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Music Interventions for the Facilitation of Sleep in the Acute Geriatric Setting

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Music Interventions for the Facilitation of Sleep in the Acute Geriatric Setting

Abstract:

Sleep disturbance is a common problem experienced by older patients, especially in the acute care setting, and has detrimental effects on patients' health and recovery. There is a keen focus on non-pharmacological interventions because of the high risk of side effects related to pharmacotherapy. Music is safe and cost-effective, and there is a growing body of evidence for its potential health benefits.

The purpose of our study is to examine the impact of music listening interventions on the facilitation of sleep for patients admitted to the geriatric assessment unit (GAU).

We predict that a musical listening exercise will more effectively contribute to the facilitation of sleep compared to non-musical sounds and compared to standard of care on the GAU. We plan to conduct this study as a feasibility study. It will be a 3-arm randomized controlled trial where participants will be randomized to either: (1) music listening intervention, (2) non-musical sounds involving nature sounds, or (3) standard of care on the GAU. The intervention will take place over 7 consecutive nights.

The primary outcome will be sleep quality, which will be measured objectively using sleep logs and subjectively through patients' own perspectives of their sleep through the Insomnia Severity Index. Secondary outcomes will include patients' sleep quality assessed by smart watches, which we will evaluate to see if the data correlates to the sleep logs and patients' subjective view of their sleep. Other secondary outcomes will include patients' mood, level of pain, number medications used for sleep, duration of stay in hospital, patients' level of enjoyment of the music or non-musical sounds, and feasibility measures.

As this is a feasibility study, the goal is to show that it is possible to conduct a larger study with the same objectives and methodology. The ultimate goal is to create high-quality evidence to support (or refute) our hypothesis that music listening interventions are effective at facilitating sleep for patients admitted to the GAU. This would be a safe and cost-effective intervention to improve the health outcomes of this vulnerable population.

Background/literature review:

Impact of sleep disturbance in older adults

Sleep disturbance is a common problem experienced by older patients. In fact, epidemiological studies have demonstrated that the prevalence of insomnia symptoms in adults aged 65 and older approaches 50% [1]. Insomnia is defined as dissatisfaction with sleep quality and/or quantity, difficulty initiating sleep, difficulty maintaining sleep, waking up too early, and/or nonrestorative or poor sleep, with a negative impact on daytime functioning [2]. A study from 2017 based on a cohort of 2544 community dwelling adults showed that sleep quality generally decreases across the lifespan, most strongly for sleep efficiency defined as the amount of time actually asleep divided by the time spent in bed [3]. This study also showed that better self-reported sleep is associated with better mental, physical, and cognitive health outcomes [3].

Sleep in normal aging

Sleep is characterized by several sleep stages on a cycle that averages 90 minutes. Rapid eye movement (REM) and non-rapid eye movement (NREM) sleep are the two major sleep states. Brain activity that is similar to wake and a complete loss of skeletal muscle tone occur during REM sleep, and NREM sleep is divided into 3 stages: N1 (stage 1), N2 (stage 2), and N3 (stages 3 and 4), where N1 is considered light sleep and N3 considered deep sleep [4]. Sleep patterns change with age. As people age, they experience a decrease in sleep efficiency [4]. Furthermore, older people are more sensitive to external stimuli [5] and they more commonly have medical conditions and medications that also disrupt their sleep, such as medications that promote daytime sleepiness (anticholinergic agents, antihistamines, opioids, dopamine agonists, anticonvulsants), medications that activate the central nervous system (corticosteroids, methylphenidate, selegiline, activating antidepressants such as bupropion and venlafaxine), and medications that affect sleep architecture by other mechanisms such as beta-blockers which suppress

melatonin and increase sleep fragmentation, and other agents such as lithium and benzodiazepines which are associated with a worsening of disorders of non-REM parasomnias [6]. Older people spend more time in N1 (stage 1) of the sleep cycle, have a slightly decreased or unchanged duration of N2 (stage 2), and a significantly decreased duration of N3 (stages 3 and 4) [5]. There is no significant change in REM sleep, but this stage is reached faster because of the decreased duration of N3 [5]. Overall, sleep cycles are not as long in older patients, therefore leading to more brief periods of awakening [5]. These differences may be due to hormonal changes (levels of androgens, cortisol, and growth hormone) [7], and alterations in immunologic and inflammatory processes [8]. Older people also experience changes in their circadian rhythm where they tend to fall asleep earlier and wake up earlier in the day [8].

