined the effects of group music-making on the health and wellbeing of 22 nursing-home residents aged 72 to 95 years of age in Switzerland. Professional and student musicians delivered ten weekly music sessions in four nursing homes, focusing on singing, rhythm-based activities with percussion instruments and listening to short, live performances. Being involved in musical activities offered engagement and novelty, providing learning opportunities and facilitating interpersonal relationships. Residents particularly appreciated the opportunity to listen to live performances.

McDermott and colleagues (2014) undertook a qualitative study to explore how care-home residents with dementia and their families, day-hospital clients with dementia, care-home staff, and music therapists

perceived the role of music therapy. Music was viewed as being accessible for people at all stages of dementia. There were perceived to be close links between music, personal identity and life events, while music was seen as being useful for building relationships. The effects of music were viewed as going beyond the reduction of behavioural and psychological symptoms, in part because individual preferences for music were preserved in spite of dementia. This helped others to value the dementia sufferer as a person and to support and maintain the quality of their life.

In a case study, Giovagnoli and colleagues (2014) described the effects of active music therapy on cognition and behaviour in one individual with chronic vascular encephalopathy who suffered with memory, attention and verbal fluency deficits. A four-month programme of 16 sessions was implemented based on creative and interactive music-making, in addition to pharmacological therapy. At baseline, the patient reported a tendency to feel tense, nervous and angry, and had difficulties with memory and visuospatial performance, frequently accompanied by loss of attention. Following music therapy, there were improvements in attention, visuomotor coordination, verbal and spatial memory, an increase in interpersonal interactions and a reduction in anxiety.

In an acute hospital setting, Cheong et al. (2016) evaluated the impact of a creative music therapy programme on mood and engagement in older patients with delirium and or dementia. Twenty-five patients of approximately 80 years of age were observed before and after music therapy, which included improvisation and playing songs of the patient's choice. There was a significant positive change in patients in relation to constructive and passive engagement, pleasure and general alertness. Also focusing on hospital stays for people with dementia, Daykin and colleagues (2018) examined the effects of ten weeks of music sessions on patients' wellbeing and the environment in an acute elderly care service in a UK hospital. Observational data, semi-structured interviews and focus groups with patients, visitors, musicians and staff showed that patients generally enjoyed the activity and that there was a reduction in the prescription of antipsychotic drugs, enhanced patient and staff experiences, and an improvement in care. Feeding difficulties can be a problem as dementia progresses, resulting in malnutrition which, in turn, can compromise physical and cognitive functioning. Fifteen

participants in a care facility, who were not malnourished at the start, participated in 12 music sessions lasting for 25 minutes just before lunch, with songs likely to be known by residents. Unfortunately, there were too many confounding variables for any conclusions to be drawn (McHugh et al., 2012).

Some research has attempted to identify the most effective type of music. For instance, Lem (2015) studied the levels of engagement with music of 12 people with dementia who participated in 20 weekly music therapy sessions, and found that engagement increased midway through the programme when a more intuitive approach was adopted, with more challenging musical experiences and less structure. An evaluation of an intervention based on group singing activities—developed by the Alzheimer's Society for people with dementia and their carers—showed that social inclusiveness and improvements in relationships, memory and mood were particularly important to participants, who enjoyed the sessions and found that they helped in accepting and coping with dementia (Osman and colleagues, 2016). Pavlicevic and colleagues (2015) explored music therapists' strategies for creating musical communities in dementia care settings. Six experienced music therapists identified a ripple effect of music from person-to-person music-making to that which continued beyond session time, within the care home and beyond. Ongoing qualitative research by Skinner and colleagues (2018) is examining the potential for dance to improve social inclusion for people living with dementia in care facilities.

Some programmes have focused on training care-home staff to deliver music sessions. For instance, Tapson and colleagues (2018) evaluated an intervention comprising an 11-session interactive weekly music programme in five care homes in the UK, which included training for staff. The programme focused on singing and the use of voice, and was led by pairs of trained professional musicians for 45 minutes each week. The programme provided positive social experiences, creative engagement, fun and a sense of achievement, and enhanced the working and living environment for care-home residents and staff, playing a crucial role in developing a sense of identity and empowerment for residents, facilitated by musicians and care teams working together. The role of those delivering such programmes cannot be overestimated. Tuckett and colleagues (2015), in evaluating the effectiveness of a

group music therapy intervention, concluded that the impact was mediated by the older person's dementia state, its psychosomatic effect on the participants and the nature of the session. The therapy evoked memories and facilitated reminiscence, and acted as a diversion, but the independent effects of the music and the therapist could not be determined.

While most research has focused on active engagement with making music, some has concentrated on the impact of listening to music. For instance, Costa and colleagues (2018a) assessed the effect of listening to preferred music on pain, depression and anxiety in older care-home residents. One hundred and thirteen participants either continued with their usual routine or listened to a daily 30-minute programme of preferred music over a three-week period. Levels of pain, depression and anxiety were assessed and showed decreases, although these were less for pain. Those who regarded music as important listened most, and those whose preferences were accommodated benefited most. In a similar study, Costa and colleagues (2018b) studied the effects of listening to preferred music on 117 participants from nine care homes. In addition to their usual routine, each participant listened to a daily 30-minute programme of their preferred music for three weeks. Findings showed that listening to preferred music resulted in relaxation, positive reminiscence, reduced depression and boredom, and a range of physical reactions including chills, tears or emotional arousal. Some reactions, such as foot-tapping, were beneficial to the most disabled participants. The use of preferred and favourite music was the principal factor in the intervention's effectiveness.

Some interventions have combined active music-making with listening activities. For instance, Särkämö and colleagues (2014) determined the efficacy of a novel music intervention based on coaching the caregivers of patients with dementia to use either singing or music-listening regularly as a part of everyday care. Eighty-nine patient caregiver dyads were randomised to a ten-week singing coaching group, a ten-week music-listening coaching group or a usual-care control group. The coaching sessions consisted mainly of singing or listening to familiar songs, with some vocal exercises and rhythmic movements for the singing group, and reminiscence and discussions for the music-listening group. The intervention also included regular musical exercises

at home. The findings showed that, compared with usual care, singing and music listening improved mood, orientation and remote episodic memory, and to a lesser extent attention, executive function and general cognition. Singing also enhanced short-term and working memory, and caregiver wellbeing, whereas music-listening had a positive effect on quality of life. Särkämö and colleagues (2014) concluded that regular musical leisure activities could have long-term cognitive, emotional and social benefits in those with mild to moderate dementia. Although music can be considered as a leisure activity enjoyed for its own sake, there is some evidence which highlights the benefits of prescribed therapy that can be personalised to meet the needs and skill level of each individual (Genoe and Dupuis, 2012). Menne and colleagues (2012) also point out that, when designing interventions for people with dementia, it is important to ensure that they enjoy the activities.

Live music performances have been shown to have a positive effect on human contact, care relationships, positive emotions and negative emotions in people with dementia in nursing homes (van der Vleuten et al., 2012). Shibazaki and Marshall (2017) explored the effects of live music concerts on dementia sufferers, their families, nursing staff and caregivers. Interviews and researcher attendance at concerts in care facilities showed that concerts were beneficial to patients and staff, even when they did not attend the concerts. Those with mild to mid-stage dementia showed increased levels of cooperation, interaction and conversation, while those with more advanced forms exhibited decreased levels of agitation and anti-social behaviour. Staff members reported increased cooperation and opportunities for assessment, while family members noted an increase in levels of wellbeing. The concerts revealed that knowledge of music and its rules (as well as musical preferences) remained when other cognitive skills and abilities had disappeared. De Wit (2020) also explored the impact of live music-making on hospital nurses and nursing-home caregivers working with vulnerable elderly patients. The healthcare professionals collaborated with the musicians to connect with residents, taking time to become engaged with them in musical situations. This enabled new understandings to develop, supporting the delivery of person-centred care.

Music, Dementia and Care in the Home

Most of the research relating to music and dementia has been undertaken in residential, nursing and hospital settings despite estimates that, in the UK, two thirds of those living with dementia continue to live in their own homes (Wittenberg et al., 2019), a practice known as 'ageing in place' (Wiles et al., 2012). Those with Alzheimer's and related dementias who live at home have unique advantages in terms of being in a familiar place with people they are close to, but carers and those cared for are at risk of depression, isolation and decreased contact with peers and the networks that normally help to maintain social, intellectual, physical, sensory and spiritual needs. As memory declines, the person with dementia loses life skills and sense of self, while their caregiver is increasingly burdened physically and emotionally. Services are now developing to support those who are ageing in place (Dawson et al., 2015). For instance, the BUDI Orchestra was created as a music-based initiative for people with dementia and their family carers living in the community. The initiative comprised ten weekly sessions, facilitated by professional musicians and supported by university students. At the end of the programme, participants showcased their achievements at a public performance. There were a range of positive outcomes, including enjoyment for participants, a sense of social inclusion for musicians and participants alike, and (for the dementia sufferers) increased engagement, a sense of achievement, confidence and enhanced mood. Carers reported improved mood, feelings of relaxation and improvements in their relationships with the cared-for. Musicians' preconceptions of musical learning were challenged and they learnt more about themselves through facilitating the sessions. In addition, the performance positively impacted audience members' perceptions of dementia. The findings challenged assumptions of the capacity of people with dementia to learn new skills and play instruments, and highlighted the power of performance to challenge negative perceptions of dementia (BUDI Orchestra, 2015). Similarly, Lee and colleagues (2020) explored how a community-based group singing intervention impacted the wellbeing of people with early-stage dementia and their family carers. Participants engaged in a six-week group singing intervention facilitated by a music therapist in a community arts centre. Semi-structured interviews revealed enhanced

social connection, happiness and rejuvenation, reconnection with the self and support for the relationship between carer and cared-for. Overall, community-based music therapy can be effective in supporting carers and those they care for (Rio, 2018).

Prattini (2016) examined music's effects on levels of agitation in people with Alzheimer's disease or other dementias. The research focused on those living at home who were cared for by an informal caregiver. The participants either participated in active music-making or listened to music. Only active participation had an impact on agitation. Smith and colleagues (2021) arranged ten music-making sessions for community-dwelling people living with dementia and their care partners, once a month over a period of seven months. Eighteen participants consented to take part, including seven people living with dementia, five care partners and six former care partners. Baseline semi-structured interviews explored the lived experience of music, and expectations of the upcoming music-making cafés. Self-report questionnaires captured the experiences of each music-making café, while follow-up semi-structured interviews explored the impact of music-making on participants' self-reported wellbeing. The findings demonstrated that participating in a music-making cafe benefited the wellbeing of participants, providing a sense of camaraderie that facilitated connections with others, creating opportunities to level the playing field, drawing on a person's strengths and abilities, and providing meaningful musical experiences. Participating in music-making promoted the wellbeing of community-dwelling people living with dementia and their care partners, offering opportunities for peer support and a reduction in feelings of isolation through a shared love of music, as well as providing meaningful musical experiences in a supportive, enabling environment.

In a home-based programme, participants with major or minor depressive disorder learned how to use music to reduce stress. They either received a weekly home visit by a music therapist, participated in a self-administered programme where they applied the same techniques with moderate therapist intervention, received a weekly telephone call, or were part of a wait-list control group. Participants in the music conditions performed significantly better than controls on standardised tests of depression, distress, self-esteem and mood. These

improvements were maintained nine months after the end of the project (Hanser and Thompson, 1994). In a community-based arts programme in Canada, Moody and Phinney (2012) found that participating older adults experienced enhanced capacity to connect to the community and a stronger sense of community through collaboration as a group, as they worked together on the project towards a final demonstration to the larger community.

Reviews of the Relationship between Music Therapy and Dementia

There has been little agreement between reviews of the literature pertaining to the role of music therapy with the older generation and its effectiveness. Some reviews have drawn relatively positive conclusions, although sometimes with caveats. For instance, Abraha and colleagues (2017) provided an overview of 142 non-pharmacological interventions for behavioural and psychological symptoms in dementia, including music therapy, and concluded that overall, music therapy and behavioural management techniques were effective for reducing the behavioural and psychological symptoms of dementia. Zeilig and colleagues (2014) also reviewed a range of interventions and reported that music could generate feelings of peace for patients with dementia. A range of arts projects have been identified as promoting social engagement, but it has been difficult to establish if the effects related to the role of the arts specifically or could have been attained by any form of social engagement, although the emphasis in the arts on creation and play may have supported patients with dementia, as may the emphasis in the arts on emotion. Istvandity (2017) reviewed intervention studies that utilised music and reminiscence activities in elderly adult populations, and found positive effects in four out of five studies, while Zhao and colleagues (2016) (in a meta-analysis of 19 articles) suggested that music therapy plus standard treatment reduced depressive symptoms to some extent.

