The Use of Music Therapy/Music to Address Sleep Quality and Sleep Disorders: A Systematic Literature Review

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ABSTRACT

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Bing-Yi Pan

Approximately 40% of adult Canadians struggle with sleep impairments of some kind. As more people turn to non-medical treatments, such as music therapy and the use of music for sleep troubles, music therapists need to be prepared to help. This systematic literature review investigated, synthesized, and analyzed research concerning the impact of music therapy/music on sleep quality. In this study, 37 articles including 35 published in peer-reviewed journals and 2 Master's theses were examined and categorized based on the type of study, the use of music therapy or music medicine, the geographic and cultural background, the population and sample size, the research design, the interventions used, the measurement tools used, the music delivery method, the intervention duration, frequency, and treatment period; the music selection rationale, and the results of the study. The analysis showed the studies: a) came from a variety of countries and fields; b) investigated a number of different populations, both clinical and non-clinical; and c) employed an array of measurement tools, music delivery methods, intervention durations, frequencies, and treatment periods, rationales for music choice for the interventions, and mixed results. Of the 37 studies, 33 (89.2%) showed a positive influence of music therapy/music on sleep quality, while 4 (10.8%) found no impact. Six articles reported that music therapy/music had more or equal impact on sleep quality compared to other treatments. These results demonstrated that further research needs to be done to find the most effective interventions for improving the sleep quality of different populations and to explore music therapists' roles in the area of enhancing sleep quality.

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Chapter 1. Introduction

Significance of the Inquiry

Sleep is vital to health (Buysse, 2014). High quality sleep, in particular, is an important element of people's well-being (Lemola, Ledermann, & Friedman, 2013). Tragically, despite the recognition of the important health benefits of high quality sleep, sleep disorders plague 40% of adult Canadians according to a national survey conducted by Morin et al. (2011). Similarly, it has been reported that sleep disorders affect as many as 50-70 million adults in the United States (Centers for Disease Control and Prevention, 2011).

Numerous pharmacological and non-pharmacological treatment methods have been used to manage sleep disorders (Joshi, 2008; Maness & Khan, 2015; Sarris & Byrne, 2011; Tariq & Pulisetty, 2008). To avoid negative side effects of pharmacological treatment, music, known for reducing stress and anxiety, is often promoted as a holistic, non-pharmacological intervention to help people improve their sleep quality. (Bouhairie, Kemper, Martin, & Woods, 2006; Gagner-Tjellesen, Yurkovich, & Gragert, 2001; Street, Weed, & Spurlock, 2014).

Research shows that music therapy interventions can benefit a variety of clinical populations that suffer from poor quality of sleep and/or sleep disorders. Some of these populations include: people with schizophrenia (Bloch et al., 2010), women survivors of abuse (Hernandez-Ruiz, 2005), refugees living with trauma (Jespersen & Vuust, 2012), people with depression (Deshmukh, Sarvaiya, Seethalakshmi, & Nayak, 2009), the elderly (Ziv, Rotem, Arnon, & Haimov, 2008), and premature infants (Loewy, Stewart, Dassler, Telsey, & Homel, 2013). Music therapists could benefit from a comprehensive guide to inform their practices so they can best serve their clients when addressing goals related to sleep quality.

Studies from various fields have explored the use of music to improve sleep quality and/or address sleep disorders of various clinical populations. These fields include music therapy (Bloch et al., 2010; Hernandez-Ruiz, 2005; Jespersen & Vuust, 2012; Ziv et al., 2008), nursing (Chan, 2011; de Niet, Tiemens, Lendemeijer, & Hutschemaekers, 2009; de Niet, Tiemens, van Achterberg, & Hutschemaekers, 2011; Lafçi & Öztunç, 2015), music medicine (Bradt et al., 2015; Chan, Chan, & Mok, 2010; Morin, LeBlanc, Daley, Gregoire, & Mérette, 2006), etc. However, music therapy research resources for enhancing sleep quality are scarce. There does not appear to be clear guidance on how music therapy interventions should or should not be used to promote sleep quality or help persons with sleep disorders. Additionally, despite music

therapists needing to look to other fields to find resources related to improving sleep quality, the term "music therapy" has often been misused in publications where music therapists were not involved in the research and/or the clinical process (e.g., Lazic & Ogilvie, 2007; Wang, Sun, & Zang, 2014). There has also been a recent heightened awareness of the use of arts/music for the purpose of health and well-being (Tan, 2004). As a result, music therapists may be called upon more frequently to serve as consultants on the use of music for health and well-being (Laurel Young, personal communication November 21, 2016).

Given these findings, this study was designed as a systematic literature review focusing on organizing current knowledge from qualitative and quantitative research for use by music therapists in their work as clinicians and consultants, in order to help persons who struggle with sleep quality issues/disorders. This study was also intended to provide information to support the use of music in best practices and to avoid its inadvertent misuse, based on current knowledge. Furthermore, gaps in knowledge identified through this review could be useful in pointing to areas for future research.

Personal Relationship to the Topic

When people find out I am a music therapist, they often ask what music they should listen to in order to sleep better. It seems that many people think improving sleep quality is a large part of music therapy, and they want to seek advice from a music therapist for help with their sleep issues. However, when consulting the literature, I found that information was quite scattered, specifically regarding interventions, contexts/circumstances, outcomes, and recommendations.

I also often struggle to fall asleep. Music is one of the main tools I have tried to help myself to go to sleep. I have used both listening to recorded music as I fall asleep and playing live calming music for myself before going to sleep. These interventions have had mixed results.

These two reasons form my main motivation for conducting the current research. The goal of this research was to provide some guidance for music therapists by compiling and organizing previous research conducted on the use of music to improve sleep quality.

Assumptions

Based on my personal exploration of music therapy literature related to sleep quality and sleep disorders, I assume that music therapy can be used to improve sleep quality and/or address the sleep disorders of various clinical populations. As a Music Therapist Accredited (MTA), I

may have a biased opinion of music therapy over other clinical disciplines. Inspired by my discussions with my professors and peers, I assume that music therapists can work as clinicians and consultants to help people with sleep problems.

Research Questions

The primary research question established for this research is: What literature exists that involves the use of music therapy/music to address sleep disorders and/or improve sleep quality? The subsidiary research question established for this research is: How can the information contained in this literature be organized to serve as a resource for music therapists in their clinical work and in their "arts in health" consultant roles?

Key Terms

A number of key terms are identified and explained in this section to clarify the parameters of this literature review. Given numerous ways of measuring "sleep quality" subjectively and objectively, the main challenge of determining "sleep quality" is the lack of any standard definition of "sleep quality" (Buysse, 2014; Krystal & Edinger, 2008). This study identifies, organizes, and synthesizes the sleep quality measurements used in the reviewed articles. Any disorder that affects, disrupts, or involves sleep is considered a "sleep disorder" (American Academy of Sleep Medicine, 2014).

According to the Canadian Association of Music Therapists (2016), "music therapy" is defined as "a discipline in which credentialed professionals (MTA) use music purposefully within therapeutic relationships to support development, health, and well-being. Music therapists use music safely and ethically to address human needs within cognitive, communicative, emotional, musical, physical, social, and spiritual domains" (About Music Therapy section, para. 1).

In distinguishing between music therapy and music medicine research, a "music therapy study" investigates how music therapy interventions are used to help clients improve their health. It requires the presence of a systematic therapeutic process between the client and a trained music therapist (Bradt et al., 2015; Gold et al., 2011). A "music medicine study" investigates the use of music to promote clients' health, but does not involve a systematic therapeutic process or a trained music therapist and cannot be considered a music therapy study. In keeping with the distinctions of Bradt et al. (2015) and Gold et al. (2011), this type of research is referred to as music medicine study in the current review.

Chapter Overview

After a general introduction and outline of the researcher's interest in the topic, assumptions, and definitions in Chapter 1, Chapter 2 explores the rationale for the research through a brief literature review, and how it would be beneficial for the music therapy field. In Chapter 3, the research methods, search strategies, selection criteria, and data analysis procedures are explained. Chapter 4 presents the results of the literature review on how to use music to improve sleep quality. Finally, Chapter 5 discusses the findings of this literature review, answers the research questions, identifies the limitations, and suggests considerations for future research and clinical work.

Chapter 2. Brief Literature Review

Importance of High Sleep Quality

Sleep is the time the body takes to recuperate, repair cells, regulate hormones, and consolidate memories (National Sleep Foundation, n.d.). Take that away and what happens? It "can wreak havoc on our bodies" (Erickson, 2016, title). Not sleeping can impact people's ability to concentrate and make good decisions; it can also result in making pain more severe and weakening the immune system (Erickson, 2016; Hafner, 2017). Hafner (2017) indicates that sleep deprivation can cause people to act as if they are drunk. According to Williamson and Feyer (2000), after 17 hours without sleep, people can have a blood alcohol level of 0.08% (0.08 g per alcohol for every dl of blood) and at 24 hours, it rises to 0.1%. There are many other repercussions of not sleeping properly that can have long-term effects and lead to some distressing problems (Baglioni et al., 2011; Fernandez-mendoza et al., 2016; Kojima et al., 2000). Increased risk of mortality (Kojima et al., 2000) and of developing Type 2 diabetes (Pyykkönen et al., 2014), depression (Baglioni et al., 2011), other psychiatric disorders (Fernandez-mendoza et al., 2016), and cardiovascular and coronary heart disease (Hoevenaar-Blom, Spijkerman, Kromhout, van den Berg, & Verschuren, 2011) are some problems that can result from short sleep duration or poor sleep quality.

Sleep quality is also important because it can affect many aspects of people's overall well-being, yet a large number of people do not get enough high-quality sleep (Canadian Sleep Review Panel, 2016; Morin et al., 2006; Morin et al., 2011). Stress, insomnia, and environments not conducive to sleep have been identified as the main factors causing Canadians to have dissatisfaction with their sleep quality and duration (Canadian Sleep Review Panel, 2016).

Sleep and sleep quality can be affected by psychological, cognitive, and other disorders (Arroll et al., 2012; Pigeon, 2010). It can be a vicious cycle: lack of sleep can lead to psychological dysfunction and psychological disorders can impair sleep (Drake, Roehrs, & Roth, 2003). Lack of sleep can also be related to side effects of antidepressants, such as imipramine and desipramine (Mayers & Baldwin, 2005). Daytime fatigue, psychological distress, and physical discomfort have been identified as the main determinants that prompt individuals with insomnia to seek treatment (Morin et al., 2006). This underscores the importance of finding effective ways to address insomnia and other sleep disorders, along with the factors that lead to poor sleep quality.

Clinicians use both medical and non-pharmaceutical approaches to treat insomnia and other sleep-related issues (Drake et al., 2003; Pigeon, 2010). Compared to medical treatment methods, the most prominent benefit of non-pharmaceutical procedures is their potential for avoiding potentially harmful side effects (DiBonaventura et al., 2015). One widely used, non-pharmaceutical and cost-effective way of improving sleep quality is music (de Niet et al., 2009; Morin et al., 2006; Wang et al., 2014).

Music and Sleep

People from many different cultures and eras have believed that music can improve their sleep quality. There is a story about music and sleep related to Johann Sebastian Bach's *Goldberg Variations*. The story goes that there was a Russian count who asked Bach to write some music for his harpsichordist to play to help him sleep (Tomita, n.d.). Although there is dispute about the veracity of the story, the story is significant in highlighting a common belief in the connection between music and sleep (Tomita, n.d.). Situated far from Europe, a classic Chinese novel based on Indian mythology, *Journey to the West* (Wu, 1592), features a character named Yul-hkhor-bsrun who has the ability to play music to put people to sleep. Moving beyond the realm of stories, it has been documented that parents from different eras and countries have used lullabies to help their children sleep (Unyk, Trehub, Trainor, & Schellenberg, 1992). This demonstrates that parents and many throughout the ages have an intuitive sense of the benefits of using music to facilitate sleep or improve sleep quality. Therefore, if lullabies can help children fall asleep, it stands to reason that lullabies, or other music, might aid adults in enhancing their sleep quality.