Sleep disturbance in the hospital setting

Sleep disturbance is even more prevalent for older patients who are hospitalized. A prospective observational study published in 2021 including patients aged 65 and older admitted to internal medicine wards showed that patients' sleep deteriorated within 1 week of their admission [9]. Specifically, sleep duration was significantly decreased during their hospitalization, going from 6.4 to 5.9 hours [9]. Hospital wards expose patients to disturbing environmental factors such as increased light, an unfamiliar bed, and increased noise [10]. In addition to these factors, patient factors such as pain and anxiety which are often associated with acute illness contribute to sleep disturbance in older inpatients [11]. Furthermore, frequent awakenings by care providers may also be necessary to complete medical care related tasks which further contribute to sleep disruption in the acute care setting [11]. Overall, an admission to hospital involves a significant change in patients' usual sleep hygiene routine and sleep patterns.

Sleep loss in the hospital has detrimental effects on patients' health and recovery and is associated with worse health outcomes, including an increased risk of delirium, cardiometabolic derangements such as high blood pressure and hyperglycemia, as well as the development of chronic insomnia after discharge [11]. In general, sleep disturbance also contributes to cognitive dysfunction, especially in the domains of

attention and working memory [12]. Interestingly, global cognitive decline was found in individuals with insufficient (≤ 4 hours per night) or excessive (≥ 10 hours per night) sleep duration in a pooled cohort study from 2020 [13]. Sleep disturbance also leads to increased falls [14], poor quality of life, emotional distress, and decline in physical function [15] which geriatric patients are already at risk for. The profound implications of sleep disruptions on the health and wellbeing of geriatric patients therefore warrants further research that aims to identify methods for improving sleep and quality of life.

Intervention for sleep disturbances

There is a keen focus on the use of non-pharmacological interventions for the facilitation of sleep in these vulnerable patients because of the high risk of side effects related to pharmacotherapy. Benzodiazepines are one of the most widely prescribed classes of medications for insomnia [16]. Their safety and efficacy are significantly restricted by the risk of development of tolerance and dependency with their long-term use [16]. They are also associated with long-term side effects and increased morbidity and mortality [16]. Long-acting benzodiazepines used long-term (>1 month) are listed as medications that should not be used in elderly patients according to geriatric clinical algorithms (e.g., STOPP/START criteria) due to their risk of prolonged sedation, confusion, impaired balance, and falls [17]. Furthermore, other agents, such as antihistamines, tricyclic antidepressants, antipsychotics, and anticholinergics for insomnia should also be avoided in elderly patients owing to their side effect profile [11, 18]. Finally, sedative medications are also used in patients with hyperactive delirium and behavioural symptoms of dementia which are both exacerbated by sleep disturbance. Therefore, if sleep can be improved by non-pharmacological interventions in these patients, this may prevent the excessive use of medications in these cases as well.

Use of music in the older adults

Music interventions are safe and cost-effective non-pharmacological tools for which there is a growing body of evidence for their potential health benefits in multiple domains. Studies with participatory musical interventions showed that there were multiple health benefits in geriatric patients. In a randomized

controlled study from 2014, patients with dementia were assigned to either singing coaching sessions with their caregivers consisting of vocal exercises and rhythmic movements to familiar songs, listening coaching groups with their caregivers consisting of listening to familiar songs, or usual care [19]. Both the singing and listening groups were shown to have improved mood and social benefits, as well as cognitive benefits, specifically orientation, remote episodic memory and to a lesser extent, attention, and executive function [19]. Singing also enhanced working memory and caregiver well-being, whereas music listening improved quality of life [19]. A study from 2015, conducted in elderly people in nursing homes, showed that using interactive music therapy lead by qualified music therapists, consisting of group singing, receptive music therapy, instrumental improvisation, dance/movement, and taking into account each individual's biography when choosing the songs, improved patients' mood by decreasing depressive symptoms, compared to recreational singing [20].