Dowlen and colleagues (2018), in a review of 18 studies, identified benefits in terms of taking part, being connected, affirming identity and immersion in the moment, while Zhang and colleagues (2017)—in a review of 34 studies with 1575 participants—showed that disease subtype, intervention method, nature of the control or comparison

group, participant location, trial design, trial period and outcome measure instruments made little difference to outcomes. Overall, there was positive evidence to support the use of music therapy to treat disruptive behaviour and anxiety, and positive trends supporting the use of music therapy for the treatment of cognitive function, depression and quality of life. Raglio and colleagues (2012), reviewing clinically controlled trials focusing on the use of music and music therapy in the context of dementia, found that (with some limitations) the findings were consistent in showing the efficacy of music therapy in impacting positively on the behavioural and psychological symptoms of dementia. However, the ability of the music therapist to directly interact with the participants appeared to be crucial for success.

No difference was found in cognitive function between dementia sufferers receiving interactive or receptive music therapy or usual care in one review of 38 trials involving 1418 participants aged 75 to 90 years old. Those receiving receptive therapy showed a significant decrease in agitation and behavioural problems, although there was no significant difference between those engaged in interactive music therapy and usual care in relation to behavioural and psychiatric problems (Tsoi et al., 2018). McDermott and colleagues (2012) found consistent improvement in behavioural disturbance in the short term, in a review of 18 studies adopting a diverse range of active music-making activities, with singing often being used as a medium of change. However, the review did not find any high-quality longitudinal studies that demonstrated long-term benefits. Focusing on the impact of music therapy on anxiety in a review of studies where the severity of dementia varied from mild to severe, Ing-Randolph and colleagues (2015) found variation in the nature of the interventions and the group sizes. While the findings seemed promising, the small number of studies and the variability in methods made it impossible to draw firm conclusions. Also taking account of variations in the quality of the research and how it was reported, van der Steen and colleagues (2018) reviewed 22 studies with 1097 dementia patients in nursing homes or hospitals, and concluded that people with dementia in institutional care participating in at least five sessions of a music-based therapeutic intervention probably experienced reduced depression and anxiety, improved overall behaviour and possible enhanced emotional wellbeing and quality of life, although there was no impact on agitation,

aggression or cognition. The effect on social behaviour and the long-term impact of the interventions was unclear.

In a scoping review, Elliott and Gardner (2018) summarised what was known about the role and impact of music in the lives of community-dwelling older adults with dementia, and reported that music could reduce agitation, improve cognition and enhance social wellbeing, while Bamford and Bowell (2018) also concluded that music could promote a range of benefits for people with dementia when used appropriately and in a meaningful way. In contrast, Vink and colleagues (2003) reviewed ten music therapy interventions designed to treat the behavioural, social, cognitive and emotional problems of older people with dementia, criticised the methodological quality of the research and reported that it was not possible to draw any firm conclusions. In a later review, Vink and Hanser (2018) reported that most descriptions of music therapy interventions lacked sufficient detail to enable researchers to compare and replicate studies, or for clinicians to apply the techniques. Definitions of music therapy and music-based interventions were inconsistent, and practitioners varied in the extent of their professional training and preparation for implementing music-based clinical strategies. Fusar-Poli and colleagues (2018) carried out a meta-analysis of six studies including 330 participants with an age range of 79 to 86 years old, and found no significant effects of music therapy on any outcomes. Similarly, Hui-Chi and colleagues (2015) conducted a review of music therapy interventions with older people in nursing homes, hospitals or communities, and indicated that (in the short-term) music therapy did not improve the cognitive function of older people. Considering the role of the arts in relation to dementia more broadly, Schneider and colleagues (2018) included 11 relevant studies and concluded that there was insufficient evidence demonstrating causality to draw any firm conclusions.

Music, Public Health and Music on Prescription

Music has been used to communicate public health messages. For instance, Cournoyer Lemaire (2020) report how the Quebec government promoted adherence to COVID-19 measures through the use of music, taking advantage of its capacity to reach a large population, capture the

population's attention quickly regardless of age, language or cultural barriers, effectively communicate messages and thus change behaviour.

Clift and Camic (2016) provided an evidence base supporting the role of the creative arts in public health, bringing together contributions from practitioners and researchers to provide a comprehensive account of the field and the approaches that had successfully led to improvements. They showed that several countries had moved towards offering a range of arts interventions on prescription. Similarly, Jensen and colleagues (2016) reviewed current practice relating to arts and culture on prescription in Sweden, Norway, Denmark and the UK, considering the evidence supporting social prescription and potential barriers to its implementation. In a later article, Jensen and Bonde (2018) illustrated the variety and multitude of studies, showing that participation in arts activities could be beneficial for those with mental and physical health problems, and demonstrating the possible impact on reducing physical symptoms and improving mental health.

Some research has focused on showing how arts on prescription can be effective. For instance, Batt-Rawden and Tellnes (2011) explored the role and significance of making music in the lives of men and women with long-term illnesses in different life phases, facing different challenges. In a longitudinal study that included eight interviews with each of the 22 participants, aged between 35 and 65, they found that music could promote movement, release anger or aggression, and transcend pain. Personal listening preferences were important. Crone and colleagues (2018) presented findings from a longitudinal follow-up study of an arts-on-referral programme in UK general practice over a seven-year period, including 1,297 patients who were referred to an eight- or ten-week intervention. Of all referrals, just over half completed their course of prescribed art. Of those that attended, 75 percent were observed to be engaged with the intervention. A significant increase in wellbeing was observed from pre- to post-intervention for those that engaged with or completed their programme. Some had multiple health issues. In the main, this group completed the programme, were rated as engaged and showed a significant increase in wellbeing. Poulos and colleagues (2019) targeted community-dwelling older people with a wide range of health and wellness needs who were referred to a programme by their healthcare practitioner. The courses, led by professional artists in

a range of artistic activities, included dance, singing and music. Classes were held weekly for eight to ten weeks with six to eight participants in each group, culminating with a showing of work or a performance. Data from 127 participants aged 65 years old and over showed that *Arts on Prescription* had a positive impact on wellbeing, self-reported creativity and the frequency of undertaking creative activities. The activities on offer were challenging, created a sense of purpose and direction, enabled personal growth and achievement, and empowered participants in an environment which fostered the development of meaningful relationships with others. Similarly, Murabayashi and colleagues (2019) studied 115 frail elderly individuals aged between 65 and 89 years of age, who were divided into two groups. The music therapy group participated in group sessions of 45 to 50 minutes conducted by a music therapist for 12 weeks. A control group waited for 12 weeks before participation. Cognitive, physical and psychophysical functions were assessed. Improvements were observed in physical function, depressive mood and quality of life.

Overall, there is evidence that art interventions can be effective in the promotion of wellbeing, whether individuals choose to participate or are referred through social prescribing (Bungay and Clift, 2010; Jones et al., 2013). Engaging with the arts can reduce loneliness and social isolation (Poscia et al., 2017), particularly for those living in rural or disadvantaged areas (MacLeod et al., 2016; Murrock and Graor, 2016; Pearce and Lillyman, 2015).

The Role of Community Music and Creative Workshops

In developed countries, there are high levels of mental and physical illness associated with long-term health conditions, unhealthy lifestyles and an ageing population. Community music activities can address these issues (Jones et al., 2013). Increasing numbers of mental health organisations are developing music-making interventions for patients. To demonstrate whether such programmes could be effective, Fancourt and colleagues (2016) studied a ten-week group drumming programme and found significant decreases in depression and increases in social resilience, anxiety and wellbeing. These changes were maintained three

months later. Participants also provided saliva samples to test for immune responses. These showed underlying biological effects, supporting the programme's potential for enhancing mental health. Similarly, Ascenso and colleagues (2018) studied 39 participants engaged in a community drumming programme. There were a range of benefits for patients and carers, including enhanced emotions, initiative and sense of control, accomplishment, redefinition of self and social wellbeing. Perkins and colleagues (2016) researched group djembe-drumming and found that the drumming itself was important as a form of non-verbal communication, providing a connection with life through rhythm, and generating and liberating energy. The group setting facilitated feelings of acceptance, safety and care, and enabled new social interactions. Inclusivity, musical freedom and the acceptance of making mistakes supported by the music facilitator were important for learning. Solli and colleagues (2013), in a review, explored service users' experiences of music therapy in the development of recovery-oriented provision. Key factors were having a good time, being together, exploring feelings and self-concept. Music therapy supported the development of strengths and resources that contributed to the growth of positive identity and hope.

Stickley and colleagues (2018) established that a range of arts activities could support recovery through enhancing connectedness and improving hope. Van Lith and colleagues (2013), in a review, concluded that arts could play a substantial role in mental health recovery, while Stevens and colleagues (2018) reported significant increases in self-reported mental wellbeing, social inclusion and the ongoing use of skills learned for some, but not all participants, depending on the in-course experience of artistic growth. Community-based creative workshops have supported those experiencing severe and persistent mental illness. Workshops typically aim to build the skills and capacities of participants, providing alternative ways to communicate identity and recovery stories through visual arts, writing, dance and music, facilitated by practising artists. Participants typically enjoy the workshops and being involved in creative activities with others, which improves their confidence and understanding of their illness (Stewart et al., 2018; Slatterly et al., 2020).

Bolger (2015) investigated the process of collaboration between a music therapist and community participants in three music projects in

Australia. The projects were undertaken with three separate communities which supported groups of marginalised young people. The findings provided an understanding of the conditions required to optimise the potential for positive growth in collaborators in participatory music projects. MacGlone and colleagues (2020) investigated a community music intervention for a population with varied disabilities—physical, learning or both—who took part in weekly music workshops. Although the findings showed improvements in individuals' self-expression, confidence, mood and social skills, there were differences in outcomes in different centres. Participants in one centre improved their musical skills; in another, some participated with enthusiasm but others chose other art activities over music; while in another there was a lasting positive impact. Despite this, all groups showed improvement in communication, interaction with others and joint attention.

Music, Brain Plasticity and Movement

Motor skills tend to deteriorate with age. Activities which support lifelong neuroplasticity, such as making music, can counteract these processes and allow for the reacquisition of motor and cognitive skills in the elderly following brain-tissue damage (for instance, after a stroke). Playing a keyboard can improve fine motor functions through neurophysiological changes in audiomotor networks. Rhythmic cueing has a positive effect on gait disorders, improving stride length, speed and overall mobility. Melodic intonation therapy can improve recovery from non-fluent aphasia through the activation of right-hemisphere networks. Importantly, the rewarding effects of music-making and listening provoke neurochemical effects which, in combination with music-induced brain plasticity, can facilitate neurorehabilitation (Altenmüller and James, 2020). Much of the research on mobility has focused on rhythm. Clinical evidence has shown that the use of external rhythmic auditory cueing can aid in the rehabilitation of motor movements such as gait in patients with Parkinson's disease, traumatic brain injury, spinal cord injury and Huntington's disease (Thaut et al., 2015). Neurological music therapy techniques can promote sensorimotor rehabilitation (Mainka et al., 2016). Music can support improvement in movement in a range of conditions, improving individuals' quality,

range and speed of movement. In acute medical settings or neurological rehabilitation, music can facilitate and target specific therapeutic goals. Making music can be beneficial for those who have partial paralysis following a stroke (LaGasse and Thaut, 2012). While the motivational aspects of music may account for some gains made, there is evidence of increased activation of the motor cortex and improved cortical connectivity (Altenmuller et al., 2009). Särkämö and colleagues (2014) carried out a voxel-based morphometry analysis on acute and six-month post-stroke patients. Structural magnetic resonance imaging data from 49 patients who listened to either their favourite music, verbal material or no listening material during the six-month recovery period showed that listening to music enhanced behavioural recovery and also induced fine-grained neuroanatomical changes in the recovering brain.

Also working with stroke patients, Schneider and colleagues (2007) evaluated a music-supported training programme designed to induce an auditory sensorimotor co-representation of movements. Patients without any previous musical experience participated in intensive step-by-step training, first of the paretic extremity, followed by training of both extremities. Training was given 15 times over three weeks in addition to conventional treatment. Fine as well as gross motor skills were addressed by using either a MIDI piano or electronic drum pads. Pre- and post-treatment motor functions were monitored using a computerised movement analysis system and established motor tests. Patients showed significant improvement after treatment with respect to speed, precision and smoothness of movement and motor control in everyday activities. Similarly, Villeneuve and colleagues (2014) engaged 13 stroke patients in three weeks of piano training comprising nine 60-minute supervised sessions and home practice. Fine and gross manual dexterity, movement coordination and functional use of the upper extremity were assessed pre- and post-intervention at a three-week follow-up. Significant improvements were observed for all outcomes, particularly in those with a higher initial level of motor recovery at the beginning of the intervention. Also working with stroke patients, Särkämö and colleagues (2008) studied 60patients in the acute recovery phase who were either assigned to a music, language or control group. During the following two months, the music and language groups listened daily to self-selected music or audiobooks respectively, while the control group received no listening material. All patients

received standard medical care and rehabilitation. The findings showed that recovery in the domains of verbal memory and focused attention improved significantly more in the music group than the other groups. The music group also experienced a less depressed and confused mood.

