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Review Article

Music Therapy and Pain Management in Patients with End-Stage Liver Disease: An Evidence-Based Practice Quality Improvement Project



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ABSTRACT

Background: Pain can negatively affect the inpatient hospitalization experience; however, in patients with compromised metabolic pathways who are more vulnerable to medication side effects, pain control becomes even more challenging.

Aims: This evidence-based practice quality improvement project explored the feasibility of implementing a music therapy intervention for improved pain management (pain intensity, analgesic volume) and patient satisfaction among patients with a diagnosis of cirrhotic end-stage liver disease in the acute care setting.

Design: The plan–do–check–act cycle served as the implementation framework. Four nurse champions were trained to implement a 30-minute music intervention. Self-selected musical selections were delivered via unit-based iPads with earbud headphones during 3 consecutive days.

Methods: Data collection was performed using unit-based measures for pain and patient satisfaction and an investigator-developed audit tool. Bivariate analyses and descriptive statistics were used to assess the effect of the intervention on the three outcomes of interest.

Results: Overall results from data collected with eight participants during a 6-week period indicated a 10% reduction in pain intensity and a 30% improvement in patient satisfaction with pain management care.

Conclusions: Findings from this evidence-based practice quality improvement project provide support for the effectiveness of music therapy as an adjunct to traditional pharmacologic modalities for pain management of the end-stage liver disease patient population.

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Music as a therapeutic intervention has existed in various cultures for centuries. However, it was first used for pain management during the post–World War II era, with the Veterans Administration hospitals being among the first clinical facilities to use music therapy (MT) for the treatment of soldiers experiencing pain (Iribarren, Prolo, Neagos & Chiappelli, 2005; Yinger & Standley, 2011). Emerging evidence from numerous studies has also indicated the effectiveness of MT for control of acute and chronic pain and to decrease patient analgesia requirements (Bernatzky, Presch, Anderson, & Panksepp, 2011; Cepeda, Carr, Lau, & Alvarez, 2006; Cole & LoBiondo-Wood, 2014; Costa, Ockelford, & Hargreaves, 2018; Guetin et al., 2012; Huang, Good, & Zausznieski, 2010). Such benefits are especially promising for patients with disease states

leading to compromised metabolic pathways, including cirrhotic liver and end-stage liver disease (ESLD), especially given that inpatient admissions for these diagnoses total 700,000 of all annual hospitalizations (Kamath, 2017). Moreover, pharmacotherapy is often used as the standard in the pain management plan, despite well-documented adverse effects. To date there has been a paucity of evidence assessing the utility of nonpharmacologic modalities such as MT for improved pain control and decreased analgesia volume among patients with cirrhotic ESLD in the acute care setting. Hence, there is an urgent need to identify effective pain management interventions for this patient cohort (Allen & Kim, 2016).

The pharmacokinetics of analgesia are predominantly dependent on hepatic clearance, with low bioavailability in a normal healthy liver (Chandok & Watt, 2010). However, hepatic impairment can result in analgesia toxicity as a result of altered drug metabolism and subsequent increased drug bioavailability. This impaired state can cause complications such as hepatorenal

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syndrome, hepatic encephalopathy, gastrointestinal bleeding, and possibly death (Amarapurkar, 2011; Chandok & Watt, 2010; Dwyer, Jayasekera, & Nicoll, 2014). As a result, patients with impaired hepatic function are prescribed low levels of or infrequent analgesics to avoid adverse effects and fatal complications (Amarapurkar, 2011; Chandok & Watt, 2010; Dwyer et al., 2014). Front-line clinical nursing staff typically direct the pain management plan with limited options for cirrhotic ESLD patients. The lower dosing and infrequent prescribing of analgesics in this patient population can lead to inadequate pain control and negatively influence patients' satisfaction with pain management.

In addition to these physiologic adverse effects, other potential and detrimental effects of long-term opioid use are dependence, abuse, and fatal unintentional overdoses (Chou et al., 2015). This is a significant risk factor for cohorts with a history of addiction and substance abuse, such as patients with cirrhotic ESLD. Recent guidelines from the Agency for Healthcare Research and Quality (AHRQ, 2014) include recommendations for the use of MT as a complementary intervention for the treatment of pain. The National Institute on Drug Abuse (NIDA) also encourages the use of multimodal evidence-based strategies for pain relief that minimizes the risk of opioid abuse and its negative consequences and reduces suffering (NIDA, 2014). The use of a nonpharmacologic modality such as MT as a supplement to traditional pain management has the potential to facilitate optimum pain reduction, decrease extensive pharmacologic dependence, and improve patient satisfaction with pain management (Cole & LoBiondo-Wood, 2014; Yinger & Standley, 2011), thereby enhancing the quality of life for cirrhotic ESLD patients (Awikunprasert, Vogtaturapat, Li, & Sittipra-paporn, 2012). The objective of this evidence-based practice (EBP) quality improvement (QI) project is to assess the feasibility of MT on three specific outcomes: pain intensity, analgesic use, and patient satisfaction among in-patients with cirrhotic ESLD. EBP is defined as the judicious use of the best current research evidence integrated with clinical expertise and patient preference to promote individualization of care (Sackett, Rosenberg, Gray, Hayes, & Richardson, 1996).