In addition to interactive musical interventions, passive listening interventions also have stress-reducing, relaxation, pain reduction, and overall mood benefits in geriatric patients. For example, intimate live music performances in nursing homes were shown to improve the quality of life of patients with dementia by improving human contact, communication, increasing positive emotions, decreasing negative emotions, and improving the relationship between the caregiver and receiver [21]. Furthermore, in a randomized controlled trial from 2017, patients admitted to the geriatric care unit who participated in a music listening session compared to a television watching session reported increased happiness, displayed increased pleasure, demonstrated increased levels of positive emotions and decreased levels of negative emotions [22]. These findings were noted within only a few minutes of a single music concert intervention on the geriatric care unit [22]. In addition, single-session music interventions (live active and passive music-based experiences) have appeared successful in increasing observed and self-reported pain control, physical comfort, and relaxation [23].

Furthermore, a Cochrane review from 2018 found moderate-quality evidence that for people with dementia who are in institutional care, at least 5 sessions of music interventions (either active or receptive to individuals or groups) reduce depressive symptoms and overall behavioural problems at the end of treatment [24]. A systematic review from 2020 found that music-related therapy reduced comorbid emotional disorders (depression and anxiety) for patients with dementia [25]. In patients with advanced dementia, weekly individual music therapy interventions in a home setting, consisting of elements of active music therapy (singing and instrumental improvisation) and receptive elements (listening to biographical relevant music), were shown to have a significant positive effect on patients' communication behaviour, situational well-being, and their expression of positive emotions [26]. Finally, a recent pilot randomized controlled trial performed in the intensive care unit suggested that relaxing slow-tempo music may reduce patients' number of delirium days [27].

Use of music for insomnia

Non-pharmacologic approaches to improve sleep and promote optimal sleep hygiene are needed for hospitalized patients, especially given the detrimental effects of sedative medications, as discussed above. The importance of sleep hygiene in hospitalized patients was emphasized by the American Academy of Nursing recommending against unnecessary interruptions of patients' sleep in the hospital [28]. Sleep hygiene interventions aim to minimize factors that can disturb and disrupt sleep, both in the environment and on a personal level [29], and music has been studied as part of sleep hygiene interventions.

For example, a study from 2021 examined a sleep hygiene intervention to improve sleep quality in hospitalized patients. The sleep hygiene bundle included relaxing music played for 5 minutes overhead in the hallway at bedtime, and other items such as turning off the lights, using an eye mask, earplugs, lavender scent pad and non-caffeinated tea [30]. It showed that these interventions produced modest improvements in patients' perceived sleep [30]. A systematic review from 2011 evaluating nursing interventions for promoting sleep in health care settings showed that the effects of getting a back

massage, acupuncture, listening to soothing music, listening to natural sounds, or watching music videos were considerable [29]. This systematic review included a study from 1992 showing that the use of ocean sounds played for 3 consecutive nights in post-operative coronary artery bypass graft patients after transfer from an intensive care unit improved patients' sleep quality [31], and a study from 1996 showing that watching a music video in post-operative coronary bypass graft patients significantly improved their sleep scores on the third morning [32].

The use of music for insomnia in adults who are not in acute care hospitals has been studied as well and may be effective. A Cochrane review from 2015 included 6 studies examining the effect of listening to pre-recorded music daily, for 25-60 minutes at bedtime in 4 of the studies (time of day not specified in 2 of the studies), for a period of 3 days to 5 weeks [33]. The results of random-effects meta-analysis revealed an effect in favour of music listening for improvement in sleep quality (assessed by the Pittsburgh Sleep Quality Index), qualified as moderate quality evidence by this Cochrane review [33]. Only one study reported data on sleep onset latency, total sleep time, sleep interruption, and sleep efficiency, using polysomnography [34]. However, this study did not find evidence that music improved these sleep outcomes [34]. But interestingly, it found that music prolonged REM sleep and shortened stage 2 of the sleep cycle [34].

