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The theory of music, mood and movement to improve health outcomes

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Abstract

Aim—This paper presents a discussion of the development of a middle-range nursing theory of the effects of music on physical activity and improved health outcomes.

Background—Due to the high rate of physical inactivity and the associated negative health outcomes worldwide, nurses need new evidence-based theories and interventions to increase physical activity.

Data sources—The theory of music, mood and movement (MMM) was developed from physical activity guidelines and music theory using the principles of statement and theory synthesis. The concepts of music, physical activity and health outcomes were searched using the CINAHL, MEDLINE, ProQuest Nursing and Allied Health Source, PsycINFO and Cochrane Library databases covering the years 1975–2008.

Discussion—The theory of MMM was synthesized by combining the psychological and physiological responses of music to increase physical activity and improve health outcomes. It proposes that music alters mood, is a cue for movement, and makes physical activity more enjoyable leading to improved health outcomes of weight, blood pressure, blood sugar and cardiovascular risk factor management, and improved quality of life.

Conclusion—As it was developed from the physical activity guidelines, the middle-range theory is prescriptive, produces testable hypotheses, and can guide nursing research and practice. The middle-range theory needs to be tested to determine its usefulness for nurses to develop physical activity programmes to improve health outcomes across various cultures.

Keywords

health outcomes; middle-range theory; music; physical activity

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Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

CM and PAH were responsible for the study conception and design. CM was responsible for the drafting of the manuscript. PAH supervised the study.

Introduction

International guidelines for physical activity recommend that adults engage in regular, moderate-intensity physical activity for at least 30 minutes per day for 3–5 days per week to obtain health benefits (USDHHS 2000, Canadian Fitness and Lifestyle Research Institute 2002, Van Sluijs *et al.* 2006). Unfortunately, physical inactivity is increasingly prevalent in industrialized countries and contributes to obesity and chronic diseases, such as cancer, cardiovascular disease and diabetes (Hirvensalo *et al.* 2000, Littman *et al.* 2005, NCCDPHP 2007). Hence, cross-cultural, innovative, evidence-based strategies to promote physical activity and improve a wide range of health outcomes continue to be an important area for nursing research and practice worldwide.

One strategy is to develop a middle-range theory with music as an intervention to increase physical activity and improve health outcomes. Through the ordering of tones or sounds to produce compositions, music produces psychological and physiological responses within the human body. Currently, there are two middle-range nursing theories that emphasize the psychological responses of music to improve health outcomes: the theory of pain: a balance between analgesia and side effects (Good 1998) and the theory of individualized music intervention for agitation (IMIA) (Gerdner 1997). Based on the Parse Research Method, music is the medium for expressing feelings (Jonas-Simpson 1997), the experience of being listened to (Jonas-Simpson 2003) and quality of life in patients with dementia (Jonas-Simpson 2004). As for physiological responses, the rhythmic auditory stimulation (RAS) technique (Thaut *et al.* 1999) uses music as a cue for movement. By combining psychological and physiological responses to music, the proposed theory of music, mood and movement (MMM) provides potential cross-cultural prescriptions for music as a nursing intervention to promote the initiation and maintenance of physical activity. Thus, this paper presents a discussion of a middle-range nursing theory developed from physical activity guidelines and music theory to improve the health outcomes of weight, blood pressure, glycolated haemoglobin, cardiovascular risk factors and quality of life.

Background

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure (USDHHS 2000). It is recommended that adults engage in at least 30 minutes of physical activity three to five times per week to obtain health benefits. These health benefits include decreased risk of cardiovascular disease, stroke, type 2 diabetes, colon and breast cancer. Furthermore, physical activity produces health benefits through positive effects on hypertension, osteoporosis, body weight and composition, decreased depression, anxiety, stress and decreased falls (World Health Organization 2008). Unfortunately, at least 60% of the world's population does not engage in the recommended amount of physical activity needed to produce these health benefits (World Health Organization 2008). As a result, physical inactivity is a major public health problem in most countries; therefore, effective strategies are urgently needed to improve physical activity in all populations worldwide.