Working with patients with Parkinson's disease, Pantelyat and colleagues (2016) assessed the feasibility and effects of twice-weekly group West African drum-circle classes for six weeks. Compared with controls, those in the drumming group showed significantly improved walking performance and quality of life. Studying patients with cerebral palsy, Ghai and colleagues (2017) reviewed 547 records of the effects of rhythmic auditory cueing on spatiotemporal and kinematic parameters of gait in people with cerebral palsy, and concluded that there was converging evidence towards the application of rhythmic auditory cueing to enhance gait performance and stability. Alves-Pinto and colleagues (2016) also reviewed the evidence supporting the use of musical-instrument-playing for rehabilitation in cerebral palsy. They proposed that active musical-instrument-playing could be an efficient way of triggering the neuroplastic processes necessary for the development of sensorimotor skills in patients with early brain damage. In a later study, Alves-Pinto and colleagues (2017) studied adolescents and adult patients with cerebral palsy, as well as a group of typically developing children, who learned to play the piano for four consecutive weeks, completing a total of eight hours of training. For ten of the participants, learning was supported by a special technical system aimed at helping people with sensorimotor deficits to better discriminate fingers and orient themselves along the piano keyboard. The potential effects of piano training were assessed with tests of finger-tapping at the piano and perception of vibratory stimulation of fingers, as well as neuronal correlates of motor learning in the absence of and after piano training. Although the findings were highly variable, there were significant effects of training on the ability to perceive the localisation of vibrations over fingers, but there was no effect of training on the performance of simple finger-tapping sequences at the piano or on motor-associated brain responses.

Some work has focused on children. For instance, Marrades-Caballero and colleagues (2018) studied 18 children between 4 and 16 years of age with severe bilateral cerebral palsy, who received music therapy for 16

weeks. Significant improvements were observed in overall and specific arm and hand position, as well as activities from standard locomotor stages. The improvements persisted at a four-month follow-up. Also working with children, Peng and colleagues (2011) explored the effects of patterned sensory enhancement music on muscle power and movement control in children with spastic diplegia during loaded sit-to-stands. Twenty-three children with spastic diplegia, aged five to twelve years old, participated. Individual patterned sensory-enhanced music was composed by a music therapist based on each participant's sit-to-stand movement, with 50 percent one repetition maximum load. Each participant performed sit-to-stands continuously for eight repetitions under randomly assigned music or no music conditions, while kinematic and kinetic data were measured simultaneously. In the music condition, the music was played only during the first five repetitions. The following three repetitions were referred to as the 'continuation condition'. Compared to the control condition, greater peak knee extensor power, greater total extensor power and better centre of mass smoothness, but less movement time was found in the music condition. Significant effects of the music were also found for the continuation condition.

Auditory stimulation has been shown to improve upper-extremity skills. Ben-Pazi and colleagues (2018) studied nine matched pairs of children aged 7.5 years old. The children listened to auditory stimulation embedded in music or music alone for at least ten minutes, four times a week for four weeks. The children with auditory stimulation achieved more goals than children who listened to music alone. Parents reported improved care and comfort in the children in the intervention group, compared to a slight deterioration in the control group. Bringas and colleagues (2015) tested the effectiveness of a music therapy intervention for children with severe neurological disorders. The control group received only a standard neurorestoration programme, while the experimental group received an additional music therapy auditory attention plus communication protocol immediately before the usual occupational and speech therapy. Overall, the findings showed improved attention and communication, as well as changes in brain plasticity, in children with severe neurological impairments who experienced adjunct music therapy.

Another strand of research has focused on individuals with Huntingdon's disease, a neurodegenerative condition that leads to progressive loss of motor and cognitive functions. Metzler-Baddley and colleagues (2014) devised an intervention involving drumming and rhythm exercises to target early executive problems, such as difficulties in sequence and reversal learning, response speed, timing and dual-tasking. Five people completed the two-month music intervention. The effects of rhythm exercises on executive function, basal ganglia volume and white-matter microstructure in the anterior corpus callosum, the anterior thalamic radiation and the corticospinal tract were assessed. After two months of training, there were improvements in executive function and white-matter microstructure, notably in the genus of the corpus callosum (which connects the prefrontal cortices of both hemispheres). There were no changes in basal ganglia volume.

Some research has focused on whether music therapy can support those suffering from multiple sclerosis. Aldridge and colleagues (2005) aimed to see which components of multiple sclerosis would respond to music therapy. Twenty adult multiple sclerosis patients participated, half receiving music therapy, over the course of one year. Measurements were taken before therapy began and subsequently every three months, then at a six-month follow-up without music therapy. Tests included indicators of clinical depression and anxiety, a self-acceptance scale and a life-quality assessment. Data were also collected on cognitive and functional measures. Significant improvements were found for the therapy group over time in relation to self-esteem, depression and anxiety but these worsened when the therapy stopped.

Breathing

Several studies have investigated whether singing has a beneficial effect on aspects of breathing. Overall, the findings are mixed (Clift, 2012). For instance, Schorr-Lesnick and colleagues (1985) compared singers with instrumentalists and reported no difference between participants aged 25 to 83 in choir, string, percussion or wind ensembles in pulmonary function. Studies of patients with chronic pulmonary disease have also had mixed results, with some research on singing showing improvements compared with controls (Bonilha et al., 2009),

while some has shown limited impact (Lord et al., 2010). Despite this, those participating in singing activities frequently report that singing has exercised body systems through the physical exertion involved, especially the lungs (Clift et al., 2008; Stacey et al., 2002). Skingley and colleagues (2018) established the views of participants with chronic obstructive pulmonary disease who took part in a ten-month 'singing for better breathing' programme. The findings showed that participants learned about breath control, relaxation, exercises for breathing and using singing as a means to deflect attention away from breathing problems. The programme led to increased activity levels, was seen as fun, provided friendship, increased motivation to participate in further activities and offered support. For some, it was the highlight of the week. The majority of participants reported improvements in respiratory symptoms and mental and social wellbeing.

Speech Impairment

Music can play a therapeutic role in supporting improvement in speech impairments. Rhythmic cueing has been used to reduce speech rate and increase speech intelligibility in patients with severe dysarthria and problems with the muscles that support speech due to traumatic brain injury (for instance, as the result of a stroke; Pilon et al., 1998). Similar results have been found for increasing the intelligibility of the speech of patients with Parkinson's disease (Thaut et al., 2001). Hays and Minichiello (2005) found that music provided a means of communication with spouses, friends or others, where language-based communication was restricted due to Parkinson's disease, dementia or other illnesses affecting verbal communication.

Matthews (2018) compared two groups of people with Parkinson's disease who participated in voice and choral singing or a music appreciation activity. Both groups attended once a week for nine weeks. There was significant improvement for those in the choir for voice volume and quality, maximum sustained phonation time and functional symptom severity. At the end of the intervention, significant group differences were observed in average and maximum voice volume, voice quality and glottal function. Attendance for both groups was over 96 percent, suggesting that both groups found the nature and format of the activities enjoyable and worthwhile. Quinn and colleagues (2021)

worked with post-verbal people with strokes, learning difficulties, acquired brain injury, dementia or autism. The findings showed how post-verbal people could use music to communicate and demonstrate their capacities, and how those working with them used music to foster a sense of inclusion and belonging.

The surgical removal of the larynx (i.e. the voice box) has a profound psychosocial impact, often leading to depression and social isolation. After laryngectomy, breathing, voicing, articulation and tongue movement are important in restoring communication, and require exercises which can be challenging motivationally. Moors and colleagues (2020) explored the use of basic beatboxing techniques to create a wide variety of fun and interactive exercises that maximised the use of the structures important in alaryngeal phonation to maintain motivation. An instructional online video was created to support patients working on their own or with support from speech therapists. For patients, the approach was engaging, useful, informative and motivating. O'Donoghue and colleagues (2021) studied whether music therapy—including song-writing, improvisation and singing—could help adolescents who stuttered. The findings revealed participants' experiences of living with stuttering, the importance of music in their everyday lives and how music could help them.

Music in Hospital Settings

Music and Hospitalised Babies, Infants and Children

Babies born premature or underweight can benefit from the stimulation of music in neonatal intensive care units. Music can enhance heart rate, respiration, oxygen saturation, mean arterial pressure, sucking, feeding ability and behavioural state. It has also been linked with overall reductions in the length of stay in intensive care (Caine, 1991; Cassidy and Standley, 1995; Keith et al., 2009; Standley, 2002; 2011; 2012). Music can significantly reduce the frequency and duration of episodes of inconsolable crying (Keith et al., 2009; Loewy, 2014) and have longer-term benefits, reducing reactions to fear and anger at 12 and 24 months (LeJeune et al., 2019). Some research has found reductions in the number of negative critical events (Filippa et al., 2013) and the regulation of

salivary cortisol levels (Shenfield et al., 2003). In a meta-analysis of 14 studies involving 964 infants and 266 parents, Bieleninik and colleagues (2016) found significant large effects, indicating the positive effects of music therapy on infant respiratory rate and maternal anxiety. There was insufficient evidence to confirm or refute other effects. Walworth (2009) examined the effect of music therapy on premature and full-term infants' developmental responses and the responsiveness of parents. Sixty-five parent-infant dyads either attended music groups or a control group. Infants participating in musical activities with their parents demonstrated significantly more social toy-play than the control group.

Music therapy with hospitalised infants has shown positive effects on infants' capacity to self-regulate and engage in social interaction with adults compared to controls (Malloch et al., 2012). Music has been effective in promoting the wellbeing of young patients, enhancing relaxation, providing distraction and helping them to cope with their hospital experiences. In some cases, music-making can reduce or remove the need for sedation. Listening to music can increase oxygenation levels in the blood of long-term paediatric patients and have a positive psychological impact on the chronically ill (Longhi and Pickett, 2008). Patients react better to music therapy than other therapies (Hendon and Bohon, 2008; Longhi and Pickett, 2008; Longhi et al., 2015), perhaps because it is frequently perceived as fun (O'Callaghan et al., 2013).

Music is used in paediatric settings to enhance the wellbeing of young patients (Klassen et al., 2008; Preti, 2013; Preti and McFerran, 2016). It can help children and young people relax (Daveson, 2001; Longhi and Pickett, 2008; Malone, 1996), be used as a distraction (Caprilli et al., 2007; Hendon and Bohon, 2008) and help children and young people to talk about their hospital experiences and develop coping strategies (Brodsky, 1989; Froehlich, 1984; Robb, 2000). Familiar music can reduce anxiety associated with the hospital environment (Preti and Welch, 2011) and can reduce children's stress during painful procedures (Caprilli et al., 2007; Klassen et al., 2008; Nguyen et al., 2010; Vohra and Nilsson, 2011; Whitehead-Pleaux et al., 2006;). In some cases, music-making can reduce or remove the need for sedation (DeLoach Walworth, 2005). In a recent review of research with participants aged 0 to 21 years old, Johnson and colleagues (2021) showed consistent and significant evidence that music could reduce anxiety before and during medical procedures, although the findings relating to pain and

vital signs were mixed. Several studies have highlighted the importance of patient preference in selecting music. This can be achieved easily through the use of headphones. Group music-making can also benefit teenagers in hospital (Bittman et al., 2001; Burns et al., 2005; Nicholson et al., 2008).

Nguyen and colleagues (2010) studied whether music interventions could influence pain and anxiety in children undergoing lumbar punctures. Forty children aged seven to twelve years of age with leukaemia participated, half experiencing a music intervention and half acting as controls. Measures were taken before, during and after the procedure. The findings showed lower anxiety, pain scores and heart and respiratory rate in the music group during and after the procedure. Similarly, Giordano and colleagues (2020) found that music therapy reduced preoperative anxiety in children affected by leukaemia when undergoing invasive diagnostic procedures. Barrera and colleagues (2002) studied the impact of music therapy on paediatric haematology and oncology patients. Data from 65 children and parents showed a significant improvement in children's emotions and wellbeing, while parents perceived improved play performance in preschoolers and adolescents but not school-aged children. In a review of 19 music therapy studies with 596 participants, Facchini and Ruini (2020) noted a significant reduction in psychological distress and an increase in wellbeing. Eight articles evaluated the effects on pain and other biological parameters, but the findings were inconclusive.

Patients undergoing haematopoietic stem cell transplants are at risk of developing post-traumatic stress disorder (PTSD). This may explain the extent of music therapy research in this area. For instance, Uggla and colleagues (2016) examined the effect of expressive and receptive music therapy delivered twice weekly on 24 patients up to the age of 16 undergoing haematopoietic stem cell transplants. The music therapy significantly reduced evening heart rate compared to controls, indicating reduced stress, although there were no significant differences in saturation or blood pressure between the groups. In a later study (Uggla et al., 2018), 29 patients aged 0 to 17 years of age were studied, 14 of whom received music therapy twice a week for four to six weeks during hospitalisation. Those experiencing music therapy had higher estimated physical function at the time of discharge and improved quality of life.