The way music may affect sleep has been assessed in a literature review by Dickson in 2019. It found that there were 6 main hypotheses identified in the literature: "1) relaxation, where music encourages physiological or psychological relaxation; 2) distraction, where music acts as a focal point to distract from inner stressful thoughts; 3) entrainment, synchronization of biological rhythms to beat structures in music; 4) masking, obscuring noxious background noise with music; 5) enjoyment, listening to preferred, emotionally relatable or pleasant music; and 6) expectation, individuals cultural beliefs around music" [35]. With the *expectation* hypothesis, music, in effect, acts as a placebo rather than an active process (for example, an individual may find that music they believe to aid sleep is alone sufficient to improve their

sleep) [35]. Masking was identified as having support for improving sleep, relaxation, distraction, and enjoyment had mixed levels of support, expectation had possible support, and entertainment had mixed possible support [35].

The use of music listening interventions for the improvement of sleep quality specifically in older patients has been shown to be effective in two recent systematic reviews and meta-analyses [15, 36]. The systematic review by Chen 2021 included 5 studies of older patients in the community for whom the music interventions took place over weeks. It found that music is a safe and effective non-pharmacological intervention for improving the sleep quality of community-dwelling elderly people [15]. The systematic review by Wang in 2021 included 9 studies, 6 of which were included in the meta-analysis. The results of the post-hoc meta-analysis indicated that music interventions might have a positive effect on sleep quality, but that more randomized controlled trials are required [36].

To the best of our knowledge, there has not been a randomized controlled trial evaluating the effect of music listening on sleep quality in geriatric patients hospitalized in the acute care setting, nor have there been trials with carefully selected/controlled music stimuli. Therefore, there is still a need for more high-quality evidence to support how music interventions can effectively be used for the facilitation of sleep for geriatric patients hospitalized in the acute care setting, over a shorter period of time, and how this intervention could potentially improve other health outcomes in this vulnerable population.

Purpose:

The purpose of this study is to examine the impact of music listening interventions on the facilitation of sleep and the improvement of sleep quality for patients admitted to the geriatric assessment unit (GAU), as well as the feasibility of applying these interventions.

Hypothesis:

We predict that a musical listening exercise involving instrumental slow-tempo music (STM) will more effectively contribute to the facilitation of sleep compared to non-musical sounds (nature sounds) and compared to standard of care on the GAU which involves an adapted in-hospital approach to geriatric patients.

Study methods:

Study design:

We plan to conduct this study as a feasibility study. It will be a 3-arm randomized controlled trial where participants will be randomized to one of the three following groups: music listening intervention involving instrumental STM, non-musical sounds involving nature sounds, or standard of care on the GAU (control). The patients will be randomized in equal ratios to the 3 groups using a random number generator. Each intervention will take place over 7 consecutive nights. The music or non-musical sounds will be played throughout the whole night for each patient in those groups.

We note that patients' medical situation will likely change throughout their hospitalization stay and this may be a confounding factor affecting their sleep. We also note that patients may be discharged prior to completing the 7-day intervention.

Selection of music and non-musical sounds:

The music selected in our study will be pleasant instrumental STM in a major mode. It will also be low contrast (without periods of silence). The non-musical sounds will be low-contrast nature sounds such as waves. We plan to use non-musical sounds that align with the frequency range of the musical stimuli.

Study outcomes:

The primary outcome to be measured will be sleep quality. This will be measured objectively by sleep logs and subjectively through patients' own perspectives of their sleep.

Secondary outcomes will include patients' sleep quality assessed by smart watches. We will evaluate if the data from the smart watches correlates to patients' sleep log and to their subjective view of their sleep quality.

Other secondary outcomes will include the patients' mood (depression, anxiety), level of pain, the number medications used for sleep (PRNs and regular medications), and the duration of stay in hospital. Of note, as part of our study, we will not be administering any medications to the patients, and we do not expect there to be any alcohol use on the GAU. We will simply be taking note if the patients received any medications for the indication of facilitating their sleep, prescribed by their treating physician. On the GAU, the patients will be assessed daily their treating physician for their medical management.