Why music can improve sleep quality is as yet unclear. However, there are several hypotheses to explain how. Listening to music while falling asleep can be used to block out extra noise (Hillin, 2015). It can provide a calming effect and serve as a distraction (Metrus, 2017). Music can also alter brainwaves to promote sleep (DuRousseau, Mindlin, Insler, & Levin, 2011).

Music can help improve sleep quality because it can block out extraneous noise (Hillin, 2015). Some people have trouble when there is a lot of noise from neighbours, the city, or other sources. It can be frustrating for people when such noises keep them awake, so music can offer an excellent solution for this problem. Not only can music mask annoying sounds; for certain populations, such as post-operative patients, it can be a distraction from pain which can cause sleep problems (Zimmerman, Nieveen, Barnason, & Schmaderer, 1996).

Music can be used to alleviate pain (Curtis, 1986; Garza-Villarreal et al., 2014). Pain can be a large factor that interferes with people's ability to sleep well (Pompili et al., 2016). Music can be used to help people to relax so they can go to sleep, or it can distract people so they do not dwell on the fact that they are not sleeping (Oxtoby, Sacre, & Lurie-Beck, 2013). When people are aware they are not sleeping, it can sometimes add to their suffering and frustration (Oxtoby, 2013). Therefore, music can alleviate suffering and distract from those troublesome thoughts. How can music help people relax? Perhaps, one main reason can be found in how music affects humans' brain waves (Will, & Berg, 2007).

Different components of brain waves are associated with different states of brain activity (Demos, 2005). Alpha waves are characteristic of a brain in a relaxed state, such as deep sleep (Fraiwan, Lweesy, Khasawneh, Wenz, & Dickhaus, 2012). Slow music with a tempo of 60-80 beats per minute (bpm) has been reported to be able to improve people's sleep quality (Ryu, Park, & Park, 2012). Some early research on music and the brain demonstrated the connection between the music tempo and the alpha waves (Borling, 1981; Wagner, 1975). When the speed of music resonates with the alpha brain waves, it increases the strength of the alpha waves, and leads the person's brain to be in a calmer state (Wagner, 1975). Thus, the music with certain frequencies and that is between 60-80 bpm is also referred to as alpha-wave music (Borling, 1981). Subsequent music and neuroscience experiments have shown that the use of alpha music is an effective way to treat insomnia in many contexts (Levin, 1998; Ryu et al., 2012).

Music and Sleep in Music Medicine and Other Non-music Therapy Contexts

Many believe music is a safe, side effect-free way to improve sleep quality (Bouhairie et al., 2006; Gagner-Tjellesen et al., 2001; Morin et al., 2006). Music is used both in hospital settings (Bouhairie et al., 2006; Gagner-Tjellesen et al., 2001) and for self-treatment purposes (Morin et al., 2006). Bouhairie, et al. (2006) reported that nearly 80% of staff in the neonatal intensive care unit thought that listening to music could help improve sleep quality, which was consistent with another hospital-based study (Gagner-Tjellesen et al., 2001). Gagner-Tjellesen et al. (2001) found that nurses working in acute inpatient settings rated music as the most frequently used independent therapeutic intervention for improving sleep quality. A telephone survey conducted by Morin et al. (2006) also reported that music, as a holistic intervention, was one of the self-help strategies most used by French-speaking adult Canadians in Québec to

increase their sleep quality. Not only do people believe that music can help them or their clients get a better night's sleep, but this belief is also supported by objective research.

A number of clinical music medicine studies and meta-analyses (de Niet et al., 2009; Wang et al., 2014) have evaluated the efficacy of using music to improve sleep quality. de Niet et al. (2009) and Wang et al. (2014) found the positive efficacy of listening to music and sleep quality to be statistically significant and suggested music as a non-pharmacological intervention for treating sleep disorders. However, there are some limitations to the studies evaluated in the meta-analyses by de Niet et al. (2009) and Wang et al. (2014), such as their inaccurate representation of the profession of music therapy, the music interventions used, and exclusion of studies with participants from specific populations, such as those with neurological and cognitive disorders. There are three main issues with how these meta-analyses present the music therapy profession.

One concern of these two reviews, as well as the studies they reviewed, is that music therapy, as the profession of using music to help people with their health issues, was not accurately represented. First of all, both articles considered only studies using recorded music as the intervention and specifically excluded studies involving live music and active engagement in music, such as playing an instrument. It is understandable that this may make the study easier to control receptive music, however, it is only one of four types of intervention used for music therapy. A review from the perspective of music therapy should include a broader range of music interventions.

The term "music therapy" was misused in Wang et al.'s (2014) study. The article was entitled "Music Therapy Improves Sleep Quality in Acute and Chronic Sleep Disorders: A Meta-Analysis of 10 Randomized Studies" however, most of the studies that were reviewed were music medicine studies from the nursing field. Except for Hernandez-Ruiz's (2005) article, none of the other reviewed studies were either published in a music therapy journal or conducted by or in consultation with a music therapist. In addition to using the term "music therapy" incorrectly, Wang et al. (2014) concluded that "Music therapy is low cost and safe, is easy to learn, and could be used readily by nurses in hospital as well as health-care professionals in community" (p. 55). This shows the lack of understanding, in the research area of music and sleep, of what music therapy is as a profession, how music therapists are trained, and how music therapy interventions are used to benefit the patients.

Another limitation of these two reviews is their intentional exclusion of studies involving patients with neurological or cognitive disorders. As previously discussed, poor sleep quality can increase the risk of developing psychiatric disorders (Fernandez-Mendoza et al., 2016). Studies also showed that people with neurological or cognitive disorders can suffer from poor sleep quality sleep (Fulda & Schulz, 2001; Iranzo et al., 2006; Potvin et al., 2012; Ramsawh, Stein, Belik, Jacobi, & Sareen, 2009) Efficient sleep quality management can help improve their ability to cope with these diseases. To address this limitation, a review of the use of music to improve sleep quality that includes a wider population sample is necessary, one that considers an accurate view of the impact of music therapy on sleep quality.

Music Therapy and Sleep

It is important to bring music therapy into this discussion of how music can improve sleep because music therapists are trained in how to use music therapeutically and in being sensitive to their clients' reactions to specific music (Bradt et al., 2015; Gold et al., 2011). Although Corning (1899) was a neurologist working before the establishment of the profession of music therapy, Davis (2012) identified Corning's 1899 study as the first systematic music therapy experiment examining the effects of music therapy and sleep disorders. In this study, Corning (1899) designed equipment to provide carefully selected "music vibration" (music composed by Richard Wagner) in combination with visual stimulation. It should be noted that, typical of research of that time, no rationale was provided for the selection of music by Wagner. After several weeks of treatment, positive effects on sleep quality were found in both participants. One client also reported that he enjoyed uninterrupted sleep for the first time in many months. This early study shows an important connection between music therapy and sleep. Music therapy has also been shown to be effective in improving sleep quality because it can be used to help calm people so they can sleep, and it can aid in relieving other factors that can inhibit sleep quality and duration, such as symptoms related to depression, anxiety, and schizophrenia. (Bloch et al., 2010). Since the previously mentioned early music therapy study, there have been other studies that examine the connection between music therapy and sleep quality.

Paralleled with research published in music medicine and other professional fields, recent research in the music therapy field (in music therapy journals or conducted by music therapists) has provided clinical evidence that music therapy interventions can improve the sleep quality of

those from different populations that suffer from various sleep disorders. Compared to the articles that de Niet et al. (2009) and Wang et al. (2014) reviewed, studies from the music therapy field included a wider range of population groups that have sleep problems. Music therapy interventions have been found to help those from many different populations improve their sleep quality including people with schizophrenia (Bloch et al., 2010), abused women living in shelters (Hernandez-Ruiz, 2005), refugees dealing with trauma (Jespersen & Vuust, 2012), babies for EEG procedures (Loewy, Hallan, Friedmann, & Martinez, 2005), the elderly (Short, 2007), and elementary school children (Tan, 2004). Information from a broader range of populations can be beneficial in informing music therapists' practice.

Another important difference between music therapy articles and music medicine articles from other fields like nursing is that the former tend to provide more detailed information in describing the music intervention used to improve sleep quality. For example, in the study by Bloch et al. (2010), the authors described detailed content on the 40-minute relaxation CD that was used in the study:

> A male voice is heard, explaining the recording contains music for relaxation…The music is a modal harmonic progression in Am/C, played in largo tempo (52 bpm) in moderate volume with no dynamic changes throughout. A harp plays arpeggiated chords starting from a repetition of Am four times…a piano sound plays a melody composed of diatonic notes of the chords…around the 6th minute, a violin is added, playing long diatonic notes…The whole sequence's duration is 10 mins, and it is repeated four times, creating a total duration of 40 mins. (pp. 35-36)

In Hernandez-Ruiz's (2005) research, the music selections were customized according to participants' preferred music, and all the music selections were listed in the article. In both Oxtoby et al. (2013) and Jespersen & Vuust's (2012) study, in addition to providing a thorough description of the music used in the experiments, the researchers investigated people's subjective response to the music before performing their respective studies. Oxtoby et al. (2013) allowed participants to select the music they listened to from three 58-minute playlists of music. The only information provided by the researchers about the music selected was that "the first set consisted of classical music, including piano and guitar-based tracks. The other two sets of music consisted of ambient/meditative songs" (p. 11). No description of ambient/meditative songs was provided.

They asked two undergraduate psychology research assistants to rate how relaxing they found the music. Jespersen and Vuust (2012) created a compilation called “Inducing Sleep”, which contained three soundtracks from MusiCure by Niels Eje. They completed a pre-study test in a language school to determine the subjective response of people from different cultures and how the music made them feel (arousal level). Jespersen & Vuust (2012) also described the stereo speakers used by participants, and how they were arranged with a special pillow for participants. Short (2007) developed a relaxation-focused music and imagery program based on the Bonny Method of Guided Imagery and Music (GIM) to reduce client’s stress. In the 5-minute relaxation program, clients were asked to focus on imagining their favourite places or activities while listening to familiar classical pieces, followed by a therapeutic debriefing. Tan (2004) carefully selected and organized a background music program using a collection of classical adagios along with music by Enya, and described it thoroughly. It was specifically designed for relaxation based on Gaston's (1951) definition of sedative music. In these music therapy studies on sleep quality, music interventions were described comprehensively. Compared to the articles from other fields, in which music details are not often included, the benefits of including these details for researchers and practitioners are clear. For researchers, the detailed description of the music makes it possible to replicate the studies and to evaluate the effects of specific music types. For practitioners (i.e. music therapists), it can help them apply the music interventions and techniques precisely or modify them to suit their clients’ needs; and it also provides explicit guidelines of using music interventions for other caregivers and even people who want to try these techniques in consultation with a music therapist.

Cultural factors, which are not often the focus of studies about music medicine and sleep quality, have been addressed by Deshmukh et al. (2009). Deshmukh et al. (2009) specifically chose four particular types of Indian classical music (Raagas Bahar, Bihag, Mishra Pilu and Malay Marutam) and studied how they can impact the sleep quality of participants from India who have Major Depressive Disorder (MDD).

In addition to clinical studies of music use to improve sleep quality, several studies have focused on other aspects concerning music and sleep. Loewy et al. (2005) compared the effect of chloral hydrate versus music therapy on putting children to sleep before EEG procedures. Instead of using recorded music, live music was played by a music therapist to soothe the participants. The statistically significant results suggest music therapy is more effective for putting children to

sleep than chloral hydrate. The study presented the possibility of using music therapy as an alternative to anesthesia to help people fall asleep for medical purposes. Oxtoby et al. (2013) conducted a randomized-control study to assess various behaviours and thoughts that are related to insomnia. The results showed that, although listening to music was found to have a positive effect on many factors related to sleep quality (i.e. anxiety and pre-sleep arousal levels) for the experimental group, music did not improve the overall sleep quality of the experimental group. The study suggested more research is required to determine whether Harvey's (2002) cognitive model of insomnia maintenance can be used to explain the effect of music on sleep quality. This study took the research of music listening and sleep quality to a more comprehensive and theoretical level. Not much other research has been published in these areas. However, it would be important to include studies like these in a literature review to complete the picture of the field of music therapy and sleep.