In a further study, Uggla and colleagues (2019) explored six families' experiences of music therapy and found that it became a significant and helpful experience, an important element in coping with and managing treatment. In 2020, Uggla and Bond studied 38 patients, aged from two months to 17 years old, who were receiving haematopoietic stem cell transplantation and who participated in expressive and receptive music therapy. The sessions took place in the child's hospital room, and the child was invited to play different musical instruments, sing and listen to music with the music therapist. Parents and siblings could also participate. The increasing physical functioning reported by the children at discharge and the overall increased quality of life at the six--month follow-up suggested that the music therapy intervention was effective. Similarly, Robb and colleagues (2014) examined the efficacy of a therapeutic music video intervention on adolescents and young adults who were in the acute phase of having a haematopoietic stem cell transplant. Participants were allocated to the video intervention or an audiobook group for six sessions over a three-week period. After the intervention, the music video group reported significantly better social integration and family environment. Haase and colleagues (2020) also reported adolescents' and young adults' experiences of a therapeutic music video intervention during hospitalisation for haematopoietic stem cell transplants. Fourteen participants were interviewed and revealed that the video provided an opportunity for reflection, self-expression and meaning-making: it helped them to tell their story and to overcome the negative aspects of cancer. It supported participants in overcoming distress and challenges by providing opportunities to reflect on what was meaningful, connect with others, and explore and identify personal strengths.

Other research has focused on the effect of listening to music in the recovery period following a range of surgery. Preethy and Gurunathan (2020) studied the effects on the vital signs and behaviour of 62 children, and showed that those listening to music demonstrated more positive behaviour, significantly lower pulse rate and diastolic and systolic blood pressure, and significantly higher oxygen saturation. Focusing on burn injuries, Eid and colleagues (2020) evaluated the effect of a physical therapy rehabilitation programme combined with music therapy on children with lower limb burns, compared with controls. Both groups

improved, but the music therapy group showed greater improvement in terms of pain, range of motion and gait parameters.

There are benefits of music therapy for the families of children in hospital (Preti and McFerran, 2016). Parents value being able to participate in musical activities with their child. Music can open up communication between family members (Lindenfelser et al., 2012). In addition to supporting children during stressful procedures, parents are indirectly supported by music, creating a more relaxed environment (Preti and Welch, 2004; 2011). Music can also contribute to the overall hospital environment, modulating patient and staff mood (Rossetti, 2020).

Music Therapy and Cancer

There are an increasing number of music interventions focused on supporting those with cancer. For instance, Boldt (1996) assessed the effects of music therapy on bone-marrow-transplant patients who needed to exercise to prevent muscle atrophy (although this was difficult due to treatment effects). The long-term findings indicated that music was effective in increasing participants' self-reported relaxation and comfort. Endurance increased, as did cooperative behaviour and participation levels. Robb and colleagues (2003) examined the impact of music therapy on anxiety and depression following bone-marrow transplants. Three patients experienced music therapy for one hour a week over six weeks, while three did not. Analysis of the content of patient-generated songs revealed hope, positive coping, control and appreciation. The findings provided insight into the individualised experience of each patient and their coping strategies. Focusing on Chinese female patients with breast cancer, Zhou and colleagues (2015) examined the effects of music therapy and progressive muscle relaxation on depression, anxiety and length of hospital stay following radical mastectomy. A group of 170 patients either received music therapy and muscle-relaxation training, or acted as controls who only received nursing care. The 30-minute intervention was implemented twice a day within 48 hours of surgery. Those participating showed significant improvement in depression and anxiety, and spent less time in hospital. A single session of patient-preferred live music has been shown to have

a significantly positive impact on pain following surgery in patients in a post-surgical oncology ward (Merry and Silverman, 2021).

Fancourt and colleagues (2016) carried out a multicentre study to assess the impact of singing on mood, stress and immune response in three groups affected by cancer: carers, bereaved carers and patients. Participants sang regularly in five choirs across South Wales. Before and after singing, mood and stress were assessed, and saliva samples were taken to test for cortisol, beta-endorphin, oxytocin and cytokines. All participants associated singing with reductions in negative affect and increases in positive affect, alongside significant increases in cytokines. Singing was associated with reductions in cortisol, beta-endorphin and oxytocin levels. Overall, it improved mood and modulated elements of the immune system. Köhler and colleagues (2020) synthesised the evidence for the effectiveness of music therapy in different oncological treatment phases with adult cancer patients. The narrative synthesis included 30 studies and showed that, overall, music therapy had positive effects on a broad range of outcomes, with techniques and effects varying in different phases. During curative treatment, the results were most promising with regard to anxiety, depression and pain-medication intake, while in palliative settings, improvements with regard to quality of life, spiritual wellbeing, pain and stress were reported. Twenty-one studies were included in a meta-analysis, which showed small but significant effects of music therapy on psychological wellbeing, physical symptom distress and quality of life. In contrast, Daykin and colleagues (2007) drew attention to the challenges and complexity of using music with cancer patients because of the wide variation in responses. They suggested that identity and creativity were key to understanding the impact of music interventions.

Music and Surgery

Music has been used in a range of ways to support people who are having surgery. Exposure to music has been shown to reduce cortisol levels during medical treatment (Le Roux et al., 2007). For instance, in pre-operative settings in hospitals, where patients are often experiencing pain, anxiety, distress and even aggressive non-compliance, meta-analytic analyses have demonstrated that music can

help to reduce anxiety (Spintge, 2012). Conrad and colleagues (2007) played critically ill patients slow movements of Mozart's piano sonatas and found that the use of music significantly reduced the amount of sedative drugs needed to achieve the degree of sedation, comparable to controls who received standard treatment. In the music group, plasma concentrations of growth hormone increased, whereas concentrations of interleukin-6 (a component of the immune system) and adrenaline decreased. Significantly lower levels of blood pressure and heart rate also indicated reductions in stress. Overall, calming music activated neurohumoral pathways associated with psychophysiological sedation. In Sweden, Nilsson (2009) found that patients who had undergone heart surgery and were allocated on the following day to 30 minutes of uninterrupted bed rest with music, followed by 30 minutes of bed rest——or alternatively 60 minutes of uninterrupted bed rest——showed a difference in cortisol levels after the initial 3030 minutes but not after 6060 minutes. The music was presented through a music pillow connected to an MP3 player. There was no difference in heart rate, respiratory rate, mean arterial pressure, arterial oxygen tension or saturation, pain or anxiety levels.

Music and Pain

There has been considerable interest in the use of music to reduce pain. Stress and anxiety exacerbate the experience of pain. Music therapy or musical stimulation can reduce the perception of pain in post-surgical patients, alone or as part of a pain management programme. Music chosen by the patient is usually more effective than music chosen by others. Patients also need to be able to control the volume at which the music is played, when and for how long (Bernatzky et al., 2011; 2012). Hole and colleagues (2015), in a review, reinforced these findings, showing that music was effective in reducing pain and anxiety, even when patients were under general anaesthetic. Pothoulaki and colleagues (2008) investigated the effects of preferred-music-listening on anxiety and pain perception in patients undergoing haemodialysis. Sixty people diagnosed with end-stage renal failure and undergoing haemodialysis treatment participated. Anxiety and pain were measured pre- and post-intervention. The control group scored significantly

higher on state anxiety than the experimental group and experienced significantly higher pain intensity. In a study where pain was induced experimentally, Basiński and colleagues (2018) showed that average pain ratings were significantly lower when any music was played, but increasingly so when the music selected was arousing or complex. Focusing on pain and stress management in everyday life, Linnemann and colleagues (2015) studied 30 women with fibromyalgia syndrome, a condition characterised by chronic pain. Participants rated their pain intensity, perceived control over pain, perceived stress level and music-listening behaviour five times a day for 14 consecutive days. At each assessment, participants provided a saliva sample for the analysis of cortisol and alpha amylase, as biomarkers of stress response systems. The findings showed that music-listening increased perceived control over pain. Listening to music in combination with guided imagery has also been found to lead to significant reductions of the β-endorphin, which the body uses to numb or dull pain (McKinney et al., 1997), although music-listening or guided imagery alone did not have this effect. Vollert and colleagues (2003) used relaxing music with coronary patients during rehabilitation and found significant decreases of β-endorphin during physical exercise, suggesting that the music compensated for the need for natural pain relief. In addition, systolic blood pressure, anxiety and worry were reduced. These decreases were not found in patients who performed the exercises without music. Gerra and colleagues (1998) extended these observations, showing that listening to upbeat techno music led to increases in β-endorphins, demonstrating that upbeat music led to different outcomes.

Some research has focused on pain reduction in terms of active engagement with music. For instance, Irons and colleagues (2020) carried out a systematic review of 13 studies on the impact of group singing on pain. There were psychological, physical and social benefits. Most interventions reduced pain intensity. Overall, music does seem to be able to contribute to the management of pain. This is gradually being recognised and the processes involved more fully understood so that treatment techniques can be refined to meet patients' needs more effectively (Mainka et al., 2016).

Music and Palliative Care

Coelho and colleagues (2017) carried out a scoping review to examine and map non-pharmacological interventions implemented to provide comfort in palliative care in home care, hospices and palliative care units. Eighteen studies were included, covering ten non-pharmacological interventions implemented in one to fourteen sessions which lasted for five to sixty minutes. The most common were music and massage therapy. The characteristics of these differed significantly across and within interventions. They were mostly implemented in palliative care units and hospices, and for patients with a cancer diagnosis. The use of music as therapy in multidisciplinary end-of-life care dates back to the 1970s. Music therapy is now one of the most frequently used complementary therapies in palliative care in the USA. Schmid and colleagues (2018) provided an overview of users' and providers' perspectives, and showed that music therapy was viewed positively. Similarly, Nyashanu and colleagues (2020) undertook a scoping review to explore the efficacy of music interventions in palliative care. Music therapy supported the management of pain, anxiety and depression, and promoted relaxation, happiness and hope, enhanced spirituality and quality of life. Leow and colleagues (2010) also reviewed terminally ill patients' experiences of using music therapy in a hospital, an inpatient hospice, a nursing home or their own homes. They concluded that music therapy could promote social interaction and communication with family, friends, other patients and healthcare workers, and provide support for patients' holistic needs. McConnell and Porter (2017), in a review of 51 articles of music therapy in palliative care, found that music had a therapeutic effect on the physical, psychological, emotional and spiritual suffering of palliative-care patients and that group music therapy might be an effective way to support staff caring for palliative-care patients.

Music and Mental Health: Stress, Anxiety and Depression

Current levels of psychosocial distress in society are significant, as evidenced by the number of prescribed antidepressants and working days lost as a result of stress and anxiety. There is a growing body

of evidence that active involvement in creative activities promotes wellbeing, quality of life and health. In adults with a mental illness, activities such as singing in a choir, creating art, expressive writing and group drumming can reduce mental distress, depression and anxiety, while simultaneously enhancing individual and social wellbeing. In the UK, there are currently a number of projects that offer creative-arts activities on prescription for those experiencing mental health issues or social isolation. The projects adopt different approaches but all take place in the community, are facilitated by professional artists and have a referral process (Bungay and Clift, 2010). Engaging with music can promote relaxation and reduce stress. Using a representative sample of the Swedish population, Juslin and colleagues (2011) found that 78 percent reported that they listened to music at least once every day and that one of the reasons for doing so was that it helped them to relax (Juslin et al., 2011). Using music was reported as beneficial because it was easily available at any time or place, and could be tailored to personal taste. Linnemann and colleagues (2016) assessed whether the presence of others while listening enhanced music's stress-reducing effect. Participants responded to questions on stress, the presence of others and music-listening five times each day, 30 minutes after waking and at 1100, 1400, 1800 and 2100 hours for seven consecutive days. They also collected a saliva sample after each data collection to enable a biological assessment of stress. Music had the greatest impact on stress reduction when listening took place with others or when it was deliberately listened to for relaxation. In a later study, Linnemann and colleagues (2018) studied 60 participants aged eight to 34 years old, who answered questions on music-listening and stress six times each day for a week using an electronic diary device, which reported the time and duration of listening. Self-reports of music-listening were associated with lower reported stress levels but this was not corroborated by the objective data. Participants had to listen for 20 minutes before stress was reduced.

In an experimental study, Jiang and colleagues (2013) examined the effects of sedative and stimulative music and music preference on stress reduction, following induced stress. One hundred and forty-four female music-education students performed a stressful mental arithmetic test, and were then assigned to listen to preferred or non-preferred sedative

or stimulative music. Sedative music lowered tension and anxiety, but there was no difference between preferred and non-preferred music. Gold and colleagues (2013) researched the effectiveness of three months of biweekly individual resource-oriented music therapy with 144 adults with non-organic mental disorders in Norway, Austria and Australia. The findings showed that music therapy was an effective addition to usual care for those who were not motivated to engage with other therapies.