We will also assess how much the participants enjoy listening to the selected music and non-musical sounds in our study throughout the intervention. We will not include the MMSE as part of our outcomes as it is often unreliable when patients are admitted to hospital with an acute illness and may not be at their cognitive baseline.

Other secondary outcomes will include feasibility measures: the number of participations and refusals, the number of eligible patients and exclusions, protocol adherence, the availability of the data, the time

needed to collect the data, the cost, and the standard deviation of the primary outcome measures to help estimate the sample size required to achieve sufficient statistical power in subsequent studies.

Study population:

This study will include patients admitted to the GAU at St. Mary's hospital in Montréal over the six-month study period (March to August 2022). As many of the patients admitted to the GAU have major neurocognitive disorder (MNCD), we will include them in our study (MNCD of any stage, including Alzheimer's disease). Furthermore, we will include patients who take medications for sleep in our study, and they will be randomized into the 3 groups like all the other participants. We will only include patients who accept to participate in the study with consent obtained either for the patient or from their substitute decision maker if they are deemed not capable of providing consent (to participate in this research project) themselves by their treating physician.

The patients' baseline characteristics will be noted upon entry into the study: admitting diagnosis, demographics (age, sex) and music sophistication. Patients' music sophistication will be evaluated using the General Musical Sophistication Subscale (GMSS) which is embedded within the Goldsmiths Musical Sophistication Index (Gold-MSI) and includes 18 items with excellent internal consistency (appendix 1) [37]. Furthermore, patients' normal sleep hygiene/routine will also be evaluated prior to the intervention specifically to see if they already listen to music or non-musical sounds before/while they sleep. Finally, as we will be including patients who use medications for sleep in our study, we will note what type of medication(s) the participants are taking. Specifically, we will categorize the medications in the following categories: benzodiazepines, antidepressants, antipsychotics, melatonin, or other; and we will note if the indication is specifically for sleep or not.

The following patients will be excluded from our study: patients who already listen to music or non-musical sounds as part of their sleep routine, those with medical instability which limits their ability to

participate in the study (determined by the patient's treating physician), those who have a diagnosis of a sleep disorder including obstructive sleep apnea and REM sleep behaviour disorder, and those who are unable to communicate in English or French. Furthermore, we will exclude patients with behavioural issues that limit their participation in the study; specifically, those that have agitation or hyperactivity that limits their compliance with the intervention as can be seen in cases of severe BPSD or hyperactive delirium. We will discuss with the treating physician to determine if the patient's behavioural issues would limit their ability to participate in the study and thus require exclusion from the study. Finally, we will also exclude patients with severe hearing impairment, specifically those for whom their hearing impairment affects their ability to communicate their consent for this study and to listen to music.

Recruitment and consent:

We will provide the triage questionnaire (which contains the inclusion/exclusion criteria) (appendix 2) to the treating physicians on the GAU at SMH to help them determine which patients would be appropriate for this study. We will ask the treating physician to inform the patient that there is a research project on music and sleep and ask the patient if they would be interested in hearing more. If the patient is interested, the treating physician will then inform the research team. The research assistants will then discuss with the treating physicians regarding if the patient is able to consent to the study or not. They will then know whether to seek consent directly from the patient or from their substitute decision maker. In all cases, the research assistant will then approach the patient to explain the research project in detail and confirm the patient's eligibility and interest to participate in the study.

If the patient is deemed eligible based on the inclusion and exclusion criteria, wishes to participate in the study, and deemed capable to consent by their treating physician, the research assistant will obtain the patient's consent directly from them and provide the consent form for them to sign. If the patient's physician had deemed that the patient does not have the capacity to consent, and the patient wishes to

participate in the study, the patient's substitute decision maker will be asked for consent on behalf of the patient. The consent will be done by the research assistants, not by the treating physician.