Although the efficacy of music interventions on improving sleep quality has been recognized, studied, and at times applied, a review of the literature indicates there may be a disconnect between caregivers who practice music interventions to promote sleep quality and the theoretical and empirical music therapy research on sleep quality improvement. In addition, some confusion and misunderstanding remain in the literature, making it difficult for caregivers to be aware of the importance of what the music therapy profession can offer in terms of consultation and research for best-practices music interventions that focus on improving sleep quality.

Need for a Systematic Literature Review

Numerous studies have examined the use of music to improve sleep quality from different fields including music therapy. However, the literature is scattered and incomplete, in terms of interventions, evaluations, and results. A systematic literature review is necessary to summarize clinical evidence on how to use music to facilitate sleep and promote sleep quality from the perspective of music therapy. The review could help music therapists retrieve interventions based on experimental research to guide their clinical work of helping clients of certain populations sleep better, and to guide further music therapy research on the use of music therapy/music to improve sleep quality. The present study could also help other professionals identify and understand the benefit of having music therapists providing or consulting on the treatment of improving clients' sleep quality.

Chapter 3. Method

A systematic literature review, as a research method with rigorous requirements, synthesizes information from literature on a particular topic or related concepts, in order to provide high-standard evidence to guide clinical decision-making (Brown et al., 2012). Along with the growing literature in the field of music therapy, researchers have conducted a large number of systematic literature reviews to help music therapists answer clinical questions and develop guidelines for clinical practice (Bell, 2016; Brown & Jellison, 2012; Choi, 2016; Clark, Harding, Clark, & Harding, 2012; Gold, Wigram, & Elefant, 2006; McDermott, Crellin, Ridder, & Orrell, 2013; Moore, 2013; Mössler, Chen, To, & Gold, 2013; Tung, 2014; Weller & Baker, 2011). In order to support music therapy researchers in conducting high-quality systematic literature reviews, Hanson-Abromeit and Sena Moore (2014) compared different kinds of literature review methods and observed that systematic literature reviews are effective for helping music therapists manage knowledge, make clinical decisions, and guide research. The researchers also provided a five-step guideline for conducting a systematic literature review in the music therapy field, which the author of this current research consulted.

The purpose of this study was to bring together current knowledge about using music therapy/music to address sleep disorders and/or improve sleep quality. A systematic review was used as the main method to gather as much related literature as possible to organize, analyze, and summarize the previous research and to provide comprehensive guidance for the music therapy field (Booth, Papaioannou, & Sutton, 2012; Hanson-Abromeit & Sena Moore, 2014). When designing the systematic review protocol, the researcher consulted various resources and guidelines, including guidelines from Booth et al. (2012), Glasziou, Irwig, Bain, and Colditz (2003), and Hanson-Abromeit and Sena Moore (2014), along with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Liberati et al., 2009).

Inclusion Criteria

The reviewed research had to meet certain criteria to be included in the current literature review. The inclusion criteria were established as follows:

1. The literature included only research related to the impact of music therapy/music interventions on humans' sleep quality.
2. The literature included only primary research.

3. The scope of literature reviewed was restricted to peer-reviewed studies, including articles from peer-reviewed journals and master's or doctoral theses, to ensure the quality of the reviewed research.
4. Publications in both music therapy and non-music therapy fields were included in the study in order to ensure a complete view of how music therapy/music interventions are used to improve sleep quality or manage sleep disorders,
5. Both qualitative and quantitative studies were included to have a full understanding of how music therapy/music can impact sleep.
6. Literature included only that which was published between January 2007 and December 2016.

Exclusion Criteria

Exclusion criteria were designed to complement the inclusion criteria and to clarify the scope of the target literature. The exclusion criteria were established as follows:

1. Literature published before 2007 was excluded because the purpose of the study was to synthesize recent research about music therapy/music and sleep.
2. Literature written in a language other than English was excluded, due to the language limitations of the researcher.
3. Secondary research was excluded; this involved articles that reviewed previous studies as well as book chapters.
4. Research that did not involve human participants or intervention(s) was excluded.
5. Purely theoretical research and heuristic self-inquiries were excluded.
6. Research that studied music therapy/music with non-human participants was excluded.

Search Strategy

With the aim of efficiently gathering literature that met the inclusion and exclusion criteria, the researcher designed a systematic search strategy. The strategy contained a rigorous procedure of searching electronic databases, music therapy journals, and reference lists, and a study selection protocol.

Electronic databases search strategy. The 16 databases that were searched in this study are listed in Table 1. A search syntax using Boolean operators was designed and used consistently when searching all the databases: ("music" OR "song") AND ("sleep" OR "insomnia"). The term "music therapy" was not included in the syntax because it applies to a

subset of literature that can be searched with the key word “music”. For the same reason, terms such as “sleep quality” and “sleep disorder” were not included in the syntax because they apply to a subset of literature that can be searched with key word “sleep”. “Song” was used as an alternative term for “music”. “Insomnia” was used as an alternative term for “sleep disorder” because it is the most studied sleep disorder when music or music therapy interventions are involved in the treatment.

Table 1
Electronic Databases Searched

Search Engine	Database
APA PsycNET	PsycARTICLES
EBSCOhost	Academic Search Complete
	American Doctoral Dissertations
	Art Full Text (H.W. Wilson)
	Psychology and Behavioral Sciences Collection
	PsycINFO
	RILM abstracts of music literature
Google	Google Scholar
ProQuest	ERIC
	Humanities Index
	ProQuest Dissertations & Theses Global
NCBI	PubMed Central (Free Journals)
	PubMed (Medline)
SAGE Knowledge	Encyclopedia of social psychology
	SAGE Deep Backfile Package
Web of Science	Web of Science

Search strategy for edited books. Although book chapters were excluded from the final analysis and review of the literature, the reference lists of some chapters related to the topic were used to find literature that met the inclusion criteria. Book chapters were retrieved from electronic databases mentioned in the previous section through the same search strategy. As an extra resource, the hardcopies of the music therapy related books in the library of the Concordia University were hand searched.

Search strategy for peer-reviewed journals. The researcher carefully searched the well-known music therapy journals as a complement of the literature collected through searching the electronic database and library of Concordia University. The 12 music therapy journals that were searched can be found in Table 2.

Table 2
Music Therapy Journals Searched

Search Access	Journal
EBSCOhost	Qualitative Inquiries in Music Therapy
Free Access	Music Therapy Today
Oxford Journals	Journal of music therapy
	Music Therapy Perspectives
ProQuest	Australian Journal of Music Therapy
	Canadian Journal of Music Therapy
	Journal of Music Therapy
	New Zealand Journal of Music Therapy
Taylor & Francis Journals	Approaches: An Interdisciplinary Journal of Music Therapy
	Nordic Journal of Music Therapy
	Voices: A World Forum for Music Therapy
SAGE Journals	British Journal of Music Therapy

Study selection. Results of the literature retrieved from electronic databases and peer-reviewed journals were imported to RefWorks through Concordia University library to be organized and managed. Manually-searched book chapters were also added to RefWorks. After all the preliminary resources were added to RefWorks, a duplicates detecting operation was run in RefWorks to identify and remove the duplicated literature. Then, the researcher carefully reviewed the titles, abstracts, and keywords of the remaining literature using the inclusion and exclusion criteria described previously and removed the unqualified articles. The full texts of the literature that met the inclusion criteria, and not the exclusion criteria, were retrieved and downloaded. Next, the researcher carefully examined the full text of each article to ensure they met the appropriate criteria. Finally, all the selected articles were analyzed and reported.

Data Analysis Procedure

The researcher systematically coded and analyzed the retrieved literature. A quantitative approach was designed to organize and categorize the studies. A mixed approach was employed to analyze the interventions used in the articles.

Categorizing literature. Modeled after templates used by Bell (2016) and Tung (2014), a classification template with 19 items (see Table 3) was designed to organize the studies. The information was extracted according to the template and recorded in an Excel spreadsheet. Then descriptive statistics were applied to analyze the information in the Excel spreadsheet and report the findings of what literature exists related to using music therapy/music to improve sleep quality and treat sleep disorders.

Table 3

Classification Template

Section	Item
Author and Publication	Author's background
	Country of the study
	Involvement of credentialed music therapist(s)
	Type of publication journal
	Year of publication
Participants	Age
	Clinical population
	Number of participants
Research Method	Inclusion of a control group
	Measurement instrument(s)
	Setting
Interventions	Duration
	Frequency
	Kind of intervention (interactive or receptive)
	Music used
	Treatment period
	Whether recorded or live music was used
Results	Research findings
	Statistical significance of the result

Synthesizing the interventions. As shown in Table 3, the interventions were categorized based on the duration, frequency, and treatment period of the interventions, interactive or receptive interventions, whether recorded or live music was used, and the types of or details about the music used. A short summary according to the categorization was used to synthesize key elements of the findings about the interventions systematically.

Chapter 4. Results

This chapter examines the search results and findings from the systematic literature review of the effects of music therapy/music on sleep quality in music therapy and other fields. The results of the analyzed data are described in the following categories: (a) search and inclusion results, (b) resource of reviewed literature, (c) geographic, cultural, and time distribution, (d) music therapy and music medicine research, (e) population and sample size, (f) study design, (g) measurement of sleep quality, (h) interventions, and (i) results identified in the literature.

Search and Inclusion Results

A PRISMA Flowchart (Figure 1) was created to display the process of finding and selecting articles (Liberati et al., 2009). Initially, 789 publications were found by searching 16 databases and 12 music therapy journals, and manually searching one book chapter and five review articles. All the references were imported to RefWorks to check for duplications. In total, 325 duplicated articles were removed, leaving 464 articles for primary screening. Then the author screened the remaining articles by the title, abstract, and keywords, and excluded 409 articles based on the inclusion and exclusion criteria described in Chapter 3. The remaining 55 publications were downloaded for the secondary screening to assess eligibility. After careful review of the full documents, and excluding 18 articles for various reasons (see Figure 1), 37 publications met the inclusion criteria and were included in the analysis.

Resources of Reviewed Literature

The 37 pieces of literature reviewed in this study came from multiple sources of publication. The articles were arranged in seven categories, plus the master's theses, based on the field of the journal they were published in to help understand the distribution of music therapy/music and sleep research in different disciplines (Table 4).

The field of the journals with the largest number of articles was nursing. There were ten articles from eight different journals in the field of nursing. These made up 27.0% of the articles reviewed. The field of the journals with the second highest number of articles was music therapy with eight articles from three journals, *Australian Journal of Music Therapy, Journal of Music Therapy,* and *Nordic Journal of Music Therapy*. These made up 21.6% of the reviewed literature. The field of the journals with the third largest number of articles was complementary medicine with five articles, making up 13.5% of the reviewed articles. The fields of the remaining journals

that contributed to this review were medicine (three articles from three journals, 8.1%), other health-related fields (four articles from four journals, 10.8%), psychology (three articles from three journals, 8.1%), and other uncategorized fields (two articles from two journals, 5.4%). The two master's theses included in this review were from science and music therapy. They comprised the remaining 5.4% of the reviewed literature. An ID number was assigned to each study for easy reference in the current literature review, as shown in Table 4.