Historically, music has been universally valued for its psychological and physiological effects on humans (Murrock 2005). Ancient Egyptians, Chinese and Florence Nightingale have documented the therapeutic uses of music for healing purposes (White 2000). In fact, the word music comes from the Greek word 'mousike', and the Greeks were the first to investigate music and its influence on health (McClellan 1991). A comprehensive review of music theory is beyond the scope of this paper, but basic discussions of the five elements of music are provided.

Music, which is both a science and art, is created by ordering tones or sounds in succession, in combination, and in temporal relationships to produce a composition having unity and continuity (Merriam-Webster's Collegiate Dictionary 1994). Musical compositions are complex blends of expressively organized sound consisting of five elements: rhythm, melody, pitch, harmony and interval (Bunt 1994). As proposed by the MMM, these five elements are vital when selecting music to invoke both psychological and physiological responses within the listener. The first element, rhythm, is the pattern of repeated sounds and silences and is music's most fundamental, essential, structural and organizational element (Thaut *et al.* 1999). By capturing an individual's attention, rhythm is an auditory cue for the synchronization of skeletal muscle movement and is the most important consideration when selecting music for specific and therapeutic purposes (Thaut *et al.* 1999). As the second element, melody is the sequencing of musical pitch and intervals between musical notes. Structured by its length and intensity, melody expresses a mood, a thought, an idea or an emotion (Schneck & Berger 1999). Melody is a form of non-verbal communication that can elicit a broad spectrum of emotions from one extreme response (happy, calm and euphoric) to another (sad, anxious and angry). The number of cycles that a particular sound vibrates per second is the third element, pitch. Faster vibrations cause high-pitched tones that are usually associated with cheerful or happy reactions. On the other hand, slower vibrations cause lower tones and typically connote dreariness or depression. The vibration rate per unit of time can influence an emotional response as rapid vibrations are viewed as stimulating and slow vibrations are considered as relaxing (Bunt 1994). The fourth element is the product of blending pitches together to form a combination of sounds known as harmony, which links rhythm to the melody. These blended combinations can be characterized as consonant or dissonant (Bunt 1994) and form distinct patterns from the simultaneous musical notes resulting in a musical chord. In conjunction with timbre, which is the quality of sound, the composition of chords results in a specific sound that enables a person to identify a particular musical instrument or type of singing voice. The fifth and final element is interval, which is the distance between two notes. It is an integral component of the melody giving it its character and emotional response (Schneck & Berger 1999). As evidenced by the rich variety of music among cultures, the five elements of music, along with its set of rules, combine a finite range of sounds in an infinite number of ways. As one of the oldest and most accepted modes for expressing cultural diversity, music elicits emotional responses and stimulates movement that can be used for therapeutic purposes.

Over the years, workers in various schools of thought have worked to explain the psychological responses of music to alter mood and serve as auditory distraction. For example, referentialists claim that music summons memories of past experiences and the associated emotional responses to alter mood (Jourdain 1997) while absolutists believe that it is only the sound of the music that produces the meaning and emotional responses to alter mood (White 2000). Building on this, the middle-range theory of IMIA used music to alter mood by decreasing agitation in patients with Alzheimer's disease and related disorders (Gerdner 1997). In addition, the theory of pain: a balance between analgesia and side effects used music as a type of auditory distraction to relieve the sensation and distress of pain (Good 1998). However, these theories do not address the physiological responses of music to improve health outcomes.