Data collection procedure:

The data on sleep quality will be collected via multiple measures:

Sleep logs will be used to clinically track patients' sleep (bedtime, sleep onset, wake time) (appendix 3). This information will be gathered by the research assistants from the nursing report in the morning after the night shift. The number and duration of naps that patients take during the day will also be tracked.

Subjective measures of sleep will be assessed via the Insomnia Severity Index (ISI) questionnaire (appendix 4) which will be administered to the patients daily. The ISI questions will be slightly modified so that the questions focus on patients' latest night of sleep, not on their sleep over the past 2 weeks, as this questionnaire will be administered daily. The ISI has been shown to be a reliable and valid tool as an outcome measure in insomnia treatment and research in older patients [38]. The ISI has been used in previous studies for older patients [39-41].

The patients will wear smart watches (Samsung Galaxy Fit2) at all times throughout the study period. The smart watches assess sleep quality by tracking a set of non-staging sleep parameters including total sleep time, sleep onset latency, wake after sleep onset, and sleep efficiency. Smart watches have shown good inter-test reliability (96-99%) when assessing sleep parameters in individual adults, and although more limited in comparison to laboratory-based polysomnography, smart watches can allow for the examination of changes within individual patients [42]. The data collected from the smart watches will be time stamped and extracted by the study investigator without any identifying information. We will assess if the data from the smart watches correlates to patients' sleep logs and their subjective view of their sleep quality.

The data on patients' mood will be assessed via visual analog mood scales of specifically 8 emotions: afraid, confused, sad, angry, energetic, tired, happy, and tense (appendix 5). These will be administered to the patients daily throughout the study period. Pain will also be assessed via a visual analog scale that the patients will be asked to answer daily (appendix 6). The data on the number of medications used for sleep (PRNs and regular medications) will be gathered at the nursing report in the morning after the night shift. The data on duration of stay in hospital will be gathered via chart review.

Furthermore, we will gather data on how much the patients enjoy the selected music and non-musical sounds in our study by asking them to rate their music enjoyment on a scale of 0 to 10 and by noting their qualitative comments on the music or non-musical sounds. These questions will be asked to the patients daily.

Data on protocol adherence, specifically whether the patients kept their headphones on throughout the night, or whether they turned the music off (by checking the mp3 player), will be gathered at the nursing report in the morning after the night shift. Furthermore, we plan to measure the noise present around the patients at night by placing a sound recorder at their bedside.

Lastly, we will note whether patients are in the bed next to the window in their hospital room (most rooms have double occupancy – bed A or B), to examine if light exposure may have had an impact on their sleep. We also recognize that light exposure will change over the 6-month study period as the seasons change and may impact patients' overall sleep quality.

The data collection will take place over the 6-month study period (March to August 2022) and will be put together for analysis over the following months. The data analysis will take place over the 4 months following the study period and will be completed by December 2022.

Sample size:

As this is a feasibility study, we aim to enroll around 50 participants in the study, estimating that 2 patients will be enrolled every week. This sample size estimation is based on previous similar studies. A randomized controlled trial conducted in 2017 in the same patient population, specifically patients admitted to the GAU at St. Mary's Hospital, included 36 patients [22]. This study examined the effect of music on patients' health, specifically their emotions and mobility [22]. Furthermore, most of the studies included in two recent systematic reviews and meta-analyses examining the impact of music for the improvement of sleep quality in older patients in the community had sample sizes mostly between 40 and 60 patients [15, 36].

A power calculation cannot be done as this is a feasibility study and there is too much patient heterogeneity with respect to medical and cognitive status to apply a power analysis from more homogenous study populations to the current study. We plan to use the results of this study to help determine the sample size required to achieve sufficient statistical power in a subsequent larger study with the same objectives and methodology.

Data analysis:

The participants' baseline characteristics will be summarized using means and standard deviations or frequencies and percentages, as appropriate. Between-group comparisons will be performed using unpaired sample t-test, Mann-Whitney, and/or Chi-square test, as appropriate. Multiple linear or logistic regression models will be used to identify whether the interventions influenced sleep outcomes. We will likely also utilize repeated-measure analysis of variance, to assess outcomes in our study.