Figure 1

Stage of Selection Process Based on the PRISMA Flowchart Guideline

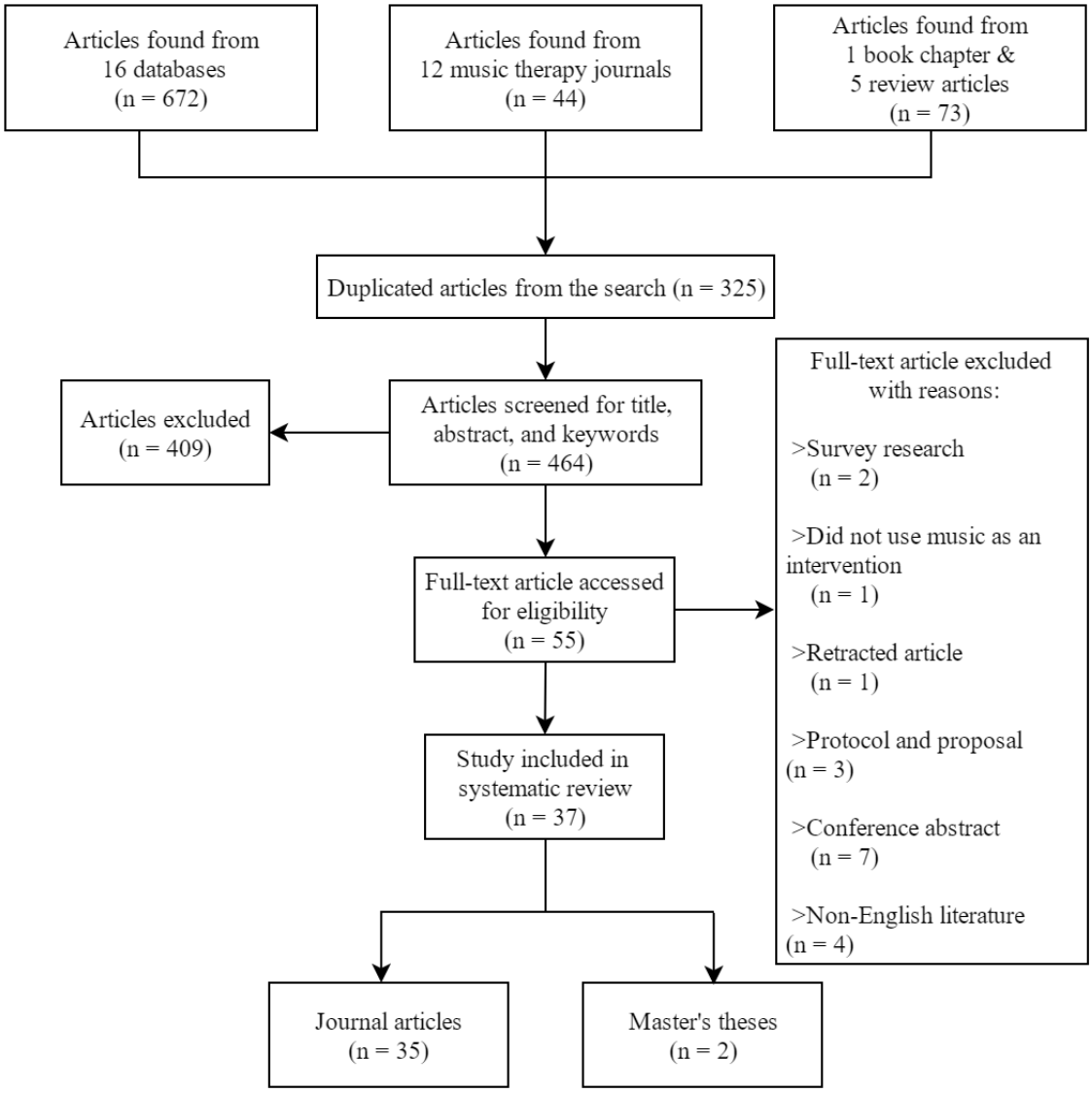


Table 4

Resource of Reviewed Literature

Journal Title/University	Author(s) (Publication Year)	ID
Music Therapy		
Australian Journal of Music Therapy	Oxtoby, Sacre, & Lurie-Beck (2013)	[1]
Journal of Music Therapy	Ziv, Rotem, Arnon, & Haimov (2008)	[2]
	Bloch et al. (2010)	[3]
	Jespersen & Vuust (2012)	[4]
	Beck, Hansen, & Gold (2015)	**[5]**
Nordic Journal of Music Therapy	Deshmukh, Sarvaiya, Seethalakshmi, & Nayak (2009)	[6]
	Koenig et al. (2013)	**[7]**
	Garunkstiene, Buinauskiene, Uloziene, & Markuniene (2014)	**[8]**
Nursing		
Applied Nursing Research	Huang, Chang, & Lai (2016)	[9]
Biological Research for Nursing	Lai et al. (2015)	[10]
Critical Care	Hu, Jiang, Hegadoren, & Zhang (2015)	[11]
Holistic Nursing Practice	Street, Weed, & Spurlock (2014)	[12]
International Journal of Nursing Studies	Chang, Lai, Chen, Hsieh, & Lee (2012)	[13]
Journal of Advanced Nursing	Harmat, Takacs, & Bodizs (2008)	[14]
	Su et al. (2013)	[15]
Journal of Clinical Nursing	Ryu, Park, & Park (2012)	[16]
Journal of Psychiatric Nursing	Altan Sarikaya & Oguz (2016)	[17]
Medical-Surgical Nursing Journal	Ardabili, Abdi, Ghezeljeh, Hoesseini, & Teymoori (2016)	[18]
Medical		
International Journal of Medical Research and Health Sciences	Shobeiri, Khaledi, Masoumi, & Roshanaei (2016)	[19]
Pediatrics	Loewy, Stewart, Dassler, Telsey, & Homel (2013)	**[20]**
The Journal of Alzheimer's Disease	Innes, Selfe, Khalsa, & Kandati (2016)	[21]
Complementary Medicine		
Complementary Therapies in Medicine	Chan, Chan, & Mok (2010)	[22]
	Shum, Taylor, Thayala, & Chan (2014)	[23]
Journal of Neurotherapy	DuRousseau, Mindlin, Insler, & Levin (2011)	[24]
The Journal of Alternative and Complementary Medicine	Chen et al. (2014)	**[25]**
	Wang, Ying, Wong, & Li (2016)	[26]
Other Health-Related Fields		
International Journal of Caring Sciences	Lafçi, & Öztunç (2015)	[27]
Journal of Biology, Agriculture, and Health	Gonzales (2013)	[28]
Pain Research and Management	Picard et al. (2014)	[29]
Women and Health	Liu, Lee, Yu, & Chen (2016)	**[30]**
Psychology		
International Journal of Indian Psychology	Mottaghi, Kamkar, & Mardpoor (2015)	**[31]**
International Journal of Psychophysiology	Lazic, & Ogilvie (2007)	[32]
Mental Illness	Blanaru et al. (2012)	[33]
Others		
International Journal of Science and Research	Hemavathy & Muthamizh Selvan (2016)	[34]
Voices of Research	Sharma & Sharma (2015)	[35]
Theses		
Boston University (Master of Science)	Kolesnik (2012)	[36]
Florida State University (Master of Music)	Patterson (2011)	**[37]**

Geographic, Cultural, and Time Distribution

The reviewed articles came from 15 different countries. As shown in Table 5, nine studies were conducted in China; six studies in the U.S.A.; three studies in India, Iran, and Israel, respectively; two studies in Canada, Denmark, and Turkey, respectively; one study in each of Australia, Germany, Hungary, Lithuania, the Philippines, Singapore, and South Korea. According to the Standard Country or Area Codes for Statistics Use (United Nations, 1999), these studies were from four regions (Americas, Asia, Europe, and Oceania) of the world.

Table 5

Geographic Distribution of Reviewed Literature

Americas		**Asia**		**Europe**		**Oceania**	
Canada	2	China	9	Denmark	2	Australia	1
U.S.A.	6	India	3	Germany	1		
		Iran	3	Hungary	1		
		Singapore	1	Israel	3		
		South Korea	1	Lithuania	1		
		The Philippines	1				
		Turkey	2				

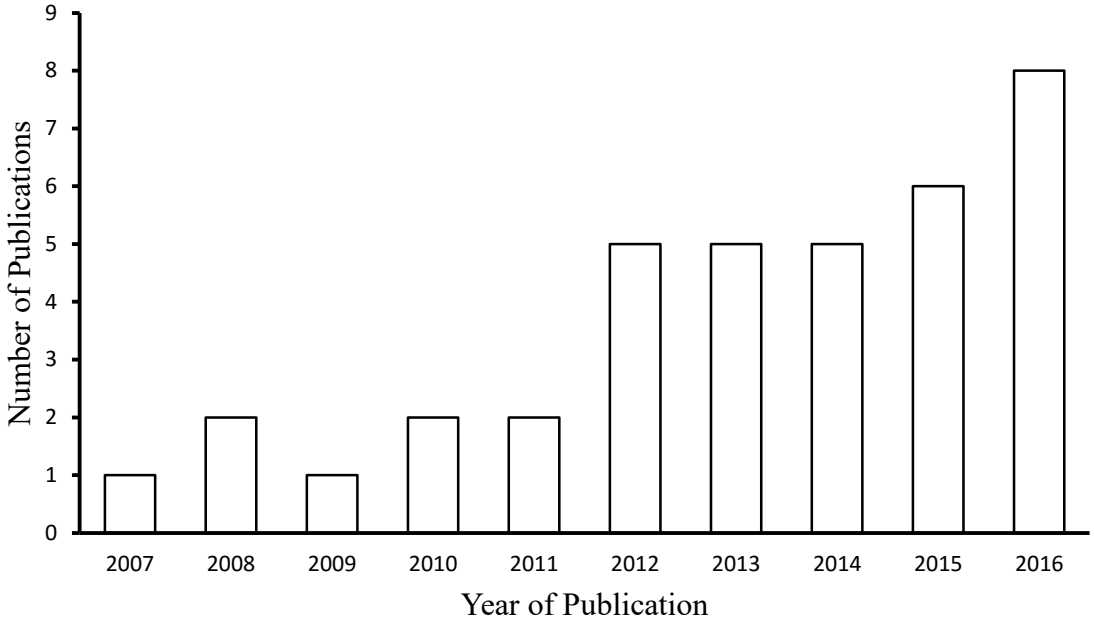
The number of publications from each year of the time range (2007-2016) included in the review were counted and shown in a graph (Figure 2). As can be seen in Figure 2, there is a trend of an increasing number of articles being published in the area of music therapy/music and sleep research in the more recent years. The majority of the studies were published in the last 5 years (2012-2016). There were 29 out of 37 (78.4%) studies published between 2012 and 2016, compared to the previous 5 years (2007-2011), during which time, only eight (21.6%) studies were published. The highest number of studies published in a year was eight in 2016. The lowest number of research articles published in a year was one in 2007 and 2009. The average number of publications per year was 3.7 (SD = 2.41).

Music Therapy and Music Medicine Research

According to the definitions in Chapter 1, the criteria of this thesis for a study to be considered music therapy research is that there were music therapist(s) involved as researcher, clinician, or consultant. After carefully checking the authors' backgrounds and reviewing the intervention procedures of each study, eight out of 37 (21.6%) studies met the criteria and were identified as music therapy research (the IDs of the music therapy literature are bolded in Table 4 and the subsequent tables).

Figure 2

Publication Year of Reviewed Literature



In six of the music therapy research articles, music therapists were listed as author and were involved in conducting the studies. Lee (Liu, Lee, Yu, & Chen, 2016), Loewy (Loewy et al., 2013), and Patterson (Patterson, 2011) are MT-BCs. Gold (Beck, Hansen, & Gold, 2015) and Hilleche (Koenig et al., 2013) work as professors in music therapy departments in European universities (The Grieg Academy Music Therapy Research Centre in Norway and SRH University in Germany, respectively). According to a footnote in the article, Mottaghi (Mottaghi, Kamkar, & Mardpoor, 2015) worked as a music therapist in Iran.

In the other two music therapy research articles, music therapists contributed as clinicians and played essential roles in designing and carrying out interventions. In Chen et al.'s (2014) study, two credentialed music therapists composed and recorded the sedative music for the study. In Garunkstiene, Buinauskiene, Uloziene, and Markuniene's (2014) study, a music therapist was involved in selecting, playing (live), and recording music.