Reviews relating to music and stress have had broadly positive outcomes. For instance, Panteleeva and colleagues (2017) conducted a meta-analysis of 19 trials on the effects of music on anxiety and showed an overall decrease in self-reported anxiety, while music also had an impact on blood pressure, cortisol level and heart rate. De Witte and colleagues (2019), in a review of 104 trials with 9,617 participants, showed that music interventions had a positive effect on stress reduction, with larger effects for heart rate compared to blood pressure and hormone levels. Also in a meta-analysis, Pelletier (2004) reviewed 22 articles which used music to decrease arousal due to stress. Music alone and music-assisted relaxation techniques significantly decreased arousal, but the extent of reduction was mediated by age, type of stress, the relaxation technique adopted, musical preference, previous musical experience and the type of intervention. Leckey (2011), reviewing 11 studies, suggested that creative activities could have a healing and protective effect on mental wellbeing through promoting relaxation, providing a means of self-expression and reducing blood pressure, while boosting the immune system and reducing stress. Overall, however, the evidence was weak. Williams and colleagues (2018) systematically reviewed 13 articles with 667 participants. The findings of seven longitudinal studies showed that,, when people with mental health conditions participated in choral singing, their mental health and wellbeing significantly improved,, with moderate to large effect sizes. Qualitative studies showed that group singing provided enjoyment, enhanced emotional states, a a developed sense of belonging and enhanced self-confidence.

In the modern world, depression is common, leading to a loss of social function, reduced quality of life and increased mortality. Music interventions have been used as an alternative to therapy or antidepressant drugs. Leubner and Hinterberger (2017) reviewed 28

studies with 1,810 participants distinguishing between passive listening to music and active singing, playing, or improvising with instruments. In almost all studies, there was a significant reduction in depression levels over time in response to musical activities, particularly in the elderly. Group settings had slightly better outcomes than individual sessions. There were improvements in participants' confidence, self-esteem and motivation. In a meta-analysis, Aalbers and colleagues (2017) found that music therapy, in addition to usual treatment, reduced depressive symptoms and anxiety, and helped to improve functioning, including maintaining employment, activities and relationships. They concluded that music therapy was likely to be effective for people by decreasing symptoms of depression and anxiety and helping them to function in everyday life, although they were reluctant to draw firm conclusions because of the small number of studies and the lack of detailed descriptions of the nature of the interventions. Fancourt and colleagues (2016) studied the reaction of pro-inflammatory cytokines to music interventions, as these decrease in individuals with depression as they recover. The impact of group drumming on a broad array of inflammatory measures was assessed over a six-week intervention. Thirty-one participants with mild or moderate depression completed psychological scales related to depression, anxiety, wellbeing, social resilience and social inclusion before and after participation. The drumming sessions lasted for 90 minutes over a period of six weeks, with groups of 15 to 20 playing together. The sessions consisted of call-and-response exercises and the learning of drumming patterns that were built up into larger pieces. Significant improvements were found for depression, wellbeing and social resilience. Stress and tiredness levels decreased from the beginning to the end of each session, while happiness, relaxation and energy levels increased. There was no impact on blood pressure, but a decrease in heart rate. Overall, the drumming had a positive impact on mental and physical health.

Postnatal depression can be reduced when mothers sing to their babies on a daily basis or listen to music (Fancourt and Perkins, 2017). In comparison with other mother-infant interactions, singing is associated with greater increases in emotional closeness, positive emotions and decreases in psychological and biological markers of anxiety (Fancourt and Perkins, 2018). Music therapy can also be used to support those who are grieving. Smeijsters and van den Hurk (1999) described a single case

study of the treatment of a woman experiencing grief after the death of her husband. They described how she was able to express a part of her personality which she had been suppressing since childhood through playing the piano and vocalising during improvisational music therapy.

People with depression are more likely to engage in group rumination related to music, which can amplify negative emotions (Garrido et al., 2017), although Sakka and Juslin (2018)—in a comparison of the everyday use of music for mood regulation in depressed and non-depressed individuals aged 19 to 65 years of age—found few differences between depressed and non-depressed participants.

Mental Health Care in Children, Adolescents and Young People

Children and young people can experience mental illness, and music can sometimes act to support them. McFerran and colleagues (2018) studied whether involvement in a brief music-based intervention engaged young people, was appropriate, decreased distress and increased their understanding of ways to use music positively. The findings showed that at least some of the measurable decreases in distress were related to participation in the music sessions. Similarly, arts engagement, including music therapy and dance, can reduce internalising symptoms such as anxiety and depression in children and adolescents (Geipel et al., 2018). Henderson (1983) studied 13 hospitalised young people, diagnosed with adjustment reactions to adolescence, who either received 18 one-hour sessions of music therapy or acted as controls. The music sessions involved discussion about emotions in music, expression, the identification of body language, story composition to recorded music and drawing to music. Participants showed greater emotional awareness and felt a greater sense of inclusion. In Hong Kong, Kwok (2019) examined the effectiveness of an intervention integrating positive psychology and elements of music therapy in increasing sense of hope, emotional competence and happiness, and decreasing anxiety in 106 students in Grades Eight to Nine who were suffering from anxiety. There was an improvement, with changes in hope acting as a significant mediator in the relationship between the intervention, a decrease in anxiety and an increase in subjective happiness.

In Northern Ireland, Porter and colleagues (2017) examined the efficacy of active music therapy with 251 children aged eight to sixteen years old—who had social, emotional, behavioural and developmental difficulties—and their parents. They either participated in usual care or had an additional 12 sessions of music therapy delivered weekly. Those in the music group showed improvements in communication, social skills, social functioning, self-esteem, depression and family-functioning. In Austria, Grebosz-Haring and Thun-Hohenstein (2018) assessed the potential neuroendocrine, immune and psychological efficacy of group singing and group music-listening in children and adolescents with mental disorders. Seventeen patients aged 11 to 18 in a department for child and adolescent psychiatry participated in a singing or music-listening programme in five daily, 45-minute sessions in one week. Saliva samples were taken to assess cortisol. Mood was also measured before and after the music activities. Singing led to a significantly higher reduction in cortisol than music-listening, while listening led to significantly higher positive change in feelings of calmness and wellbeing. Group music therapy also positively affected the mood states of 352 adolescents aged 12 to 21 who were inpatients in a psychiatric hospital (Shuman et al., 2016). Individual music therapy has also been found to slightly improve the quality of life for some children with psychopathology in an outpatient department, although the impact on symptoms depended on the severity of comorbid medical conditions (Gold et al., 2007b). Promoting positive identities and social participation has been shown to help recovery from mental illness in a range of studies (Hense and McFerran, 2017).

Some interventions have used music through the medium of dance. For instance, Jeong and colleagues (2005) assessed psychological health and changes in the neurohormones of adolescents with mild depression after 12 weeks of dance movement therapy. Forty middle-school seniors participated and were randomly assigned to a dance movement group or acted as controls. Following treatment there was a reduction in psychological distress. Plasma serotonin concentration increased and dopamine concentration decreased. It seems that dance movement therapy can stabilise the sympathetic nervous system. Similarly, Gandhi and colleagues (2021) are studying 36 institutionalised adolescents with depression who will either engage in a therapeutic listening programme

or traditional music therapy for 30 minutes a day, two days each week for eight weeks, while participants in a dance group will perform for 30 minutes a day, three days each week for six weeks.

Music has been found to help alleviate depression in university students. For instance, Wu (2002) studied the effect of 20 hours of music therapy on the anxiety, depression and self-esteem of 24 Taiwanese undergraduates. There were positive outcomes in relation to anxiety immediately following music therapy and after a two-month follow-up. The effects on depression were less positive, although the music therapy did lead to enhanced confidence, ability to relax and decreased negative emotions. Also studying university students, Thomson and colleagues (2014) explored how the use of music to regulate moods was associated with depression, anxiety and stress. One hundred and forty-six university students aged between 17 and 24 years of age completed an online questionnaire addressing levels of psychopathology, music-related mood regulation behaviours, and personal music-related information. Overall, music-related mood regulation predicted levels of psychopathology. High use of music for the venting of negative emotions predicted high levels of depression, anxiety and stress. Diversion (distraction from worries and stress) predicted high levels of anxiety and stress, while music for entertainment or maintaining or enhancing a happy mood predicted low levels of depression. For some individuals, using music to regulate mood may be maladaptive, although it may be that young people experiencing psychopathology are more likely to use music to help to reduce their symptoms. Indeed, Miranda and colleagues (2012) suggested that music-listening might influence internalising psychopathology because of its role in emotion regulation and coping.

Insomnia

Losing sleep is a widespread problem which can have serious physical and economic consequences. Music's impact on physical, psychological and emotional states may explain why it has helped people with sleeping disorders. Music can improve sleep quality, sleep efficiency and time-to-sleep onset, with greater effectiveness than a range of other interventions, including acupuncture and medication. Trahan and

colleagues (2018) investigated music as a sleep aid amongst the general public using an online survey that assessed musicality, sleep habits and which music helped sleep (and why). Of the 651 responses, 62 percent of respondents stated that they used music to help them sleep. Fourteen musical genres and 545 different artists were reported to be used as sleep aids. Stress, age and music use were significant predictors of sleep quality. Younger people with higher musical engagement were significantly more likely to use music to aid sleep. Respondents reported that music helped them sleep because of its unique sleep-inducing properties, its role as part of their normal sleep routine, and the way it blocked internal or external stimuli that would otherwise disrupt sleep. Jespersen and Vuust (2012) studied the use of relaxing music at bedtime with 15 traumatised refugees experiencing difficulties in sleeping. The intervention group heard relaxing music played at night through a music player nested in a pillow. There was a significant improvement in sleep quality and wellbeing but no changes in trauma symptoms. In a later study, Jespersen and colleagues (2019) studied 57 people with insomnia who either listened to music or were given audiobooks to listen to. The severity of insomnia decreased and participants perceived an improvement in sleep and quality of life, but there were no changes in objective measures of sleep.

Reviews of the role of music in supporting sleep have had broadly positive results. Feng and colleagues (2018) reviewed 20 studies involving 1339 patients and 12 interventions. All interventions were statistically more effective than usual care, but patients ranked listening to music as the best method for overall sleep quality. In terms of sleep onset latency, music-associated relaxation and listening to music had significant advantages. Listening to music and music with exercise also tended to improve sleep efficiency. Wang and colleagues (2014) reviewed ten studies involving 557 participants, and showed that sleep quality was improved significantly by music and that there was a cumulative effect for chronic sleep disorders. Jespersen and colleagues (2015) reviewed six publications involving 314 participants across a variety of settings including the participant's own home, a sleep laboratory and an inpatient rehabilitation facility. Sample sizes varied between 15 to 65 participants aged from 19 to 83 years of age. Some trials used music only, others music with relaxation. The music included

Eastern and Chinese classical music, new age, electric, popular oldies, and jazz. The music was played for 25 to 60 minutes once a day over three to 35 days. Sleep quality improved with music-listening in almost all studies. Similarly, De Niet and colleagues (2009) conducted a meta-analysis with data from 170 adults, including older people, to evaluate the efficacy of music-assisted relaxation to improve sleep quality. Music had a moderate effect. In ongoing research, Lund and colleagues (2020) are trialling how music might help people with depression who suffer from insomnia by asking them to listen to music for a minimum of 30 minutes at bedtime for four weeks.

Music, Trauma and Abuse

Music therapists around the world work in a wide range of settings with those who are traumatised or abused (Pavlicevic and Ansdell, 2004). Music has been shown to be cost-effective and powerful in supporting sustainable community development, mental and physical health, and peace initiatives (Hesser and Heinemann, 2010). It can help to reduce symptoms and improve general functioning among those exposed to trauma (McFerran et al., 2020), acting as an adjunct to conventional therapy and promoting emotional regulation, increased pleasure and anxiety reduction. It can be particularly helpful when individuals struggle with the stigma associated with asking for professional help (Landis-Shack et al., 2017), or when cognitive behavioural therapy has had limited success. Rhythm may be particularly important in supporting recovery. Research in neurobiology has shown that rhythmic music has a specific impact on the brain. Therapy models using rhythm have been used since 2003 in centres for young people at risk, in refugee trauma centres, forensic psychiatric wards in prisons, and child and adult mental health services. Its benefits include increased levels of social integration, improvements in affect and mood stabilisation, reductions in anxiety and depression, and increases in self-esteem (Faulkner, 2017).