Throughout history and across societies and cultures, music has stimulated and shaped physical movements for religious ceremonies, entertainment and coordinated physical efforts during work (Thaut *et al.* 1999). The connection between music and movement is described by the RAS technique as the manner in which rhythm influences muscle control and provides predictable cues for movement. The RAS has improved balance and gait in stroke survivors (Thaut *et al.* 1997) and those with traumatic brain injury (Hurt *et al.* 1998),

and Parkinson disease (Thaut 1997). Also, RAS has been tested as a cue for movement to increase physical activity in healthy adult populations (Hamburg & Clair 2003). However, RAS does not account for the psychological responses to music and associated improved health outcomes. To fill this gap, the MMM proposes relationships among the psychological responses of mood alteration and auditory distraction and physiological responses as a cue for movement to increase physical activity and improve health outcomes in adult populations.

Data sources

The middle-range MMM theory was developed from the physical activity guidelines and music theory using the strategies of statement synthesis and theory synthesis (Walker & Avant 2005). Statement synthesis identifies relationships among concepts and theory synthesis combines the relational statements into an organized conceptual framework or theory. The steps for statement synthesis, theory synthesis, and empirical evidence for the theoretical statements are outlined below.

Statement synthesis

The first step in statement synthesis was to review the physical activity guidelines to identify the prescriptive relationships (Good & Moore 1996). Next, the physical activity guidelines were used to identify the concepts that represent the problem (lack of physical activity), prescriptions (music intervention) and the desired outcome (improved health outcomes). The final step was to identify the relationships among these concepts that would be most useful in achieving the desired outcome of increasing physical activity (Walker & Avant 2005). Statements should predict the relationships among the concepts and produce testable hypotheses to guide practice (Good 1998). Hence, developing a theory from physical activity guidelines offers more efficiency and prescriptive power than other methods of theory development (Good & Moore 1996).

Theory synthesis

The purpose of theory synthesis is to combine the relational statements into an organized theory. At least three theoretical statements are needed to develop a theory, which should also be expressed in a relational model with definitions and measurements of the concepts (Walker & Avant 2005). Prescriptive theories need to demonstrate connections between the concepts and between the relational statements and indicate the intervention needed to achieve the anticipated health outcome (Good & Moore 1996). In writing a theoretical statement for the theory of MMM, the intervention (music) and outcome (improved health outcomes) were combined. For example, physical activity is any moderate-intensity activity that can be engaged in for at least 30 minutes for 3–5 days a week to produce health benefits. As an intervention, music produces both psychological and physiological responses to promote the initiation and maintenance of a physical activity programme leading to the desired result of improved health outcomes. Thus, the theoretical statements must be measurable, produce testable hypotheses, and guide research and practice (Walker & Avant 2005).

Review of literature

For the final step, the concepts of music, physical activity and health outcomes were searched using the Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE, ProQuest Nursing and Allied Health Source, PsychInfo, and Cochrane Library databases covering the years 1975–2008. Inclusion criteria were: a study population of adults, a conceptual framework/theory, the intervention was recorded music, outcomes included psychological and/or physiological responses to music, and a control group. Only

papers in English or translated into English were reviewed. Papers relating to infants, children, adolescents, and meta-analyses were excluded from the review. The search resulted in 265 papers, which were then limited to 149 that met the inclusion criteria and were not duplicate citations. Of the 149 papers subject to review, 75 used a music intervention to improve health outcomes. A critical review of the empirical evidence supported the theoretical statements and served as the foundation for the middle-range theory of MMM.

Discussion

There are three theoretical statements of the middle-range MMM theory, and the theoretical model (Figure 1), together with the definition of the concepts and their measurements, is shown in Table 1.