Three of the music therapy studies were published in music therapy journals, *Journal of Music Therapy* (Beck et al., 2015), and *Nordic Journal of Music Therapy* (Garunkstiene et al., 2014; Koenig et al., 2013). Four of the articles were published in non-music therapy journals, *Women and Health* (Liu et al., 2016), *Pediatrics* (Loewy et al., 2013), *The International Journal of Indian Psychology* (Mottaghi et al., 2015), and the *Journal of Alternative and Complementary*

Medicine (Chen et al., 2014). Patterson's (2011) study was the thesis for her Master of Music Therapy. It is noteworthy that five of the reviewed articles that were published in music therapy journals were not categorized as music therapy research because there were no music therapists involved in the study (Bloch et al., 2010; Deshmukh et al., 2009; Jespersen & Vuust, 2012; Oxtoby et al., 2013; Ziv et al., 2008).

In keeping with the definition in Chapter 1, the 29 articles (78.4%) that did not have music therapists involved were considered "music medicine" studies. The backgrounds of the authors of the music medicine articles span a wide range. Majority of these authors were from the fields of nursing, neuroscience, psychology, medicine, psychiatry, and behavioural sciences.

The research also looked at whether the reviewed articles considered themselves "music therapy" by looking at the sections in the article where the term "music therapy" was used. As shown in Table 6, eight articles had "music therapy" in their titles, 15 articles mentioned it in their abstracts, ten articles used "music therapy" as a keyword, 27 articles talked about "music therapy" in their introductions, and 20 articles made references to "music therapy" in their methods, results, or discussions sections. This showed that there is a common misunderstanding of music therapy as a profession in many clinical fields.

Table 6
Self-Considered Music Therapy Literature

Section	**[Literature ID]**
Title	[17, 18, 19, **20**, **31**, 34, 35, 36]
Abstract	**[5**, 10, 17, 18, 19, **20**, 24, 27, 28, **31**, 32, 34, 35, 36, 37]
Keyword	[1, **8**, 17, 19, **20**, 30, **31**, 32, 34, 35],
Introduction	[1, 3, **5**, 6, **7**, **8**, 9, 10, 12, 13, 16, 17, 18, 19, **20**, 21, 22, **25**, 26, 27, 28, **31**, 33, 34, 35, 36, 37]
Method, Result, & Discussion	**[5**, **8**, 11, 14, 15, 17, 18, 19, **20**, 21, 22, 24, 27, 28, 30, **31**, 32, 34, 35, 36]

Population and Sample Size

The populations and sample size of the reviewed articles were analyzed (Table 7). Of the 18 investigated populations, three were non-clinical, investigated by nine studies (24.3%). Four studies (10.8%) examined the effect of music therapy/music on young adults/university students. Four articles (10.8%) involved seniors. One article (2.7%) used children in a daycare as participants.

Table 7

Population and Sample Size of Reviewed Literature

Populations	[Literature ID] Sample size					# Articles	% of total	# Participants	% of total participants
Non-Clinical									
Children	**[37] 51**					1	2.7%	51	2.8%
Seniors	[17] 31	[22] 42	[23] 60	[34] 30		4	10.8%	163	8.8%
University Students	[1] 56	**[7] 20**	[32] 10	[35] 44		4	10.8%	130	7.0%
Total						**9**	**24.3%**	**344**	**18.7%**
Clinical									
Breast Cancer	[27] 60					1	2.7%	60	3.3%
Cardiac Patients	[11] 45	[16] 58				2	5.4%	103	5.6%
Children with SN*	[28] 13					1	2.7%	13	0.7%
Depression	[6] 44					1	2.7%	44	2.4%
Fibromyalgia	[29] 20					1	2.7%	20	1.1%
First Responders	[24] 41					1	2.7%	41	2.2%
Insomnia or PSQ**	[2] 15	[9] 38	[10] 38	[12] 11	[13] 50	10	27.0%	493	26.7%
	[14] 94	**[25] 24**	[26] 64	**[31] 61**	[36] 98				
Burn Unit Patients	[18] 50					1	2.7%	50	2.7%
Patients in ICU	[15] 28					1	2.7%	28	1.5%
Pregnant Women	[19] 88	**[30] 121**				2	5.4%	209	11.3%
Premature Infants	**[8] 35**	**[20] 272**				2	5.4%	307	16.6%
PTSD***	[4] 15	[33] 13				2	5.4%	28	1.5%
Schizophrenia	[3] 24					1	2.7%	24	1.3%
Seniors with CD****	[21] 60					1	2.7%	60	3.3%
Stressed Adults	**[5] 20**					1	2.7%	20	1.1%
Total						**37**	**75.7%**	**1 500**	**81.3%**

*SN = Special Needs; **PSQ = Poor Sleep Quality; ***PTSD = Post-Traumatic Stress Disorder

****CD = Cognitive Decline.

The remaining 28 articles (75.7%) used participants from 15 different clinical populations. The most frequently investigated clinical population was insomnia or poor sleep quality. There were 10 articles (27.0%) that researched the effects of music therapy/music on the sleep quality on people from different age groups with insomnia or poor sleep quality. Four clinical populations, cardiac patients, pregnant women, premature infants, and Post-Traumatic Stress Disorder (PTSD), were each examined by two research articles. There were 11 clinical populations that were researched by only one article each. These included breast cancer, children with special needs, depression, fibromyalgia, first responders, patients in a burn unit, patients in the ICU, people with schizophrenia, seniors with cognitive decline, and stressed adults.

In total, there were 1,844 participants included in all the studies, 344 of which were from non-clinical populations of different age groups, 1,500 of which were from various clinical populations. The population of the largest number of participants investigated people with insomnia or poor sleep quality (493, 26.7% of total participants). Other populations that with over 100 participants included premature infants (307, 16.6%), pregnant women (209, 11.3%), seniors (163, 8.8%), students (130, 7.0%) and cardiac patients (103, 5.6%). The population with the smallest number of participants was children with special needs, where only 13 participants were included in the study.

The sample size of each study was also analyzed. For all the 37 studies, the average number of participants was 49.9 (SD=45.7). The two largest sample size of individual studies were 272, investigating premature infants (Loewy et al., 2013), and 121, investigating pregnant women (Liu et al., 2016). The two smallest sample size of individual studies were 10 (Lazic & Ogilvie, 2007), investigating university students, and 11 (Street et al., 2014), investigating adults with insomnia.

Study Design

The reviewed studies were analyzed based on their research designs and sorted based on the following categories: the number of groupings, how the participants were allocated to the conditions, the types of conditions, and the conditions (see Table 8).

The majority of the reviewed studies (26 studies, 70.3%) sorted participants into two groups. Eight studies (21.6%) had only one group of participants. Three (8.1%) studies used three groups of participants. For studies with more than one group of participants, most employed a randomized allocation strategy when assigning the participants to the groups,

including 14 of 19 two-group studies, and all of the studies with three groups. When designing the interventions for each group, 30 studies (81.1%) used a simple condition design where participants of each group received only one treatment or condition. Seven studies (18.9%) used a crossover condition design, where participants from each group received all the interventions or conditions in different sequences.

Table 8

Designs of the Reviewed Studies

	Grouping Strategy	Type of Conditions	Conditions	[Literature ID]
1 Group		Simple condition	a. Music	[3, 12, 17, 28, 29, 34]
		Crossover conditions	a. Music, Tone, & NT*	[32]
			b. Lullaby, Gato box, Oceandisc, & NT*	**[20]**
2 Groups	Randomized	Simple conditions	a. Music & NT	[1, **7,** 11, 13, 15, 16, 18, 19, 22, 23, 27, **30**, 35, 36]
			b. Music & Antidepressants	[6]
			c. Music & Meditation	[21]
			d. Music and sleep hygiene education & Just sleep hygiene education	[26]
			e. Music relaxation & Muscle relaxation	[33]
			f. GIM & NT	**[5]**
		Crossover conditions	a. Music & Muscular relaxation	[2]
			b. Music video & Usual care	[10]
			c. Sedative music & Overnight PSG	**[25]**
			d. Music & Brisk walking	[9]
	Assigned	Simple conditions	a. Music and ergonomic pillow & Only ergonomic pillow	[4]
			b. Participants' brain music & Random brain music	[24]
		Crossover conditions	a. Lullaby & Rain sound	**[37]**
3 Groups	Randomized	Simple conditions	a. Music, Audio book, & NT*	[14]
			b. Recorded lullaby, Live lullaby, & NT*	**[8]**
			c. Music and CBT, CBT only, & NT*	**[31]**

NT* = No-treatment

All the studies used at least one music intervention as a condition. The most frequently used design of the reviewed studies was the two-group randomized control trial that uses a music group and a no-treatment group as two simple conditions (14 studies, 37.8%). The impact of a variety of other conditions, such as taking antidepressants, meditation, sleep hygiene education, and muscle relaxation, was also studied to compare with the effect of the music intervention and no intervention conditions on sleep quality.

Measurement of Sleep Quality

To evaluate the effect of music therapy/music, the reviewed literature employed multifarious methods to measure sleep quality. Six objective and twelve subjective measuring methods and the studies that used these methods were summarized in Table 9.

Table 9

Measurement of Sleep Quality

	Measurement	[Literature]
Objective	Observation Checklist	[28, **37**]
	Physiological Response (oxygen saturation and heart rate)	[**8**]
	Polysomnography	[2, 3, 9, 10, 13, 15, **25**, 32, 33, 36]
	Sleep Pattern Recorded by Nurses	[**20**]
	Total Number of Sleeping Hours	[16]
	Urine Analysis	[11]
Subjective	Sleep Journal	[4, **5**, **7**, **30**]
	Other Standardized Sleep Quality Questionnaires*	[1, 2, 3, 11, 15, 16, 24, 29, 33]
	Pittsburgh Sleep Quality Index (PSQI)	[1, 4, 6, **7**, 9, 11, 12, 14, 17, 18, 19, 21, 22, 23, **25**, 26, 27, **30**, **31**, 32, 34, 35, 36]
	Sleep Quality Questionnaire Designed by the Researcher	[4, **5**, 9, 10, 13, 17, 24, 27, **31**, 32, 33]

* = Dysfunctional Beliefs and Attitudes about Sleep Scale [1], Jenkins Sleep Evaluation Questionnaire [29], Pittsburgh Insomnia Rating Scale [24], Pre-Sleep Arousal Scale [1], Richards-Campbell sleep questionnaire [11], Sleep Associated Monitory Index [1], Sleep Related Behaviour Questionnaire [1], Technion Long Sleep Questionnaire [2, 3, 33], & Verran and Synder-Halpern Sleeping Scale [15, 16].

Thirty-three of the reviewed research used standardized subjective questionnaires to measure sleep quality. The Pittsburgh Sleep Quality Index (PSQI), the most prevalent method of the reviewed articles, was used by 23 studies. Other subjective questionnaires used in the reviewed studies included the Richards-Campbell Sleep Questionnaire, the Dysfunctional Beliefs and Attitudes about Sleep Scale, the Jenkins Sleep Evaluation Questionnaire, the Pittsburgh

Insomnia Rating Scale, the Pre-Sleep Arousal Scale, the Sleep Associated Monitory Index, the Sleep Related Behaviour Questionnaire, the Technion Long Sleep Questionnaire, and the Verran and Synder-Halpern Sleeping Scale. Researchers of 11 studies designed their own questionnaires to measure sleep quality. Four studies used participants' sleep journal as an evaluation tool.

Sixteen reviewed articles used objective measurements to evaluate participants' sleep quality. The most prevalent objective measurement was polysomnography, which was used by 10 studies. Other objective instruments, such as physiological responses, nurse-recorded sleep patterns, sleep duration, and urine analysis, were also utilized for the evaluation of participants' sleep quality.

Twenty-one studies used more than one method to measure sleep quality. The study that used the largest number of instruments was conducted by Oxtoby et al. (2013), which employed seven subjective questionnaires to measure the participants' sleep quality.