Infection control:

Given the context of the ongoing COVID-19 pandemic, we will ensure infection control measures throughout our study. All equipment used in this study will be sanitized with Clorox between patients

(smart watches, headphones, mp3 players, and sound recorders). Standard infection control protocol on the GAU at St-Mary's Hospital will be followed by the study investigators and research assistants.

Feasibility of this study:

Dr. Sophia Mondestin, Geriatric Medicine Fellow at McGill University will be responsible for coordinating this project. She will oversee the recruitment process of the participants (detailed above) and the data collection for this study. Furthermore, 3 research assistants will be recruited to aid in enrolling patients and for data collection. The study will also require the necessary equipment including the smart watches, headphones, and music players. The study will be funded by the St. Mary's Hospital Foundation who will provide 15 000$.

Budget:

-Research assistants: Estimated work of 4 hours per day, 7 days per week. Salary 18$/hour.

Total cost 13 000$ for 6 months. The work will be divided between 3 research assistants.

-Equipment: Smart watches: 4 smart watches = 4 x 70$ = 280$ (+tax & shipping)

Headphones (sleep headbands) = 4 x 30$ = 120$ (+tax & shipping)

Bluetooth MP3 players = 4 x 40$ = 160$ (+tax & shipping)

Sound recorder = 4 x 40$ = 160$ (+tax & shipping)

-Total budget: 13 270$.

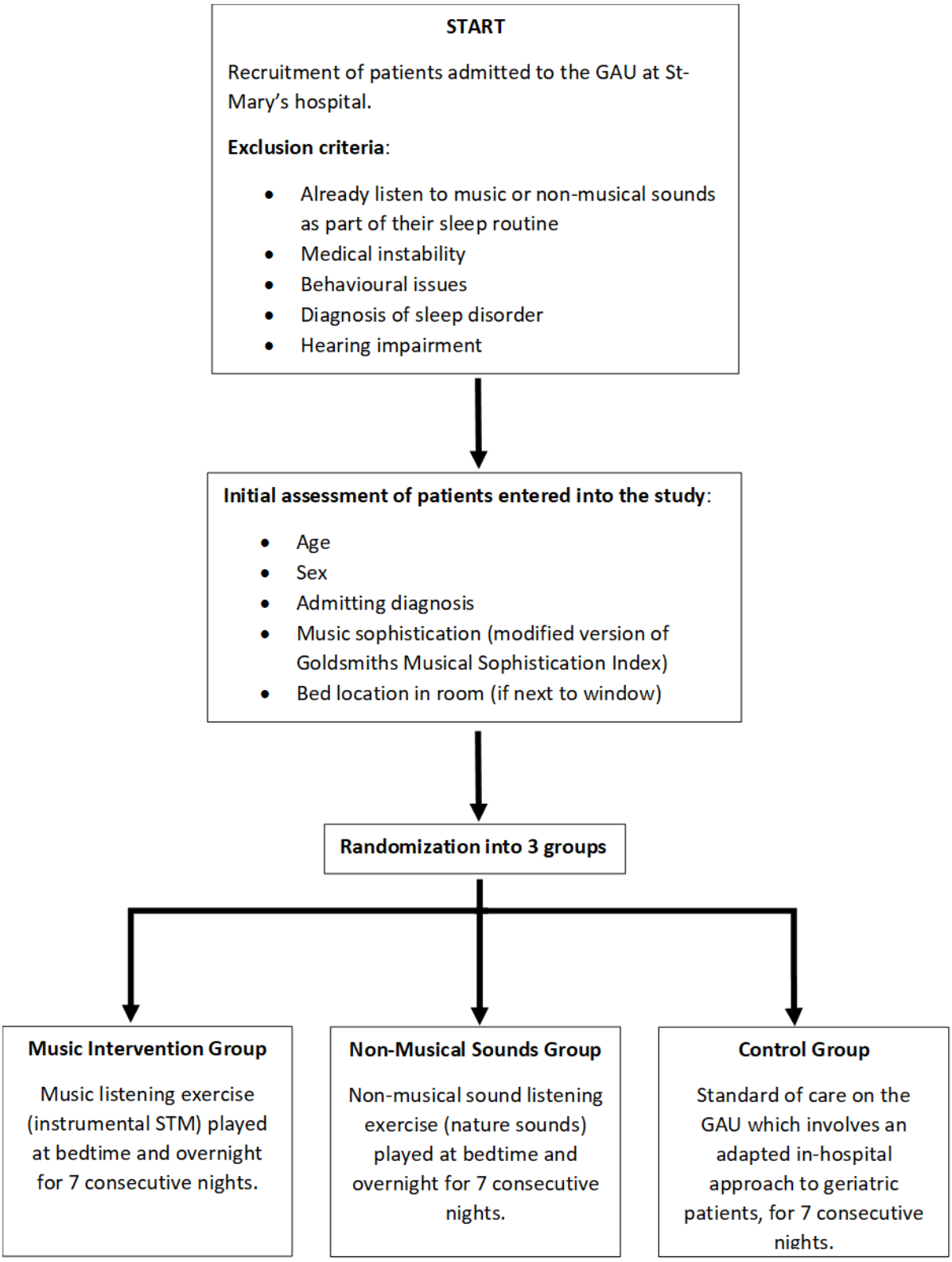
Dissemination plan:

We plan to publish a manuscript of our results in a suitable specialized journal. The results with also be presented as oral presentations at Medical Grands Rounds at St. Mary's Hospital and Geriatric Medicine Grand Rounds at the MUHC (McGill University Health Centre). Furthermore, the results will be presented at the AMGQ (Association des médecins gériatres du Québec) conference in May 2023.

Expected impact of findings:

As this is a feasibility study, the goal is to show that it is possible to conduct a larger study with the same objectives and methodology. The ultimate goal is to create high-quality evidence to support (or refute) our hypothesis that music listening interventions are effective at facilitating sleep for patients admitted to the GAU. This would be a safe and cost-effective intervention to improve the health outcomes of this vulnerable population.

Schematic flow of the methodology of the study:



Music Intervention Group	**Non-Musical Sounds Group**	**Control Group**
Daily administration: • Insomnia severity index questionnaire (ISI) • Visual analog mood scale (VAMS) • Visual analog pain scale • Questions on music enjoyment	Daily administration: • Insomnia severity index questionnaire (ISI) • Visual analog mood scale (VAMS) • Visual analog pain scale • Questions on enjoyment of non-musical sounds	Daily administration: • Insomnia severity index questionnaire (ISI) • Visual analog mood scale (VAMS) • Visual analog pain scale
Daily information from nursing report in AM: • Sleep log of the preceding night • Number and duration of naps during previous day • Medications used for sleep • Adherence to protocol: headphones on or off, and mp3 player turned on or off throughout night	Daily information from nursing report in AM: • Sleep log of the preceding night • Number and duration of naps during previous day • Medications used for sleep • Adherence to protocol: headphones on or off, and mp3 player turned on or off throughout night	Daily information from nursing report in AM: • Sleep log of the preceding night • Number and duration of naps during previous day • Medications used for sleep • Adherence to protocol: headphones on or off, and mp3 player turned on or off throughout night
Smart watch worn 24 hours/day, total 7 days	Smart watch worn 24 hours/day, total 7 days	Smart watch worn 24 hours/day, total 7 days
Sound recorder placed at bedside each night	Sound recorder placed at bedside each night	Sound recorder placed at bedside each night

Feasibility measures

- Number of participations and refusals
- Number of eligible patients and exclusions
- Protocol adherence
- Availability of the data
- Time needed to collect the data
- Cost
- Standard deviation of the primary outcome measures to help estimate future sample size

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Appendices

Appendix 1: General Musical Sophistication Subscale.

Appendix 2: Triage questionnaire.

Appendix 3: Sleep log.

Appendix 4: Insomnia Severity Index.

Appendix 5: Visual analog mood scale.

Appendix 6: Visual analog pain scale.