Post-Traumatic Stress Disorder

Post-traumatic stress disorder can be caused by a wide range of incidents, the most common following engagement in severe combat-related

emotional trauma. Symptoms include distressing memory intrusions, avoidance, emotional disturbance and hyperarousal, and lead to a significantly reduced quality of life. In recent years, there has been increasing demand for music therapy services within military treatment facilities, partly due to the increased research output, but also the increased prevalence of injuries—including traumatic brain injury and post-traumatic stress disorder—for which interdisciplinary patient-centred care is required. The complexity of traumatic brain injury and post-traumatic stress in the context of military service presents particular challenges for music therapists as they try to develop effective interventions (Bronson et al., 2018). Pezzin and colleagues (2018) examined the feasibility and potential effectiveness of an active music-instruction intervention in improving psychological health and social functioning among veterans suffering from moderate to severe post-traumatic stress disorder. Sixty-eight veterans were self- or provider-referred to the programme. Participants were aged 22 to 76 years old, mainly male, African-American or black. Almost a third were in employment, while almost half were retired due to disability. The research assessed symptomatology, depression, perceptions of cognitive failure, social functioning, isolation and health-related quality of life. Participation led to a significant reduction in post-traumatic stress symptoms and depression, with a trend towards improvement in the other assessed areas. Carr and colleagues (2012) assessed whether group music therapy had an effect on post-traumatic stress disorder symptoms and depression in 17 patients who had already participated in cognitive behavioural therapy. Participants received ten weeks of group music therapy, following which there was a significant reduction in the severity of symptoms and a reduction in depression. Participants reported the group music therapy as helpful. Vaudreuil and colleagues (2020) used public performance to support the social transformation and reintegration of US military service members. Two case studies of service members who received music therapy as part of their treatment for post-traumatic stress disorder, brain injury and other psychological health concerns were presented. The participants wrote, learned and refined songs over a number of sessions, and created songs to perform to audiences. Interviews showed evidence of beneficial psychological effects of this procedure. Similarly, Bensimon and colleagues (2012)

studied six soldiers who had been diagnosed as suffering from combat- or terror-related post-traumatic stress disorder, who participated in a series of 90-minute weekly sessions of music therapy. The sessions were filmed and in-depth interviews were undertaken with participants. Analysis of musical and verbal content revealed the importance of group engagement with issues related to trauma and non-trauma matters, decreasing reflection on traumatic emotions and increasing expressions of non-traumatic feelings. In a single case study of a 36-year-old army veteran, Wellman and Pinkerton (2015) described how a ten-week music therapy intervention enhanced motivation, decreased stress, anxiety and depression, and led to reported feelings of wholeness. Medication was reduced, which led to increased reengagement with previously enjoyed activities and enhanced quality of life following four years of medical disability and significant social phobias. The use of music for therapeutic purposes can also occur in more informal ways. For instance, one US soldier rapped about his experiences in Iraq to cope with the aftermath of his deployment there, while in Uganda, one young man constantly played a stringed instrument but was too traumatised to talk about his role as a resistance army commander (Bergh and Sloboda, 2010). Military sexual trauma is an issue for some returning veterans. Story and Beck (2017) studied five veteran women who participated in up to ten music and imagery sessions and a post-session focus group over the course of three months. Participants reported using music and imagery to manage and reduce their symptoms.

Civilians can also experience post-traumatic stress after being subject to combat events. Following the 2014 Israel Gaza conflict, Bensimon and colleagues (2017) examined the emotional effects of listening to happy and sad national songs on young and older adults and the relationship to exposure to missile attacks, post-traumatic stress symptoms and negative emotions. In young adults with low post-traumatic stress symptoms, sad national songs were related to higher negative emotions, whereas in older adults it was those with higher post-traumatic stress disorder symptoms that exhibited higher negative emotions in response to sad national songs.

Music, Asylum Seekers, Refugees and Survivors

Music therapists have become increasingly interested in the role of music in relation to war, peace, refugees and trauma (Akombo,, 2000; Edwards,, 2005; Hunt,, 2005; Kennedy,, 2001; Lopez,, 2008; Ng,, 2005). Following the attack on the USA in September 2001, many have been—and continue to be—traumatised by war, acts of terrorism and violence worldwide. Some music therapists have sought to respond actively to these events and the resulting trauma, by reaching out to trauma survivors.

Refugees have to move involuntarily from their country of residence, often having witnessed disasters, wars and the deaths of immediate family members prior to leaving. These traumatic situations provoke strong reactions and emotions. often exacerbated by challenging refugee-processing system,—for instance, detention and waiting in refugee camps—which make migration and resettlement processes for refugees and asylum-seekers much more challenging than for other migrants. The psychological effects of trauma experienced by refugees tend to be long-lasting. Multicultural arts programmes can allow for sensitivity to different identities, heritage and experience, and can be important in healing and promoting wellbeing (Gopalkrishnan, 2016). In refugee camps, the arts can support the preservation of religious identity through the celebration of festivals and events, help to alleviate psychosocial distress and trauma, and reduce stigmatisation.

Among children who have experienced trauma, including sexual abuse, terrorism, war and domestic violence, there have been promising findings for the value of the arts in supporting grief, depression and post-traumatic stress disorder, as well as supporting the communication of experiences (Andemicael, 2011). Clini and colleagues (2019) assessed the impact of arts interventions on forcibly displaced people, and identified several key issues concerning the perceived benefits of such programmes. The findings showed that participants reported the impact of creative activities in relation to skills, social engagement and personal emotions. Artistic and cultural activities impacted positively by helping participants to find a voice, creating support networks and providing opportunities to learn practical skills which were useful in gaining employment. In a review, Lenette and Sunderland (2016)

mapped the potential for participatory music practices to support the health and wellbeing of asylum-seekers and refugees in three contexts: conflict settings, refugee camps and resettlement settings. The review highlighted the different roles that music could have in people's lives as they moved away from their home countries towards resettlement. Overall, they found that the growing body of research on music and wellbeing for asylum-seekers provided a strong foundation for investment in music as a key positive social and cultural determinant of health for this group of people. Music can reduce the symptoms of post-traumatic stress disorder through reducing anxiety and depressive symptoms, increasing pleasure, helping with emotional regulation, and supporting the building of communities and support networks, thus enhancing resilience, reducing stigma and improving general functioning (Sutton, 2002). This has been demonstrated in community arts projects in Sri Lanka following the civil war and the tsunami. The arts can help people to regain control of their lives (Huss et al., 2016).

Beck and colleagues (2018) researched the impact of guided imagery with music alongside standard medication with 16 adult refugees who completed 16 one-hour individual sessions. Pre- and post-measures of post-traumatic stress symptoms, sleep quality, wellbeing and social function demonstrated significant positive changes with large effect sizes. Evaluation of single sessions showed that participants found the therapy acceptable and helpful. All of the participants used music-listening for self-care in their homes between sessions and responded positively to the intervention overall. In Australia, Lenette and colleagues (2016) studied music facilitators who regularly attended an immigration transit accommodation facility to share music and singing activities with detained asylum-seekers, to ameliorate significant mental and emotional distress resulting from indefinite detention. Drawing on the facilitators' monthly written observations, a number of key themes emerged which linked music and singing to the health and wellbeing of detained asylum-seekers. Overall, it was clear that there was the potential for participatory music-making to counter the impact of traumatic experiences and detention on asylum-seekers' health and wellbeing. Similarly, Hesser and Heinemann (2010) provided examples of music projects which supported the social inclusion of refugees and others who had experienced severe trauma. The Rwandan Genocide of

1994 killed over a million people and led to enormous distress for those who survived. D'Ardenne and Kiyendeye (2015) used focus-group interviews with 13 survivors who participated in a music programme and found that the music had changed their past, given them a safe place in the present, fellowship and prayer, and provided them with the personal resources to face the future. Research looking at the lasting impact of trauma (for example, in Holocaust survivors after 70 years) has found higher levels of resilience among those who have engaged in the arts over the course of their lives relative to those who have not, suggesting the value of the arts both in the immediate aftermath of trauma and in the decades that follow (Diamond and Shrira, 2018).

There is also evidence that music can support victims of torture. Alanne (2010) studied three traumatised men from Central Africa, South Asia and the Middle East who lived as asylum-seekers or refugees in Finland. They received weekly or bimonthly music therapy sessions over one to two years as part of their rehabilitation, using projective listening, guided imagery and free association within a psychoanalytic frame of reference. Analysis of data from the sessions revealed that music therapy approaches were effective in promoting verbalisation as well as the regulation and expression of emotions. Participants responded positively and demonstrated some improvement, although with varying degrees of satisfaction. The therapy increased the consciousness of patients regarding their traumatic experiences, and was perceived as supporting calm and relaxation. The findings suggested that music psychotherapy methods may be effective in treating patients who are survivors of torture and related traumatic experiences. Music can support the healing of children who have been traumatised through war, those forced to fight, serve as spies, soldier wives or camp followers, and who are now refugees. Using their own cultural music and creative compositions can help young people to overcome their fears and challenges, promote healing and the development of self-esteem, trust and identity. Osborne (2012) provided examples of the way that music neuroscience can provide a means of evaluating the success of music therapy with traumatised children in post-conflict societies including North Uganda, Palestine and South Thailand. Felsenstein (2013) studied the impact of a short-term music therapy intervention on three groups of preschool children in the aftermath of a forced evacuation

from their homes during the unilateral Israeli disengagement from the Gaza Strip in 2005, and the post-trauma treatment of the evacuees. The findings suggested that music could build post-trauma resilience and reduce the vulnerability of preschoolers to traumatic events, although community and family could also strengthen the way that individual children coped.

Several authors have documented the benefits of creative musical activity for children who have experienced war (Bergmann, 2002; Heidenrich, 2005; Osborne, 2009; Sutton, 2002) as a means of developing self-esteem, trust, identity and social cohesion in a range of countries including Bosnia-Herzegovina, Georgia, Sierra Leone, Rwanda and Palestine. These projects have enabled reflection and the expression of feelings. Some programmes supporting refugees or displaced young people in Sierra Leone, Ghana and Slovenia have included dance. These programmes supported the development of communication, empowered young people, gave them a sense of belonging and relief, and supported identity development (Harris, 2007; Jones et al., 2004; Lederach and Lederach, 2010; Pesek, 2009).

Zharinova-Sanderson (2004) reported work with traumatised refugees in Berlin at the Centre for the Treatment of Torture Victims. Music therapy in this context helped young people to use their own cultural music to adjust to their new culture, while performance opportunities allowed audience members to see beyond traumatised refugees to real people. In Sierra Leone, Gonsalves (2010) worked with traumatised young girls who had been forced to fight and serve as spies, soldier wives and camp followers. Through song, the girls communicated their emotional and material needs, histories, fears and current difficulties. Creative musical interaction supported increased understanding, reengagement and connections with others, and promoted healing, thus empowering the participants. In post-conflict Kosovo, Gerber and colleagues (2014) evaluated the work of a charity which aimed to promote a culture of peace and unity, as well as the development and recovery of children. Groups of non-participating students were compared with new programme participants, those participating for twelve months and those who had graduated from the programme. Overall, children who participated in the programme for at least one year had fewer emotional and cognitive problems than recently

enrolled children. In Ireland, Kenny (2018) examined the musical lives of the children of asylum-seekers living in a state system of communal housing while they waited for their refugee applications to be processed. Data were collected through six participatory music workshops, video observations, a reflective log and focus-group interviews. Eleven children aged seven to twelve years old, of six different nationalities, participated. The findings revealed the importance and relevance of the contexts of music-making in temporary accommodation settings, as well as the broader national and international contexts for children living in asylum-seeking systems.

A review of 21 school- and community-based interventions for approximately 1800 refugee and asylum-seeking children, carried out in high-income countries or refugee camps, with a focus on verbal processing of past experiences or a range of creative arts activities, suggested that interventions delivered within the school setting could be successful in helping children overcome difficulties associated with forced migration. Feelings of powerlessness, humiliation and anger were reduced and social inclusion, mental health, social acceptance and belonging were enhanced (Tyrer and Fazel, 2014).

Music and Victims of Abuse

Child sexual exploitation is a major international problem and victims need to be rehabilitated and reintegrated into society. They can be supported through the creative arts. Schrader and Wendland (2012) described how music therapists working in Phnom Penh, Cambodia—in a centre that provided care for young girls rescued from sexual violence or commercial sexual exploitation—trained staff in the centre, teaching them to play instruments, participate in ensembles and lead large group music activities so that they could support the girls. Rogers (1992) highlighted a number of factors that appear to be common to sexually abused individuals, including the participants' manipulation of music therapy, the symbolic use of instruments, the preoccupation with mess and containers, the use of boundaries, and the power of secrets. Material from case studies illuminated these points.

In the USA, there are over five million crimes involving violence to partners annually. Victims experience a lifetime of increased risk for

depression, anxiety, addiction, suicide attempts and post-traumatic stress disorder. Additionally, women's experience of abuse is a risk factor for incarceration. Palidofsky and Stolbach (2012) describe the therapeutic benefits to incarcerated adolescent girls of working collaboratively with theatre professionals to create, develop and perform musicals based on their own traumatic experiences. Similarly, Neupane and Taylor (2011) described how a gender-sensitive music intervention was able to facilitate healing and recovery in incarcerated abused women. Also working with victims of abuse, Slotoroff (1994) developed a technique in an inpatient short-term psychiatric setting using improvisational drumming and cognitive behavioural methods to address issues of power. A middle-aged woman and an eleven-year-old boy participated, and increased their sense of power and self-control, leading to long-term positive behavioural, cognitive and emotional changes. Flores and colleagues (2016) used African drumming to enhance the emotional and social wellbeing of 16 children in residential care, most of whom had been exposed to some form of neglect or abuse and displayed high levels of anger, anxiety, depression or disruptive behaviour. Participants attended weekly sessions of African djembe-drumming over a period of four months. The intervention did not appear to significantly impact the participants' long-term self-concept or levels of depression, anger or disruptive behaviour, while anxiety increased. Despite this, findings from interviews and observations suggested that the workshops did enhance the children's emotional and social functioning in terms of their self-esteem and self-confidence, prosocial behaviour, enjoyment, concentration and manifestation of musical capacity, even though these did not transfer to the children's everyday functioning. This may have been because of the severity of their socioemotional difficulties, as well as the limitations of the intervention itself. Hannigan and McBride (2011) investigated therapists' perspectives on the value of using drumming, along with other percussion instruments, as therapeutic tools in family violence treatment groups. Overall, drumming was perceived as useful in fostering group cohesion and cooperation, helping clients with a passive communication style become more involved in groupwork, facilitating emotional expression and offering participants a way to experience active relaxation and engagement in the group process.