In many studies, other aspects of participants' well-being were measured in addition to sleep quality. These aspects included: quality of life, depression, perception of stress and pain, and other areas (Beck et al., 2015; Blanaru et al., 2012; Bloch et al., 2010; Chang, Lai, Chen, Hsieh, & Lee, 2012; DuRousseau et al., 2011; Garunkstiene et al., 2014; Harmat, Takács, & Bódizs, 2008; Innes, Selfe, Khalsa, & Kandati, 2016; Liu et al., 2016).

Interventions

All 37 reviewed studies used receptive music interventions to examine the impact of music therapy/music on sleep quality. The details of the interventions used in each experiment differed on how the music was played or delivered, what kind of music was used, when and where the treatment was given, and the duration, frequency, and treatment period of each study. Non-music interventions were used in some of the research to compare to the effects of music, but only the music interventions were analyzed.

Music delivery method. Table 10 summarized how music therapy/music interventions were delivered. Most studies (35 out of 37 studies, 94.6 %) used only recorded music in the intervention. There was one study that used live music only (Garunkstiene et al., 2014) and one study that compared live and recorded music (Loewy et al., 2013) .

For the 36 studies that used recorded music (including the one that used both recorded music and live music), participants from 6 studies (16.7%) were provided headphones or earphones to listen to the music. In five of the studies (13.9%), participants listened to the music

through speakers. In one study, researchers used a music player (Maysound music player) that was specifically designed to be used in bed (Jespersen & Vuust, 2012). Twenty-four articles (66.7%) did not specify what device participants used to receive the music intervention. The researchers from two of the studies (5.6%) specified the loudness of the music during the intervention. In the two studies that used live music, music therapists sang and played instruments to deliver the music therapy interventions.

Table 10
Music Delivery Method of the Interventions

Type	Device	[Literature]
Recorded Music	Earphones/headphones	[11, 16, 22, 23, 29, 35]
	Speakers	[**8***, 27, 32, 36, **37**]
	Specially Designed Equipment	[4]
	Not specified	[1, 2, 3, **5**, 6, **7**, 9, 10, 12, 13, 14, 15*, 17, 18, 19, 21, 24, **25**, 26, 28, **30**, **31**, 33, 34]
Live Music	Sung by a music therapists	[**8**]
	Sung/Played by music therapists	[**20**]

* = loudness of music was specified

Genre. The music used in the reviewed articles came from a variety of music styles, which were classified in seven groups of genres, as shown in Table 11.

Table 11
Genre of Interventions

Genre	[Literature]
Brain Music	[24]
Culture/Religious	
Chinese	[11, 22*, 23*, 26*, **30***]
Buddhist	[9, 10]
Indian (*Raagas*)	[6, 35]
Turkish	[17, 27]
Composed for study	[2, 3, 13*, 15, **25**, 33*]
Lullaby	[**8**, 12, **20**, 28, **30***, **37**]
New Age	[4, 19, 23*, 36*]
Sedative/Not Specified	[1*, 13*, 16, 18, 22*, 29, **31**, 32, 33*, 34]
Western	
Classical	[1*, **5**, **7**, 14, 21, 22*, 23*, 26*, **30***, 36*]
Jazz	[22*, 23*, 36*]

* = studies used music from more than one genre.

The most commonly used genre of music was Western music, including "Classical" and "Jazz". These styles were used by 13 studies (35.1%). There were 11 experiments (29.7%) that used cultural/religious music, including Buddhist, Chinese, Indian, and Turkish music. Lullabies were used in six of the articles (16.2%). Researchers from four of the studies (10.8%) used New

Age music. In six of the studies (16.2%), the music used was composed for the experiment. In one study, researchers used "brain music". "Brain music" was referred to in the article as music that was created based on the EEG signals collected from participants' brains to optimize the relaxing effect (DuRousseau et al., 2011). There were 10 articles (27.0%) that either did not specify the type of music used or simply referred to it as "sedative music," which is not identifiable as a genre. Nine articles (24.3%) used music from multiple genres.

Intervention description. The details that each article provided about the music interventions used in the studies were scattered (see Table 12).

Table 12
Intervention Descriptions

Music Aspects Described	**[Literature]**	**Number (Percentage)**
Composer	[14, 16, 18, 19, 21, 36]	6 (16.2%)
Chord Progression	[3]	1 (2.7%)
Dynamics	[3, 4, 15, 26, 27]	5 (13.5%)
Instrument/Voice	[1, 2, 3, 4, 6, **8**, 10, 20, 22, 23, 24, **25**, 26, 33, 35, 36]	16 (43.2%)
Length	[1, 3, 4, **5**, 9, 10, 15, 21, 23, **30**, 36]	11 (29.7%)
Participants' Preference	[13, **20**]	2 (5.4%)
Rhythm	[8]	1 (2.7%)
Speed/Tempo	[2, 3, 4, **8**, 9, 10, 15, 22, 23, 26, 29, **30**]	12 (32.4%)
Structure	[3, 4, 16]	3 (8.1%)
Title of the music/album	[4, **7**, 9, 10, 11, 13, 14, 16, 17, 23, 28, 29, **30**, 32, 35, 36, **37**]	17 (45.9%)
Tonality	[2, 9, 10, 15, 17, **25**, 27, 33]	8 (21.6%)
No details	[12, **31**, 34]	3 (8.1%)

There were 17 articles (45.9%) that mentioned the title of the music or album that was used. Sixteen of the reviewed studies (43.2%) specified the instruments used in the recorded or live music. The most commonly used instruments were guitar, piano, and voice. There were 12 studies (32.4%) that described the speed and tempo of the music used. These studies usually used a tempo in the range of 50-80 bpm. Eleven of the articles (29.7%) mentioned the length of the music or the album the participants received. The lengths of the music interventions ranged from 10-58 minutes. There were eight studies (21.6%) that specified the tonality or scale of the music, five of which used a minor scale, one used a pentatonic scale, and two used three different Turkish scales (*Ussak, Hicaz* and *Zirefkend*). Six articles (16.2%) identified the composers of the music used. There was one article that provided very detailed information about the structure of the music, and another that provided a thorough description of the chord progressions. Two

articles (5.4%) encouraged participants to bring their own music, so details about the music those studies used is unknown. There were three articles (8.1%) that did not provide any specifics about the music that was used in the music intervention.

Music selection rationale. Some studies provided a reason for their music choices as shown in Table 13. Three articles (8.1%) chose music based on consultation with musicians. There were two studies (5.4%) that had the music evaluated by third parties, such as research assistants and students from a language school. The music from two studies (5.4%) was evaluated or confirmed by the participants before the study. For five of the studies (13.5%), the music was chosen based on previous research. Four of the experiments provided subjective reasons for their music selections, such as the music was calm, slow, and predictable (Beck et al., 2015), "all familiar and have a pleasant sound" (Chang et al., 2012, p. 923). Majority of the reviewed research (21 studies, 56.2%) provided no rationale for their music choices.

Table 13
Music Selection Rationale

Rationale	**[Literature]**	**Number (Percentage)**
Consulted musicians	[17, 26, 27]	3 (8.1%)
Evaluated by participants	[**7**, 14]	2 (5.4%)
Evaluated by third party	[1, 4]	2 (5.4%)
Previous studies	[16, 22, 23, **30**, 36]	5 (13.5%)
Subjective reasoning	[**5**, 13, 18, 29]	4 (10.8%)
Not specified	[2, 3, 6, **8**, 9, 10, 11, 12, 15, 19, **20**, 21, 24, **25**, 28, **31**, 32 ,33, 34, 35, **37**]	21 (56.8%)

Intervention schedule. The interventions in the reviewed studies were carried out at different times (see Table 14). Majority of the interventions from the studies were conducted at night, before bed (23, 61.2%). Two of the studies (5.4%) carried out their interventions at night and in the morning. One study (2.7%) conducted the intervention at naptime. Eleven studies (29.7%) did not specify when the interventions were given to participants.

Table 14
Intervention Schedule

Intervention Time	**[Literature]**	**Number (Percentage)**
Naptime	[**37**]	1 (2.7%)
Night (bed time)	[1, 2, 3, 4, 6, **7**, 9, 10, 12, 13, 14, 15, 16, 17, 18, **25**, 26, 27, 28, 29, **30**, 32, 36]	23 (61.2%)
Night and morning	[11, **31**]	2 (5.4%)
Not specified	[**5**, **8**, 19, **20**, 21, 22, 23, 24, 33, 34, 35]	11 (29.7%)

Treatment duration, frequency, and period. The duration, frequency, and treatment period of each intervention was examined. For some of the studies, especially where participants used the treatment at home without the researchers' supervision, the duration was a recommendation, rather an accurate measurement of how long the treatment lasted. A large range of treatment durations was found among the studies. The shortest treatment was 10 minutes (Loewy et al., 2005). The longest intervention was 4 hours (Lafçi & Öztunç, 2015). Eighteen of the articles (48.6%) used interventions that lasted between 31 and 60 minutes. Eleven studies (29.7%) used treatments that were 16-30 minutes long. Five articles (13.5%) did not provide information about how long each treatment lasted.

To analyze the amount of interventions the participants received in each study, the number of interventions was calculated by using the treatment frequency and entire period of treatment. For example, if an intervention was received daily for 4 weeks, the number of interventions was 28. The results showed a variety of the number of treatments. Five studies (13.5%) offered the treatment only once. The highest number of treatments was 90 (Q. Wang, Chair, Wong, & Li, 2016). Three articles (8.1%) provided no information on the number of treatments. The number of treatments was combined with the duration of treatment in Table 15 to summarize the duration, frequency, and treatment period of each intervention.

Table 15

Duration, Frequency, and Treatment Period of Each Intervention

Duration / # Treatments	1-15 mins	16-30 mins	31-60 mins	60+ mins	Not specified
1		[10, 36]	[15, **25**]		[32]
2-5		[**8**, 9, 11, 22, **37**]	[13, 18]		
6-10	[**20**]		[2, 3, 23, 28, 33]	[27]	
11-20		[1, **30**]			
21-40		[12, 35]	[4, 6, **7**, 14, 16, 17, 19, **31**]		[29]
40-100	[21]		[26]		
Not specified					[**5**, 24, 34]

Results Identified in the Literature

The results of the reviewed articles were summarized and categorized into five groups, as shown in table 16. Five articles had multiple results and were included in two categories. Thirty studies found a significant positive influence of music therapy/music on the sleep quality of a variety of populations, such as breast cancer patients (Lafçi & Öztunç, 2015), burn unit patients

(Ardabili, Abdi, Ghezeljeh, Hosseini, & Teymoori, 2016), cardiac patients (Hu, Jiang, Hegadoren, & Zhang, 2015; Ryu et al., 2012), children with special needs (Gonzales, 2013), fibromyalgia (Picard et al., 2014), first responders (DuRousseau et al., 2011), people with PTSD (Blanaru et al., 2012), people in the ICU (Su et al., 2013), people with depression (Deshmukh et al., 2009), people with schizophrenia (Bloch et al., 2010), pregnant women (Liu et al., 2016; Shobeiri, Khaledi, Masoumi, & Roshanaei, 2016), premature infants (Loewy et al., 2005), seniors with cognitive decline (Innes et al., 2016), seniors with insomnia (Chang et al., 2012; Huang, Chang, & Lai, 2016; Street et al., 2014; Q. Wang et al., 2016; Ziv et al., 2008), seniors with no sleep problems (Altan Sarikaya & Oguz, 2016; Chan et al., 2010; Hemavathy & Muthamizh Selvan, 2016; Shum, Taylor, Thayala, & Chan, 2014), traumatized refugees (Jespersen & Vuust, 2012), young adults with poor sleep quality (Chen et al., 2014; Harmat et al., 2008), and young adults with no sleep problems (Sharma & Sharma, 2015).