The first theoretical statement for the MMM is that *music produces the psychological response of altered mood leading to improved health outcomes*. Based on the elements of rhythm, melody, pitch and harmony, music produces psychological responses within a person when it passes through the auditory cortex of the brain, which processes the music. This processing occurs in the limbic system, which is known as the centre of emotions, sensations and feelings. Human responses to music occur predominantly in the right hemisphere of the brain, which is involved in intuitive and creative methods of processing information (Tramo 2001). Through affective response and cognitive recognition, music is able to alter mood. Thus, a person's current mood, response to the given music, and musical preference play an important part in mood alteration leading to various health outcomes. As a nursing intervention, music has been used across various cultures to alter mood (Nayak *et al.* 2000, Jeong & Kim 2007), decrease anxiety (Chlan 1995, Good *et al.* 1999), and reduce depression (Siedliecki & Good 2006). Nurses have also tested music to decrease agitation in patients with dementia (Goodaer & Abraham 1994, Ragneskog *et al.* 2001, Hicks-Moore 2005, Sung *et al.* 2006). Only one study used the Theory of IMIA to decrease agitation in patients with Alzheimer's disease (Gerdner 2000). Thus, music altered mood to improve the health outcomes of anxiety, depression and agitation in various international patient populations.

Music can also alter mood when used as a type of auditory distraction. By helping a person pay minimal attention to an unpleasant stimulus, music can be used as a stimulus-substitution. For example, pain typically leads to a stress response that signals the release of epinephrine and norepinephrine, resulting in increased heart rate, respiratory rate, blood pressure, and state anxiety (Lazarus 1991). Music may interrupt this stress response as it is thought that listening to calming music releases beta-endorphins, the body's natural opioid pain relievers (McKinney *et al.* 1997). Several researchers have reported using a music intervention to decrease blood pressure, heart rate, respiratory rate and oxygen consumption during percutaneous coronary interventions (Chan *et al.* 2006), mechanical ventilation (Chlan *et al.* 2001) and for patients after heart attack (White 1999). Nursing studies that used music interventions based on the theory of pain: a balance between analgesia and side effects (Good 1998) have shown decreased surgical pain (Good *et al.* 1999, McCaffrey & Good 2000), labour pain (Phumdoung & Good 2003) and chronic knee pain (McCaffrey & Freeman 2003). By interrupting the stress response, music decreased blood pressure, heart rate, respiratory rate, oxygen consumption and pain.

Another way that music alters mood is by encouraging social interaction. As a means of socially acceptable self-expression, music plays an important role in the communication of feelings and group identity (Hargreaves *et al.* 1997). Because it is based on cultural experiences and expectations, music appeals to diverse groups of people regardless of

language, economic, religious or educational factors. Music interventions conducted in group settings have resulted in improved social well-being, sense of belonging, companionship, and perceived psychological well-being among stroke survivors (Jeong & Kim 2007) and those with traumatic brain injury (Nayak *et al.* 2000). Therefore, music alters mood, leading to the improved health outcomes of decreased anxiety, depression, agitation, pain, altered physiological responses and improved social interaction.

The second theoretical statement for the MMM is *the physiological responses to music are a cue for movement leading to the initiation and maintenance of physical activity*. From the auditory cortex, the neural impulses of auditory rhythm stimulate the neural motor impulses, resulting in the auditory motor entrainment described in the RAS technique. The physiological mechanisms for this technique are based on interactions between auditory and motor systems, or sound and movement. As the first element of music, rhythm has important influences on motor control and function due to its recurring patterns and predictable cues. Rhythmic cueing leads to synchronization that determines timing, cadence and dynamics of physical movements (Thaut 1997). This occurs in both the upper and lower extremities, as demonstrated by finger and toe tapping. Studies based on the RAS technique have used music as an external time cue to regulate body movement and improve gait in adults with disabilities such as Parkinson disease (Thaut 1997) and stroke (Jeong & Kim 2007). Furthermore, relationship between musical rhythm and human movement has been shown to increase physical activity maintenance in patients with pulmonary disease (Bauldoff *et al.* 2002) and in healthy older adults (Hamburg & Clair 2003). Thus, music is an auditory cue for movement that can lead to the initiation and maintenance of physical activity in various adult populations.