Another approach to supporting trauma victims has been through song-writing. For instance, Fairchild and McFerran (2019) studied 15 children aged eight to fourteen years old who had experienced homelessness and family violence. Participants collaborated in writing a song about what music meant to them. Throughout the process of song-writing, the children described how music provided an escape from what was happening in their lives and offered hope for a better future. Similarly, Clendenon-Wallen (1991) studied 11 adolescents who had been sexually abused who participated in a music group where activities included song- or rap-writing, rhythm-playing, improvisation, lyric analysis and creative movement. The adolescents also designed record-album covers. The music-based activities increased participants' sense of self-worth and self-confidence. Not only did the music ease their anxiety, but it was also useful in the process of socialisation and verbalisation, and served as a starting point for discussing personal matters. Group improvisation also enhanced group cohesion and cooperation. Christenbury (2017) combined song-writing and art to promote healing in a child who had been traumatised. The child controlled the process, as the therapist composed songs in response to the child's drawings. Both related to the emotions that the child chose as being important for her healing. This increased self-esteem and provided a healthy emotional outlet. Also using song-writing, along with improvisational instrument-playing, lyric analysis and musical games where participants were asked to encode and decode various emotions, Graham (2011) determined the effects of music on the emotional expressivity of children and adolescents who had experienced abuse or neglect. All 22 participants had been removed from their homes and placed in group foster homes. The findings showed an increase in emotional expressivity and in the degree and appropriateness of the emotions expressed by participants.

Rudstam and colleagues (2017) employed group music and imagery with ten women who had been exposed to physical, psychological or sexual abuse—often with a history of childhood abuse and neglect—who were suffering from post-traumatic stress disorder. All participants completed the treatment, indicated that it was helpful and showed a decrease in post-traumatic stress and dissociative symptoms, alongside an increase in quality of life. These changes were maintained when the programme ended. Adopting a different approach, Strehlow (2009)

focused on the use of analytical music therapy to treat sexually abused children, showing how an eight-year-old rebellious girl who had suppressed her feelings after being sexually abused by her mother's partner responded positively. Similarly, Sutton and De Backer (2009) drew on case material from work with a young boy and an adult attending a psychiatric outpatient department, to show how a form of musical listening and thinking could help to understand the issues faced by those who are traumatised.

Fairchild (2018) highlighted the creative resources that children experiencing homelessness and family violence can bring to research, as well as the range of resources that they can draw upon in the face of adversity. The research challenged the view of such children as being at risk, and explored their resources and what helped them to do well. Fairchild and colleagues (2017) used song-writing and interviews to collaborate with children, focusing on what music meant to them. Music offered an escape from the outside world and provided hope that the future would be better. The children described a range of support from friends, family, sport, pets, writing a journal and creativity. They wanted to feel safe and cared for, and protect themselves and others, and exhibited considerable self-determination. A collaborative article written with one 11-year-old revealed that he believed that learning to play the drums through music therapy had changed his life.

Music therapy has been used to support parenting. For instance, Day and colleagues (2009) reported the reflections of five women who had experienced childhood abuse as they participated in a group parenting programme that incorporated song-writing. Three years after completion of the programme, all participants reflected positively on the process of creating their songs, and most reported that they continued to engage with their song creations. Parents who have experienced childhood trauma often experience challenges when parenting an adolescent as this can trigger memories of abuse, which can intensify conflict, resulting in negative relationship cycles. Colegrove and colleagues (2018) devised a dyadic music therapy for parents and adolescents which increased responsive parent-adolescent interactions and parental emotion coaching, while reducing conflict and adolescent mental health difficulties.

Children who have been exposed to ongoing maltreatment and poverty frequently experience behaviour problems. In South Korea, Kim (2013) used music therapy for 15 weeks with four such children. There was a reduction in externalising and internalising behavioural problems overall, although there was considerable individual variation. In a later study, Kim (2017) showed that, although children in the music therapy group were less depressed, anxious and withdrawn, and had less attention problems than children in standard-care waiting groups, there were many confounding factors. The *El Sistema* programme, a large-scale community-based music programme which includes children exposed to violence, showed in research conducted in 16 music centres with 2914 children aged six to fourteen years old that participating children had improved self-control and reduced behavioural difficulties (Alemán et al., 2017).

Severe Mental Ill-Health

The following sections provide examples of the way that music can be used to support recovery from severe mental ill-health, providing supplementary support to traditional pharmacological and psychological approaches. For patients with psychosis, music therapy and music-listening have both been reported to improve symptoms of general psychopathology, psychoticism, aggressiveness and interpersonal hostility, paranoid ideation, phobic anxiety, somatisation, anxiety and depression, as well as catatonic symptoms such as lack of participation, cooperation, relaxation, interaction and psychosocial functioning (Silverman, 2003). However, not all of the research has confirmed these findings (Attard and Larkin, 2016). An interesting line of enquiry has focused on the use of music individually tailored to match patients' brain rhythms. For instance, Müller and colleagues (2014) examined whether long-term exposure of psychiatric patients to music that was individually adapted to brain rhythm disorders associated with psychoticism could act to ameliorate symptoms. A total of 50 patients with various psychiatric diagnoses were randomised to listen to CDs either containing music adapted to brain-rhythm anomalies associated with psychoticism as measured by specific spectral analysis, or standard classical music. Participants were instructed to

listen to the CDs for 18 months. Psychiatric symptoms were assessed at the start of the intervention and at four, eight and eighteen months. Patients in the experimental group showed significantly decreased symptoms compared to control patients for psychoticism, paranoia, anxiety, phobic anxiety and somatisation. These changes may have resulted from the modulation of neurochemical interactions which improved brain function and enhanced neuroplasticity. Feng and colleagues (2019) explored whether music therapy could improve the brain function of patients with major depressive disorder using near-infrared spectroscopy. Fifteen mild or moderate major depressive disorder patients were compared with healthy controls, who were all treated with continuous music therapy for ten days. Verbal fluency task performance of the participants yielded significantly higher scores after music therapy. The near-infrared spectroscopy data showed increases in some channels which were significant for both groups. The major depressive disorder group showed significant activation in the dorsolateral prefrontal cortex, orbitofrontal cortex and ventromedial prefrontal cortex after music therapy, suggesting that the music therapy had been effective.

One strand of research has considered the impact of music on acute mental health. For instance, Silverman (2017) explored the effects of different levels of structure within educational music therapy interventions on knowledge of illness management, and recovery and affect in adult acute-care mental health inpatients. One hundred and fifteen participants were randomly assigned to either high- or low-structured educational music therapy or a waiting-list control. There were significant differences in relation to knowledge of illness management and recovery between the high-structure condition and the other groups. Overall, highly structured music therapy seemed to be best for efficiently and effectively imparting knowledge concerning illness management and recovery in acute mental health settings. Stefani and Biasutti (2016) studied the impact of group music therapy alongside drug care in comparison with drug care alone, in addition to other non-expressive group activities in the treatment of psychiatric outpatients. Twenty-seven patients with diagnoses of schizophrenia, schizoaffective disorders, bipolar affective disorder, depressive episode and specific personality disorders were allocated to receive group music therapy and standard care in 48 weekly sessions of two hours,

or standard care only. Those participating in the group music therapy demonstrated improvement in neuroleptic drug dosage. Although antidepressant drug usage increased for both groups, the difference was only significant for the control group. Benzodiazepines and mood stabilisers showed no significant change in either group. Overall, group music therapy combined with standard drug care was effective for controlling neuroleptic drug dosage in adult psychiatric outpatients

Grocke and colleagues (2014) studied 99 individuals with severe mental illness who experienced weekly group music therapy, including singing familiar songs and composing original songs in a professional studio. Focus group interviews and lyric analyses, along with quantitative data, were collected at 13, 26 and 39 weeks. Music therapy improved the quality of life and self-esteem of participants, with those participating in a greater number of sessions experiencing the greatest benefits. Focusing on singing, Williams and colleagues (2018) reviewed 13 articles including 667 participants on the efficacy of group singing as a mental health intervention for individuals living with a mental health condition in a community setting. The findings showed that, when people with mental health conditions participated in a choir, their mental health and wellbeing significantly improved, with moderate to large effect sizes. Group singing provided enjoyment, improved emotional states, developed a sense of belonging and enhanced self-confidence. Working with young people in a youth mental health service in Australia, Hense and McFerran (2017) showed that promoting young people's musical identities could facilitate their recovery from mental illness.

Reviews of the evidence for the effectiveness of music therapy for those with psychopathology across a range of different age groups have had mixed findings. Silverman (2003) carried out a meta-analysis including 19 studies, and showed that music could effectively suppress and combat psychotic symptoms. There were no differences between live and recorded music, structured music therapy and passive listening, or between preferred versus therapist-selected music. However, classical music was less effective than popular music. Gold and colleagues (2004) reviewed the overall efficacy of music therapy for children and adolescents with psychopathology, and examined how the size of the effect of music therapy was influenced by the nature of the pathology,

the client's age, the music therapy approach adopted, and the way that outcomes were assessed. Of the 11 studies included, with a total of 188 participants, music therapy had a medium to large positive effect on clinically relevant outcomes. The effects tended to be greater for behavioural and developmental disorders than for emotional disorders, social skills or self-concept, particularly when eclectic, psychodynamic or humanistic approaches, rather than behavioural models, were adopted. In a later review focusing on adults, Gold and colleagues (2009) found that music therapy, when supplementing standard care, had a strong and significant effect on global state, general and negative symptoms, depression, anxiety and general functioning. Small effect sizes were achieved after three to ten sessions, while 16 to 51 sessions were needed to achieve large effects. Overall, the findings suggested that music therapy was an effective treatment which could help people with psychotic and non-psychotic severe mental disorders to improve their functioning. In a review of 35 studies focusing on acute psychiatric disorders, Carr and colleagues (2013) found that drawing firm conclusions was limited by methodological shortcomings and small sample sizes. Studies with significant positive effects used active, structured musical participation and were delivered in four or more sessions. No clearly defined effective model emerged but greater frequency of therapy, actively structured music-making with verbal discussion, consistency of contact, clear boundaries and an emphasis on building a therapeutic relationship and building patient resources seemed to be of particular importance. Yinger and Gooding (2014) summarised the research on music therapy for children and adolescents, including disorders usually diagnosed in childhood (for instance, substance abuse, mood and anxiety difficulties, and eating disorders). They outlined a range of music therapy techniques and their strengths and weaknesses. Some research has considered how music might support those having electroconvulsive therapy. Graff and colleagues (2016) examined 30 patients' preferences for music prior to treatment. Most enjoyed listening to music through speakers or headphones, although 17 percent preferred no music. Gleadhill and Ferris (2010) developed a framework for evaluating the impact of music therapy on people with dissociative identity disorder. This debilitating disorder, acquired due to severe ongoing neglect or abuse, is characterised by the presence of two or more identities that frequently

control the individual's behaviour. The framework suggested that symptom relief, destigmatisation, increased self-esteem and prevention of future abuse were important outcomes.

Eating Disorders

The role of music in ameliorating eating disorders has been examined in a number of studies and reviews. Free and structured improvisation, song-writing and listening to pre-composed music can all be used to help sufferers to address specific aspects of their eating disorder, including being able to recognise and tolerate their feelings, connect with others, and make links between thoughts, feelings and their body. Music can support the development of a sense of self and facilitate understanding of the symbolic functions of the illness. Robarts and Sloboda (1994) explored the process of music therapy in the treatment of people suffering from anorexia nervosa. Individual cases have illustrated the ways in which music therapy can support the individual while addressing frequently deeply rooted problems: for instance, issues with identity, negative self-image, distorted body image, autonomy, control, avoiding facing difficult emotions and difficulty in relationships. There is a relationship between listening to music for cathartic purposes and emotional eating. Van den Tol and colleagues (2018) argued that enjoyment of food and music share similar neural activations in the brain and are both used to regulate feelings. They investigated the associations between emotional eating, disordered mood and music-related mood regulation, and found associations with depression, anxiety and stress. Music-listening for releasing anger or sadness and emotional eating were positively associated. Other music-listening strategies—including entertainment, diversion or mental work—were associated in people who had low levels of disordered mood. High levels of disordered mood were associated with high levels of emotional eating but not with music-listening strategies. This suggests that some music-listening strategies might be able to be used as healthier alternatives to emotional eating. In a retrospective analysis of songs written by adolescents with anorexia nervosa, McFerran and colleagues (2006) revealed identity as the most common theme. Mealtime is an anxious time for people with anorexia,

and music therapy has been used successfully to significantly reduce post-meal-related anxiety (Bibb et al., 2015).