Table 16

Result Categories

Result Categories	**[literature]**
Significant positive effect of music on sleep quality	[2*, 3, 4, 6*, 8*, 9*, 11, 12, 13, 14, 15, 16, 17, 18, 19, **20**, 21*, 22, 23, 24, **25**, 26, 27, 28, 29, **30**, **31***, 33*, 34, 35]
Non-significant positive effect of music on sleep quality	[1, **5**, 10]
Music compared to other treatments on sleep quality	[2*, 6*, 9*, 21*, **31***, 33*]
No effect of music on sleep quality	[7, 32, 36, **37**]
Live vs. recorded music on sleep quality	[**8***]

* = studies with results that fit into multiple categories

Three studies had positive but non-significant results. Oxtoby et al. (2013) found that listening to relaxing music had significant positive impact on insomnia-related thoughts and behaviours, but a non-significant effect on the actual sleep quality, for young adults with and without sleep problems. Beck, Hansen, & Gold (2015) reported a positive but not significant effect of GIM on the sleep quality of stressed adults. Lai et al. (2015) found watching music video allowed seniors with insomnia to fall asleep faster, but did not significantly improve their sleep quality.

Six articles compared the effect of music therapy/music and other treatments on sleep quality. Ziv et al. (2008) found music was more efficient than progressive muscular relaxation at improving the sleep quality of seniors. Deshmukh et al. (2009) compared the effect of music and antidepressants on the sleep quality of patients with depression and found the music intervention

they used could be as effective as 10 mg of Chlordiazepoxide or 7 mg of Diazepam. Huang et al. (2016) discovered that listening to soothing music had a stronger effect than brisk walking on reducing the wake time after sleep onset of seniors with insomnia. Innes et al. (2016) found that music listening and meditation had equally positive impacts on the sleep quality of seniors with cognitive decline. Mottaghi et al. (2015) suggested that combining music therapy and cognitive-behavioural therapy (CBT) was more effective at reducing seniors' insomnia symptoms than just CBT. Blanaru et al. (2012) found music relaxation was significantly better than muscle relaxation at improving sleep quality both objectively and subjectively in people with PTSD.

The results of four studies indicated that music therapy had no influence on sleep quality. Koenig et al. (2013) and Lazic and Ogilvie (2007) discovered that music had no effect on improving the sleep quality of young adults with no sleep disorders. Kolesnik (2014) found that music had no significant effect on improving the sleep quality of adults with poor sleep quality. Patterson (2011) discovered that there were no significant differences in using music or rain sounds to help preschoolers sleep during naptime.

One article compared the effect of different types of music therapy interventions on sleep quality. Garunkstiene et al. (2014) examined premature infant's sleep quality under live and recorded lullaby conditions. The results showed that, although both live and recorded lullaby helped infants sleep better, babies had significantly deeper sleep when listening to live lullabies sung by a music therapist than listening to lullabies recorded by the same person.

Chapter 5

The purpose of this research was to systematically review the existing literature about the effect of music on sleep quality in order to explore and organize the research that has been done. It was hoped that this review might serve in the future as a guide for music therapists in "arts in health" clinician and consultant roles when assisting other professionals to work on clients' sleep quality issues. Following the analysis and report of the results in Chapter 4, this final chapter summarizes the outcomes of the current study, answers the research questions, and discusses the limitations of the review process. Throughout the chapter, the researcher shares his considerations for the roles music therapists can play in clinical practice and future research.

Overview of the Reviewed Literature

In this thesis, the researcher identified and reviewed 35 journal articles and 2 master's theses from the past 10 years (2007-2016). Throughout the 10 years, the number of published studies increased from one in 2007 to eight in 2016. These studies were from diverse publishing venues, including journals from the field of nursing, music therapy, complementary medicine, etc., and were carried out across four continents in 15 different countries, including Australia, Canada, China, India, Turkey, and the United States. Participants numbered 1,500 from 15 clinical populations, including people with insomnia, cardiac patients, pregnant women, premature infant, etc., and 344 participants from 3 non-clinical populations (i.e., children, young adults, and seniors) were involved in the reviewed studies.

The research designs were varied; some studies used simple conditions with one to three groups, either assigned or randomized; some used two crossover conditions with one or two groups. The experimental groups covered interventions such as listening to live or recorded music, watching music videos, having modified GIM sessions, and a combination of music and sleep hygiene education. The control conditions included no treatment and other interventions such as, antidepressants, muscle relaxation, meditation, and brisk walking.

Most of the interventions used recorded music, and two of the studies included live music as an intervention as well. A broad range of types of music were used, including music from different cultures and religions (Buddhist, Chinese, Indian, and Turkish), Western Classical and Jazz music, music composed for the studies, etc. Although the majority of the interventions were given to the participants at night, before bedtime, some participants received treatment at naptime or both at night and in the morning. The amount of treatment participants received

varied from once for 30 minutes to 30-45 minutes daily for 3 months. To evaluate sleep quality, the reviewed studies used various measurement tools. The studies used both objective measurements, such as polysomnographic data and physiological responses, and subjective measurement tools, such as 10 different standardized sleep quality questionnaires, sleep quality questionnaires designed by the researchers, and sleep journals written by the participants. The PSQI, as the most popular sleep quality evaluation instrument, was used by 23 studies.

The reviewed studies had mixed results regarding the effect of music therapy/music on sleep quality, including significant positive results (30 studies, 81.1%), non-significant positive results (3 studies, 8.1%), and the music had no effect on quality of sleep (4 studies, 10.8%). There were also six studies that compared music to other interventions and one study that compared the influence of live and recorded music on sleep quality.

Can Music Therapy/Music Improve Sleep Quality?

The reviewed literature examined the impact of music therapy/music on sleep quality for patients/participants from various clinical populations. Researchers from numerous backgrounds showed their growing interest in using music therapy/music interventions to help people with different needs to improve their sleep quality, which immensely contributes to their overall well-being.

Insomnia. Unsurprisingly, people with insomnia or poor sleep quality were the most explored population. The results of the studies that used people with insomnia as participants were mixed. Five studies showed that music therapy/music can have a significant positive impact on the sleep quality of young adults (Chen et al., 2014; Harmat et al., 2008), adults (Chang et al., 2012; Street et al., 2014), and seniors (Q. Wang et al., 2016) with insomnia or poor sleep quality. These studies can be used as an example for music therapists to follow when designing interventions to help clients with sleep problems.

To examine the strength of the effect of music therapy/music on sleep quality, researchers also compared music interventions with other well-documented treatments (Huang et al., 2016; Ziv et al., 2008). Ziv et al. (2008) found that music relaxation was more useful for helping participants sleep than muscle relaxation. The researchers found that unlike the progressive muscle relaxation intervention, the music listening intervention did not interfere with participants' sleep quality. Huang et al. (2016) found that brisk walking and listening to soothing music both

had significant positive effects on sleep onset latency, but only music had a significant effect on shortening the wake after sleep onset.

Two studies explored the possibility of combining music listening with other interventions to help clients with their sleep issues (Lai et al., 2015; Mottaghi et al., 2015). Mottaghi et al. (2015) found the combination of music listening and CBT had significantly more influence on participants' sleep quality then using only CBT as an intervention. Lai et al. (2015) investigated the effect of watching music videos as an intervention on sleep quality. The researchers reported that listening to music while watching nature scenes with writings from Buddhist teachings had a positive but non-significant effect on the sleep quality of older adults with insomnia. These studies showed that when treating clients with insomnia or poor sleep quality, music does not need to be the only intervention to be effective; it can be used as a complement to other treatments.

Kolesnik (2014) explored whether music listening can improve clients' sleep quality on their first night in a sleep lab. The polysomnographic results suggested no difference in the sleep quality changes between the experimental and control groups. Considering the participants received music for only one night, the study did not eliminate the possibility that music could help clients sleep better if a longer intervention period were applied. This is consistent with Wang et al.'s (2014) finding that when treating patients with insomnia, the effect of music on sleep quality may not be apparent if the music treatment was used for a period of less than three weeks.

Other clinical populations. In other clinical populations, sleep quality may not be the main concern, but it can be an important part of helping individuals with various problems heal or cope with their disorders.

Seventeen studies reported significant positive results of using music interventions to aid in improving the sleep quality of people from 13 different clinical populations, including people with breast cancer (Lafçi & Öztunç, 2015), depression (Deshmukh et al., 2009), fibromyalgia (Picard et al., 2014), PTSD (Blanaru et al., 2012; Jespersen & Vuust, 2012), and schizophrenia (Bloch et al., 2010); cardiac patients (Hu et al., 2015; Ryu et al., 2012), children with special needs (Gonzales, 2013), first responders (DuRousseau et al., 2011), patients in a burn unit (Ardabili et al., 2016), patients in the ICU (Su et al., 2013), pregnant women (Liu et al., 2016; Shobeiri et al., 2016), premature infants (Garunkstiene et al., 2014; Loewy et al., 2013), and

seniors with cognitive decline (Innes et al., 2016). Compared to the studies that focused on people with insomnia, the number of experiments that studied each of these clinical populations is small. However, the significant results provide strong evidence for clinicians to consider music therapy/music interventions when sleep quality is vital for the healing process of patients from the clinical populations mentioned previously, as well as others.

As researchers did for people with insomnia or poor sleep quality, three studies went deeper and compared the effect of music interventions and other treatments. Deshmukh et al. (2009) compared music listening and antidepressants and showed that the impact of listening to *Raagas* for an hour before bed and taking 10 mg of Chlordiazepoxide or 7 mg of Diazepam on the sleep quality of adults with depression was equal. Blanaru et al. (2012) reported that music relaxation had a stronger effect on improving the sleep quality of individuals with PTSD and suggested that individuals with PTSD can use music relaxation at bedtime to treat insomnia. Innes et al. (2016) conducted a randomized controlled trial to examine and compare various effects of listening to classical relaxation music and meditation on the sleep quality of seniors with cognitive decline. The results showed that, although the meditation group seemed to improve more on mood, sleep, and quality of life, the sleep quality of the music listening group also improved significantly. Patients from various clinical populations have different needs and reasons for having sleep problems. So comparing the effects of music interventions on sleep quality with how sleep quality can be affected by pharmaceuticals and other interventions is essential to help clinicians choose the best options for their patients. Current research in this area is limited to certain clinical populations, so more studies need to be done to expand the pool of knowledge and so more patients from a wider range of clinical populations can benefit.

The only research that did not report a significant effect of a music intervention on the sleep quality of a clinical population was Beck et al.'s (2015) study, which looked at the effect of using GIM to cope with work-related stress. Sleep quality, as one of the indicators of stress, was not the only focus of this study. One possible reason that no significant effect on sleep quality was found is that the participants may not have received the GIM sessions in the evening or at bedtime (it was not mentioned in the article). However, positive changes on participants' sleep quality, although not significant, were still detected through analyzing participants' sleep journals and a sleep quality questionnaire designed for the study.

Non-clinical populations. Not only people with insomnia and other clinical issues need their sleep quality improved; people without specific medical concerns may also benefit from better sleep quality. Of the reviewed studies about the impact of music therapy/music on sleep quality, nine used participants from non-clinical populations.

Four articles evaluated the effect of listening to music on the sleep quality of seniors both in nursing homes (Altan Sarikaya & Oguz, 2016; Chan et al., 2010; Hemavathy & Muthamizh Selvan, 2016) and in the community (Shum et al., 2014). They all found music had a significant positive impact on the seniors' quality of sleep. Four studies looked at how music affects non-clinical young adults' sleep quality (Koenig et al., 2013; Lazic & Ogilvie, 2007; Oxtoby et al., 2013; Sharma & Sharma, 2015) and found mixed results. Sharma and Sharma (2015) showed that listening to sedative music resulted in significantly positive changes on the sleep quality of the Indian university students who participated in the study. Oxtoby et al. (2013) looked at the impact of music listening on sleep quality as well as a range of thought and behavioural factors that may affect the sleep quality of university students, such as stress, anxiety, and pre-sleep arousal. Although the results did not reveal significant differences between the music and control groups on sleep quality, most factors that theoretically influence sleep quality were significantly improved in the music listening group (Oxtoby et al., 2013). Koenig et al. (2013) and Lazic and Ogilvie (2007) examined the impact of music listening on normal-sleeping young adults' sleep quality through analyzing participants' sleep journals and PSQI answers (Koenig et al., 2013); and polysomnographic data (Lazic & Ogilvie, 2007). Both studies found that listening to music did not significantly change normal-sleeping young adults' sleep quality either positively or negatively (Koenig et al., 2013; Lazic & Ogilvie, 2007).