The third theoretical statement for the MMM is *both the psychological response of altered mood and the physiological response of movement to music promotes the initiation and maintenance of physical activity leading to improved health outcomes*. Although physical activity has been associated with the improved health outcomes of weight loss (Murrock & Gary 2008), weight management (Littman *et al.* 2005), reduced cardiovascular risk factors (Schneider *et al.* 2006), blood pressure management (Castaneda *et al.* 2002), blood sugar management (Kelley & Goodpaster 2001), and improved quality of life (Jeong & Kim 2007), initiation and maintenance of physical activity is difficult for many adults. Exercising to music can improve mood (Murrock 2002), and positive mood changes might influence an individual's intention to continue exercising. Thus, music has important implications for increasing physical activity. For the MMM, enjoyment is also an important component of mood alteration. Enjoyment of physical activity has been linked with decreased perceived effort and improved feeling states (McAuley *et al.* 2007), and enjoyment has been identified as a mediator between physical activity and positive mood changes (Motl *et al.* 2000). Enjoyment is defined as an optimal psychological state that leads to performing an activity primarily for its own sake, and is associated with positive feeling states, such as pleasure, liking, and fun (Csikszentmihalyi 1990). Music interventions designed to increase physical activity should focus on promoting enjoyment as this is a reinforcement of the behaviour and is critical to initiation and maintenance of a physical activity programme (Motl *et al.* 2000).

During physical activity, perceptions of discomfort and exertion occur through the peripheral cues of muscle discomfort and fatigue and through central cues of changes in heart rate, respiratory rate and oxygen consumption mediated by the autonomic nervous system. By distracting an individual's perception of exertion, music allows them to minimize the peripheral and central cues of discomfort (Szmedra & Bacharach 1998, Yamashita *et al.* 2006). Also, exercising to music can improve participation by capturing an individual's interest and connecting the physical activity with positive experiences. The

positive experiences contribute to the initiation and maintenance of physical activity (Hamburg & Clair 2003). Furthermore, the relationship between rhythm and movement benefits skill acquisition and improved performance, regardless of an individual's fitness level. Music can lead to greater frequency, intensity and duration of physical activity (Tenenbaum *et al.* 2004) all of which are important for achieving the health outcomes. As a result, exercising to music can increase enjoyment, connect physical activity with positive experiences, improve frequency, intensity, and duration, and promote the initiation and maintenance of physical activity leading to the improved health outcomes of weight, blood pressure, blood sugar, and cardiovascular risk factor management, and improved quality of life.

Implications for nursing

Around the world, healthcare professionals use evidence-based guidelines to determine appropriate interventions expected to improve health outcomes. Due to the international occurrence of negative health outcomes associated with physical inactivity and the international application of music to improve health, the middle-range MMM theory is prescriptive since it was developed from physical activity guidelines that are expected to result in important health outcomes. Furthermore, the MMM theory includes the nursing metaparadigm concepts of person, nursing, environment and health. Based on the holistic nature of nursing, the MMM theory incorporates a person's psychological, physiological, and social responses of music to improve various health outcomes. Music modifies a person's internal environment (mood alteration, enjoyment and perceptions of discomfort) and external environment (auditory distraction, movement) to improve health outcomes. Believing it was nurses' responsibility to adjust patients' environment, Florence Nightingale used music to aid the healing process (Nightingale 1859/1992). Finally, as a concept central to nursing, health is a dynamic process that occurs on a continuum and exists independently from illness and disease. Health and health outcomes will vary for each person, depending on their life circumstances. As a result, music is a nursing intervention that can improve many health outcomes through the initiation and maintenance of physical activity in adult populations in various community, assisted living, nursing homes and acute care settings around the world.