Addiction

Chronic drug abuse leads to a dopamine-deficient state in the mesolimbic system, causing dysphoria in abstinence, leading to craving and, subsequently, a return to drug use. Functional imaging studies have shown that listening to personally pleasing music activates the mesolimbic reward system in a fashion similar to that of drug abuse. Such activation could therefore ameliorate dysphoria and the craving of the hypodopaminergic state. Mathis and Han (2017) found that listening to personally pleasing or moving music could reduce craving in abstinent alcoholics. Twelve participants with alcohol-use disorder in a residential substance rehabilitation unit reported on their level of craving before and after listening to either a participant-selected song or white noise. The music intervention had a significant advantage in reducing craving compared to noise. Other studies on addiction have reported that music therapy can improve perceived control, thus reducing cravings. Silverman (2011) researched the effect of music therapy on readiness to change and craving in patients in a detoxification unit. One hundred and forty-one participants were allocated to a rockumentary music therapy intervention, verbal therapy or a recreational music therapy condition. There were significant differences between groups in readiness to change, contemplation and action, with participants in both music conditions having higher scores than those in the verbal therapy condition. They also tended to have lower mean craving scores, and perceived the intervention as helpful and enjoyable.

Group music-making activities such as choirs can enhance social connections and provide a positive diversion for people overcoming addiction. For instance, Liebowitz and colleagues (2015) investigated how participation in a music-based performance and instruction programme influenced the sense of engagement experienced by participants in a residential setting for at-risk veterans. Participants had opportunities to connect with others through shared interests, and the connections forged with other residents extended beyond relationships established in the choir through increased recognition associated with performances. The choir provided a diversion from other concerns and

may have served as a means of facilitating adjustment to change at a measured speed.

Reviews of the impact of music therapy in relation to addiction report a lack of consistency in research outcomes (Hohmann et al., 2017; Mays et al., 2008). A scoping review of 3697 articles on the impact of music in the lives of young adult drug users found that they valued music for meeting emotional, psychological and social needs, particularly when they were homeless. However, the research included in the review was limited to considering the harmful consequences of music rather than considering potential benefits (Lemaire et al., 2021).

Obsessive-Compulsive Disorder and Social Anxiety Disorder

Music can play a role in ameliorating the symptoms of obsessive-compulsive disorder alongside pharmacotherapy and cognitive behavioural therapy. In Iraq, Abdulah and colleagues (2018) evaluated the impact of passive music-listening as an adjunct therapy with 36 patients aged from 19 to 65 years old. The experimental group received seven 50-minute relaxing music tracks to listen to daily, in addition to regular pharmacological treatment for a three-month period. Controls received regular treatment only. The findings showed improvement in the severity of the behaviours for the experimental group. Similarly, Shiranibidabadi and Mehryar (2015) randomly assigned 30 patients with obsessive-compulsive disorder to standard treatment, pharmacotherapy and cognitive behaviour therapy, in addition to 12 sessions of individual music therapy or standard treatment for one month. Music therapy resulted in a greater decrease in checking and slowness but not for washing or responsibility. Overall, music therapy as an adjunct to standard care was effective in reducing obsessions, as well as comorbid anxiety and depressive symptoms.

Listening to music has been found to reduce time spent dwelling on threats in people experiencing social anxiety disorder. Lazarov and colleagues (2017) examined the efficacy of a gaze-contingent music reward therapy for social anxiety disorder, designed to reduce the extent of dwelling on threats. Forty patients were randomly assigned to eight sessions of either gaze-contingent music reward therapy (designed to divert patients' gaze toward neutral stimuli rather than threat stimuli)

or to a control condition. The music therapy yielded greater reductions in symptoms than the control condition. These effects were maintained after the intervention, which also revealed reduced time spent dwelling on threats and socially threatening faces which had not been used in training, suggesting that the outcomes transferred to other situations.

Schizophrenia

Music therapy can reduce some of the symptoms of mild schizophrenia, including hostility, hallucinations, suspiciousness, emotional withdrawal, poor rapport and difficulty in abstract thinking. Compared with controls, those with schizophrenia receiving adjunct music therapy have shown improvement regardless of the duration, frequency or number of therapy sessions (Tseng et al., 2016). In a review of 18 studies with a total of 1,215 participants, undertaken during 7 to 240 sessions, Geretsegger and colleagues (2017) showed that in the medium term, there were positive effects for adjunct music therapy on a range of negative symptoms, social functioning and quality of life, although the effects were inconsistent across studies and depended on the number of sessions and the quality of the therapy. Working in a hospital emergency psychiatric ward with 61 patients with psychosis, Volpe and colleagues (2018) found that structured music therapy led to a decrease in anxiety, depression and affective symptoms.

Liao and colleagues (2020) explored the factors which were important for the effectiveness of group singing when social robots interacted with individuals with schizophrenia. Nine participants aged 28 to 62 years old participated in four group singing therapy sessions provided by a social robot and an occupational therapist. Group cohesiveness, universality and altruism were the most important factors related to the efficacy of the programme. Similarly, Odell-Miller (2016) considered how music therapists could use the music created by patients to better understand their emotions and how they interacted with others.

Music Therapy for Those with Autistic Spectrum Disorder or Severe Learning Difficulties

Music therapists have worked with children on the autistic spectrum disorder for many years, typically as a means to improve verbal and non-verbal communication. Music can be particularly effective in supporting the development of communication, as in itself it is a kind of language (Ockelford, 2012). Using functional magnetic resonance imaging, Sharda and colleagues (2015) showed that those with autistic spectrum disorder had alternate mechanisms for speech and music processing, and established that song could overcome the structural deficit for speech. In a later study, Sharda and colleagues (2018) evaluated the neurobehavioural outcomes of an eight- to twelve-week music intervention with 51 autistic children aged six to twelve years old. Song and rhythm improvisation improved communication and the resting state brain functional connectivity between auditory and subcortical regions and auditory and frontomotor regions, although connectivity was lower between the auditory and visual regions, areas known to be overconnected in those with autistic spectrum disorder.

Some children with autistic spectrum disorder excel at creative activities, particularly music, having superior memory for pitch and timbre and a high-level capacity for processing melodic and rhythmic complexity (Janzen and Thaut, 2018). A survey of adults with autistic spectrum disorder studied their special interests, the intensity of and motivation for those interests, and their impact on quality of life. Approximately two thirds of the sample reported having a special interest, including computers, music, nature and gardening. Most engaged with more than one. Having such interests was associated with enhanced wellbeing, including social contact and leisure. However, very high intensity of engagement with special interests was negatively related to wellbeing (Grove et al., 2018). Even those on the autistic spectrum without special musical skills can benefit from music therapy as a means of enhancing social interaction, sensory perception, language and eye contact (LaGasse, 2017). Musically enriched interactions can reduce anxiety and aggressive behaviour and improve listening, attention span and social interaction (Campbell, 2010), while auditory motor rhythmic training can improve language acquisition and processing, as well as

speech control (Janzen and Thaut, 2018). However, not all interventions have successful long-term outcomes. For instance, Dvir and colleagues (2020) videoed the synchrony of body rhythms between four-to-six-year-old children with autistic spectrum disorder and their music therapists over a 20-week period. Higher levels of synchrony were found when repetitive rhythmicity that occurred twice or more times per second was used, but there was no long-term impact.

Although individuals with autistic spectrum disorder commonly have deficits in processing complex emotional cues, the ability to identify the emotional content of music is generally preserved. In Sweden, Theorell and colleagues (2014) established that playing a musical instrument, particularly in an ensemble, was associated with higher emotional competence. There is further support for this from a review conducted by Molnar-Szakacs and Heaton (2012), who pointed out that many individuals with autistic spectrum disorder showed an early preference for music and were able to understand simple and complex musical emotions in childhood and adulthood, despite the difficulties that they experienced with communication and understanding of emotions within the social domain. One study has even suggested that antenatal music training and maternal talk could reduce the risk of children developing autistic-like behaviours. In China, a study of 34,749 parents of kindergarten children completed questionnaires which revealed that antenatal music training and maternal talk to the foetus was associated with a reduction in autistic-like behaviours (Ruan et al., 2018). Parent-child integrated music activities can support the relationships between children with autistic spectrum disorder and their parents or caregivers (Lense et al., 2020), as can music-based parent coaching (Hernandez-Ruiz, 2020), while musical activities which include children with autistic spectrum disorder can reduce their being victimised by neurotypical peers (Cook et al., 2018).

Some research has considered how music might help children with learning difficulties more broadly. For instance, Mendelson and colleagues (2016) studied a classroom-based music intervention for improving communication skills in children with autistic spectrum disorder or other intellectual disabilities in four elementary school special education classrooms. The findings showed that 45-minute weekly music therapy sessions promoted improvements in verbal responsiveness. Working with young adults with severe learning

difficulties, Pavlicevic and colleagues (2014) found that long-term music-making provided them with ongoing opportunities for gaining confidence and enhancing self-esteem, with feelings of shared acceptance and success. In a case study of an individual with profound learning difficulties, McFerran and Shoemark (2013) found that the success of the therapy lay in a combination of attentive, responsive and creative behaviour over time, with the music therapist listening and taking responsibility for the structure of the activities, and the young person spontaneously initiating activities—withboth participants building a relationship over time. Biological markers of stress have also shown a reduction following music therapy in individuals with intellectual disabilities and autistic spectrum disorder (Poquérusse et al., 2018). Community music activities can also benefit those with mild to profound learning difficulties, increasing their self-confidence and enabling wider recognition of their musicality (Wilson and MacDonald, 2019).

Reviews of the impact of music on individuals with autistic spectrum disorder have generally shown positive outcomes, including improved non-verbal and verbal communication, motor development, coordination, body awareness, sensory perception, social emotional reciprocity and a wide range of social skills (Geretsegger et al., 2014; Janzen and Thaut, 2018; Shi et al., 2016; Srinivasan and Bhat, 2013; Vaiouli and Andreou, 2018). In addition to the impact on these functions, De Vries and colleagues (2015) showed that music reduced anxiety and improved cognitive skills, attention to task, enhanced body awareness, self-care skills, and the expression, recognition, understanding and processing of emotions. Ragone and colleagues (2021), focusing on the use of technology with children with autistic spectrum disorder, showed a relationship between sound-based activities and improvement of motor and social skills. The reviews all point out the limitations of the research, particularly in terms of the small sample sizes and variation in the kinds of therapy and outcome measures, while still acknowledging the benefits. In contrast, Simpson and Keen (2011) gave limited support for the use of song-writing or improvisational therapy to facilitate social, communicative and behavioural skills in young children with autism spectrum disorder. Music has been successful in increasing exercise intensity and important in reducing the risk of obesity, sleep disorders

and stereotypical behaviours common in children with autism spectrum disorder, although the effects are mediated by the extent to which the exercise is structured, the nature of the music and the characteristics of the child (Woodman et al., 2018).

Some research has focused on the nature of effective music teaching for children with a range of learning difficulties and autism. Gerrity and colleagues (2013) showed that the use of repetition, giving students choice and allowing for longer response time were important teaching strategies, while children themselves found it important to have clear directions and expectations, a behaviour plan, and fostering a positive atmosphere that was free of distractions. Thompson and colleagues (2020) gathered the perspectives of autistic individuals aged 18 to 25 years old to inform the design of music-making workshops using an online survey and structured interviews, and showed that participants expected a welcoming atmosphere and an acceptance of diversity.

Overview

Psychological wellbeing and physical health are closely linked. The former can enhance recovery from illness and limit its occurrence, while stress and anxiety can contribute to ill health. Music can enhance wellbeing, but equally it can contribute negatively to psychological health (if depressing or aggressive music is listened to constantly, particularly in the presence of others). Music-making in ensembles activates many regions of the brain, enhancing the connections between them, while listening to music—which constitutes an aspect of making music—impacts on brain regions associated with arousal, the emotions, reward and pleasure. The rhythmic aspects of music impact on movement, while whether music is slow, fast, quiet or loud affects arousal, mood and emotion. Musical preferences have a major influence on whether music therapy is effective. In these different ways, music can influence mental and physical health positively or negatively. In addition to the direct effects of music, therapy interventions typically involve interactions with other people, the therapist and other participants. The social interactions involved in music-making and listening with others are important in the impact of music on mental and physical health, and can be more or less positive. The therapist or facilitator and the approaches that they adopt

are also important mediators. It is not possible for research to untangle the differential impact of music itself and the social interactions with others that may accompany it. Overall, predicting the outcome of any musical intervention on mental or physical health is complex because of the interaction of these factors. This complexity can also account for the different research outcomes.