Patterson (2011) compared the effect of listening to lullaby music and rain sounds on helping children in a daycare sleep during naptime. She found that although children seemed to fall asleep faster in the rain sounds condition, neither listening to lullabies nor rain sounds had a significant impact on the children's sleep (Patterson, 2011). However, the intervention was given only three times for 20 minutes each.

Based on the reviewed studies, seniors can benefit from the effects of music listening on sleep quality more than young adults and children. This could be because, although seniors may not be diagnosed with insomnia or other sleep disorders, they may tend to have lower sleep quality than young adults and children, so they may have more room for improvement. More

research needs to be done to explore the effects of music on the sleep quality of non-clinical populations of different ages to provide clearer and more reliable guidelines for clinicians, consultants, and individuals who want to optimize their own sleep quality.

What Music Therapy/Music Interventions Can Be Used to Improve Sleep Quality?

To be able to use music to help clients improve their sleep quality, clinicians and consultants need to know how to select music therapy/music interventions that are effective for a certain populations. The reviewed literature provided rich resources and ideas for what interventions can be used to improve sleep quality. In all of the reviewed studies, researchers used receptive music interventions. This makes sense because the purpose of the music is to calm and relax participants rather than engage them in the music making process, which usually requires active physical and mental involvement. The types of music used in the reviewed literature were diverse.

Cultural and religious music. In many studies, researchers used music with a strong cultural style that matched participants' background or religious music resonated with participants' beliefs to help them sleep better. Hu et al. (2015) used Classical Chinese music to treat cardiac patients in China. Huang et al. (2016) and Lai et al. (2015) used Buddhist music and songs to improve the sleep quality of older adults with insomnia in China. Deshmukh et al. (2009) and Sharma and Sharma (2015) used *Raagas* played on flute to help Indian adults with depression (Deshmukh et al., 2009) and young Indian adults with no health problems (Sharma & Sharma, 2015) have a higher quality of sleep. Altan Sarikaya and Oguz (2016) and Lafçi and Öztunç (2015) employed Turkish music in different tonalities, *Ussak* (Altan Sarikaya & Oguz, 2016), and *Hicaz* and *Zirefkend* (Lafçi & Öztunç, 2015), to help seniors (Altan Sarikaya & Oguz, 2016) and breast cancer patients (Lafçi & Öztunç, 2015) from Turkey. Studies that used only Western music included Oxtoby et al. (2013) from Australia, Beck et al. (2015) from Denmark, Koenig et al. (2013) from Germany, Harmat et al., (2008) from Hungary, Innes et al. (2016) and Kolesnik (2014) from the United States. Chan et al. (2010), Liu et al. (2016), Shum et al. (2014), and Wang et al. (2016) used a combination of Chinese and Western music as the intervention to treat Chinese clients. This may be because the Chinese participants are familiar with both styles of music.

All the studies that used cultural and religious music had adults as participants. This may indicate that familiarity is an important factor to consider when choosing music for a sleep-

inducing intervention. The clients' cultural and religious backgrounds should be carefully explored and considered before a clinician designs interventions to help improve their sleep quality.

Lullaby. Lullaby, as specific genre normally created for inducing sleep, was used by six of the reviewed articles (Garunkstiene et al., 2014; Gonzales, 2013; Liu et al., 2016; Loewy et al., 2013; Patterson, 2011; Street et al., 2014). Garunkstiene et al. (2014) and Loewy et al. (2013) used lullabies to improve the sleep quality of premature infants. Gonzales (2013) used lullabies to increase children with special needs' quality of sleep. Patterson (2011) compared the effect of lullabies and rain sounds on the sleep quality of children in a daycare during naptime. Street et al. (2014) found that an arrangement of lullabies and heartbeat sounds can help adults with insomnia have a higher quality of sleep. Liu et al. (2016) used a variety of musical styles including lullabies to improve the sleep quality of pregnant women.

All the reviewed studies that involved infants or children as participants used lullabies as the music intervention. This indicates that lullabies can be effective for helping children sleep. As suggested by Liu et al. (2016) and Street et al. (2014), the sleep quality of other populations may benefit from the use of lullabies as a music intervention as well. More research needs to be done to examine this thoroughly.

Other genres. Other genres such as New Age music (Jespersen & Vuust, 2012; Kolesnik, 2014; Shobeiri et al., 2016; Shum et al., 2014) and sedative music (Chang et al., 2012; Oxtoby et al., 2013; Ryu et al., 2012) were also used in the reviewed articles. Although the definition of these music genres are not very specific, they often have similar objective musical characteristics to music from other genres that were used in other studies, such as, slow tempo and smooth melody with a limited range of pitch and dynamics. Therefore, when clinicians look for music to use in interventions for improving sleep quality, looking at the objective characteristics of the music, such as tempo, dynamics, tonality, and the complexity of the melody, harmonies, and structure, may be more informative than merely choosing music based on the genre. These features can also be used as guidelines for composing or improvising music to help increase clients' quality of sleep as did Bloch et al. (2010), Su et al. (2013), and Ziv et al. (2008).

Brain music. DuRousseau et al. (2011) evaluated the effect of brain music and reported that brain music significantly improved first responders' sleep quality. Brain music is a type of electronic music generated with the EEG signals of one's brain waves. Brain music was first

proposed by Levine, Gavrilov, Goldstein, and Dallakian (1991) as a new treatment for insomnia, anxiety, and depression. With the development of neuroscience and computer science, the equipment for generating brain music is more advanced and affordable. For clinicians to apply this high-tech tool for treating insomnia in practice, more research needs to be done to reveal the mechanism, composing process, and effects of brain music on sleep quality.

Live versus recorded music. Majority of the studies used recorded music but two music therapy studies played live music as an intervention (Garunkstiene et al., 2014; Loewy et al., 2013). The clinical population of the participants in both studies was premature infants (Garunkstiene et al., 2014; Loewy et al., 2013). Loewy et al. (2013) reported that live music therapy interventions had a significant impact on the sleep patterns of the premature infants. Garunkstiene et al. (2014) compared the effects of live and recorded music on the sleep quality of premature infants. The recorded music and live music used the same lullabies from different cultures. The same music therapist who conducted the live music intervention made the recording to isolate the independent variable, which was live versus recorded music. The researchers found that live music was more successful at enhancing the babies' sleep quality (Garunkstiene et al., 2014). This leads to the question: other than with premature infants, would live music also be more efficient for improving adults' sleep quality and the sleep quality of clients from other clinical and non-clinical populations?

Loewy et al. (2013) compared three different live music interventions, one vocal and two instrumental: sung lullabies, an ocean disc, and a gato box. The result showed that ocean disc had the most impact on improving premature infants' sleep quality. Along with Garunkstiene et al. (2014), researchers in both studies used relatively simple music with less complex arrangement and fewer instruments. This may be due to the nature of the infant population or the practicality of playing this music in a live setting. Unlike recorded music, live music, as a therapy intervention, has limited choices in terms genre, arrangement, duration, etc. This leads to another question, is some live music more effective and practical than others? More studies need to be done to answer these questions and to expand knowledge on the effect of live and recorded music on people's sleep quality.

Role of Music Therapy

The reviewed articles provided evidence from the perspectives of many disciplines that music therapy/music interventions can help enhance the sleep quality of a variety of clinical and

non-clinical populations. However, the literature was scattered because the results were mixed, the descriptions of the interventions were sometimes unclear, the rationale for music choices was often not provided, and the understanding of music therapy as a credentialed profession was lacking. Music therapy, as a profession that is specialized in using music to aid individuals in helping with their health issues and enhancing their overall well-being, can play a crucial role in helping to bridge the gap. Music therapists who are interested in helping clients with sleep issues could be involved in this interdisciplinary dialogue as researchers, clinicians, and consultants.

Implications for researchers. Although music therapists were involved only in a small proportion of the reviewed articles, their unique and crucial contributions to the field were significant. As researchers, music therapists have explored the effect of using music interventions to improve the sleep quality of different populations (Beck et al., 2015; Koenig et al., 2013; Liu et al., 2016; Mottaghi et al., 2015; Patterson, 2011) and worked towards optimizing different music therapy interventions (Loewy et al., 2013). To continue the mission of enriching the knowledge pool of music therapy/music and sleep quality, music therapists could continue investigating different populations that may benefit from enhanced sleep quality, optimizing music therapy interventions to find the best treatment for clients with different needs and health concerns, and compare the effect of music interventions and other treatments, both pharmacological and complementary, to evaluate the power of music therapy/music on sleep quality. It will also be important for music therapists to communicate with other professionals working in this field to clarify the concept of music therapy, to provide musical and music therapy expertise, and to gain knowledge from other disciplines.

Implications for clinicians. The reviewed literature may inspire music therapists to be aware of clients' needs related to their sleep quality and possibility of setting sleep quality improvement as a treatment goal for overall well-being. Credentialed music therapists composed and recorded the music intervention for the Chen et al.'s (2014) study with young adults. Garunkstiene et al. (2014) and Loewy et al. (2013) showed the benefit of using live music to improve premature infants' sleep quality. As previously discussed, other populations who have problems with sleep may benefit from live music as well. Using live music therapeutically requires the presence of a credentialed music therapist, which could create job opportunities for music therapists.

Implications for consultants. The reviewed studies showed a large demand for non-music therapy clinicians to use recorded music to improve the sleep quality of clients from various populations (Beck et al., 2015; Garunkstiene et al., 2014; Koenig et al., 2013; Liu et al., 2016; Mottaghi et al., 2015; Patterson, 2011). It was also reported that people can use receptive music interventions at home to help themselves sleep better (Deshmukh et al., 2009; Huang et al., 2016; Jespersen & Vuust, 2012; Ziv et al., 2008). However, many researchers consulted musicians instead of music therapists to provide guidance on the music selection (Altan Sarikaya & Oguz, 2016; Lafçi & Öztunç, 2015). Only a few researchers showed awareness of the need to consult a professional music therapist to decide what music they should use in the music intervention (Wang et al., 2016). Because of the lack of communication between music therapists and non-music therapy professionals and the lack of availability of music therapists in some regions, not all the clinicians have access to a music therapy consultant, and perhaps not many music therapists are aware of the opportunity to offer consultation to suggest music to improve sleep quality. To fill this void, music therapists could pay attention to the opportunities to engage with professionals from other disciplines and advertise their services as consultants for music interventions for sleep quality. Music therapists could also work together to create recorded music listening programs to help clients from different clinical populations and age groups to improve sleep quality.

Study Limitations

There are several limitations to be addressed in this study. Firstly, the reviewed articles were limited to those written in English and between January 2007 and December 2016. There may have been relevant studies published in different languages or before or after the given time period, but they could not be included. Secondly, the researcher was trained in Canada and has a Chinese background, so he has limited knowledge of music from other cultures, such as Indian and Turkish music, which may have led to a misunderstanding of the descriptions of the music interventions. Thirdly, the background of some of the authors of the reviewed studies was mentioned ambiguously, which made it difficult to determine whether some articles were music therapy articles. Fourth, many aspects of the studies were scattered, making conducting a meta-analysis a challenge. Finally, because of the time restrictions and the limited intellectual resources of only one researcher, errors in the analysis process may have been unavoidable.

Conclusion

As far as the researcher knows, this is the first systematic literature review on the effect of music therapy/music on sleep quality from a music therapy perspective. The reviewed studies revealed a growing interest in the impact of music on sleep quality. Research from the music therapy field and non-music therapy fields showed that music interventions can be used to enhance the sleep quality of various clinical and non-clinical populations. The comparison of the effect on sleep quality between music and non-music interventions and between live and recorded music were reviewed and synthesized. The results can be used as evidence of the efficacy of music interventions to treat sleep disorders. It is hoped that this review can serve as a guideline for music therapists entering the realm of working on sleep quality as researchers, clinicians, or consultants.

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