The contribution of the MMM theory to the discipline of nursing knowledge is that it can explain and predict links between music and health outcomes that are useful for guiding nursing practice and research. As a non-pharmacological intervention, music is safe, cost-effective, noninvasive and should be easy to implement in different settings. For example, music interventions can be implemented in institutional settings (nursing homes, hospitals, waiting rooms, surgical and outpatient centres, etc.) and community settings (homes, offices and places of employment, etc.) to improve the aforementioned health outcomes. Due to its portability, music promotes autonomy by allowing individuals to self-administer music interventions at their convenience. Also, music gives nurses autonomy by enabling a music intervention to be used at a nurse's discretion or when nurse and patient collaborate at a given time to yield an expected effect. As a cost-effective intervention, music could decrease the use of narcotics and enhance recovery from surgery, thereby decreasing hospital stay. Music libraries are relatively inexpensive as CDs can be reused or patients can use their own music. Finally, more nursing research is needed to determine the length of time, or 'dose effect', needed to alter mood, decrease pain, reduce anxiety and decrease agitation.

In summary, the MMM meets the criteria for middle-range theory, with its moderate level of abstraction and its comprehensive but distinct boundaries and scope (Higgins & Moore 2000). Also, the concepts of interest (music, physical activity and health outcomes) can be objectively coded, measured and applied cross-culturally with various patient populations.

Thus, with its measurable relational statements, which integrate the psychological, physiological and social components of health, the MMM can be used to generate hypotheses testing the linkages among music, physical activity and various health outcomes all over the world.

Conclusion

The middle-range theory of MMM is a prescriptive theory synthesized from physical activity guidelines and music theory that is supported with empirical evidence from music intervention studies. It fits the definition of a middle-range theory as it refines a substantive area in nursing science and practice, directs an intervention, and has the potential for cross-cultural application. Nurses need to test the theory empirically to determine its usefulness for developing physical activity programmes to improve health outcomes around the world.

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What is already known about this topic

- Following physical activity guidelines results in the health benefits of decreased risk of cardiovascular disease, stroke, type 2 diabetes, colon and cancer.
- As an intervention, music produces both psychological and physiological responses with documented improved health outcomes in various international adult populations.
- Music is an external auditory cue that determines timing and cadence of physical activity movements.

What this paper adds

- A middle-range theory developed from physical activity guidelines and music theory based on statement and theory synthesis.
- Support for the theory from empirical evidence based on music intervention studies from various disciplines.
- The middle-range theory combines the psychological and physiological responses of music to increase physical activity and improve health outcomes in various adult populations.

Implications for practice and/or policy

- As a non-pharmacological intervention, music is safe, cost-effective, non-invasive and should be easy to implement in different settings.
- The middle-range prescriptive theory should explain and predict the links between music, physical activity and health outcomes across various adult populations and settings.
- The middle-range theory should advance nursing research and practice.

Figure 1.
Theoretical model.

Table 1

Definitions and measurement of concepts of the theory of music, mood and movement

Concept	Definition	Measurement
Music	The science and art of ordering tones or sounds in succession, in combination, and in temporal relationships to produce a composition having unity and continuity	Slow jazz, classical, orchestra, soft rock, rock, big band, harps, piano, synthesizer, new age, easy listening and country music
Psychological responses	The psychological responses to music occur primarily in the limbic system, which is the centre of emotions, sensations and feelings. Music also promotes social well-being	Profile of mood states, Feelings Scale, Cohen-Mansfield Agitation Inventory, Beck's Depression Scale, State-Trait Anxiety Scale and Relationship Change Scale
Physiological responses	The physiological responses to music occur as music passes through the auditory cortex to the limbic system, affecting the autonomic nervous system From the auditory cortex, the neural impulses of auditory rhythm stimulate the neural motor impulses resulting in auditory motor entrainment	Alterations in blood pressure, respirations, heart rate and oxygen consumption, McGill Pain Scale Walking, treadmill walking, dancing, aerobics
Initiation and maintenance of physical activity	Beginning and continuing a physical activity programme over a period of time	Attendance at a physical activity programme over a period of time
Health outcomes	The results of engaging in activities that reduce the risk of developing or are helpful in managing health conditions and diseases	Weight, body mass index, body fat, glycolated haemoglobin, blood pressure, cholesterol panel, improved quality of life