Methods

Context

A quality assessment performed at the clinical agency identified the local problem, inadequate pain management and associated decreased patient satisfaction in patients with cirrhotic ESLD. A nonpharmacologic modality was sought because of this population's vulnerability to analgesia toxicity (Amarapurkar, 2011; Chandok & Watt, 2010; Dwyer et al., 2014). The SQUIRE (Standards for Quality Improvement Reporting Excellence) guidelines provided this EBP QI project's descriptive framework (Ogrinc et al., 2008). The Johns Hopkins Nursing Evidence-Based Practice model provided the conceptual framework with a problem-solving, clinical decision-making approach (Newhouse, 2007; Newhouse, Dearholt, Poe, Pugh, & White, 2007). The plan-do-check-act (PDCA) cycle (Langley, Nolan, Norman, Provost, & Nolan, 1996) served as the implementation framework, which allowed for the detailed assessment of administration, continuous refinement, and evaluation of intended outcomes of the intervention.

The EBP QI project was conducted on a 36-bed-capacity medical-surgical unit located within a large suburban academic medical center in the northeastern United States. Factors promoting this unit as a favorable setting conducive for the successful implementation of various QI projects include an organizational culture with a focus on EBP, emphasizing data-driven improvements within an environment of shared unit-level governance and

leadership that fosters the clinical development of the nursing staff. A team composed of three doctorally prepared nurses and a doctorate of nursing practice student conducted weekly meetings with the agency's patient care director to discuss the detailed importance of identifying a nonpharmacologic pain control intervention for the cirrhotic ESLD patient population on the unit. MT was considered a viable option by the leadership because the unit had recently acquired iPad and earbud headphones available for leisurely use at all patient bedsides. Planning involved an evidence-based review of the use of MT for pain reduction in a variety of patient care populations. Findings from the included studies of this review indicated the potential for MT to reduce pain intensity and analgesic use and to improve patient satisfaction with pain management among hospitalized patients experiencing acute and chronic pain (Cepeda et al., 2006; Cole & LoBiondo-Wood, 2014; Gooding, Swezey, & Zwischenberger, 2012; Yinger & Standley, 2011).

Stakeholder buy-in and participation for the intervention was promoted through a formal presentation to the unit nursing staff. Presentation content included a synthesis of the evidence-based review and the beneficial use of MT in the acute care setting, highlighting its potential to improve pain management among the cirrhotic ESLD patient population (Cepeda et al., 2006; Cole & LoBiondo-Wood, 2014; Guetin et al., 2012; Huang et al., 2010). Clinical nursing staff buy-in was a critical component for project implementation because the nurses would be administering the intervention and assisting in data collection. The presentation served to educate the nursing staff and to foster support and create a sense of urgency toward the focused goal of improving pain management care. Four day-shift nurse champions supported the EBP QI project and volunteered to administer the MT intervention.

Intervention

A teamwork approach was used in formulating the intervention protocol, which allowed for effective communication, diverse views, and strengths working toward a shared focused goal. This collaborative effort consisted of weekly meetings with the nurse champions to discuss and identify potential facilitators as well as challenges in implementing the protocol. The intervention protocol entailed administering self-selected music accessed via iPads and earbud headphones for 30-minute intervals daily over 3 consecutive days (similar to studies by Cepeda et al. [2006], Cole & LoBiondo-Wood [2014], and Huang et al. [2010]). The available music application offered the choice of a culturally relevant music selection for the predominantly Latino population served on this acute care unit. The inclusion criteria for this project were as follows: (1) English-speaking and 18 years of age and older, (2) current diagnosis of cirrhotic ESLD, (3) subjective pain intensity rated at or above a 3 on the numeric pain rating scale (Ferreira-Valente, et al., 2011) during the previous 4 hours, and (4) medical orders for "as needed" pain medication. Exclusion criteria were patients who were hearing impaired or mentally unstable (via score on the Mental Status Examination [MSE] [Synderman & Rovner, 2009]) and those with a diagnosis of hepatic encephalopathy (as identified from the medical record).

The implementation of the MT intervention was performed in conjunction with the current pain management protocol used on the acute care unit. A 1-hour training session was conducted with the nurse champions on participant recruitment, administration of the intervention protocol, data collection procedures, and use of the PDCA cycle to implement and refine the EBP QI project. A script was developed with the nurse champions to offer MT to the cirrhotic ESLD participants and served to inform patients about the intervention details, including maintenance of their current pain

medication regimen. During the project's implementation phase, challenges were identified in patient participation as a result of a low census volume. As a result, the project was extended from 4 to 6 weeks.

Measures

Measures for the EBP QI project were chosen based on tools presently in use on the unit. This helped to minimize the burden of training for the nurse champions and to enable ease of implementation, facilitating swift execution in their use.

Pain Intensity

Pain intensity was measured with the numeric pain rating scale (NPRS), a segmented numeric version of the visual analog scale that measures subjective pain intensity (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011). This 11-point scale ranges from 0 to 10, with 0 equivalent to "no pain" and 10 to the "most intense pain imaginable" (Ferreira-Valente et al., 2011). Pain experts have established the content validity of the NPRS with high test-retest reliability ($r = 0.96-0.95$) and internal consistency (coefficient $\alpha = .89-.98$) (Ferreira-Valente et al., 2011).

Patient Satisfaction

The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a standardized national survey for data collection and public reporting designed to assess the patient's perception of their hospital care (Westbrook, Babakus, & Grant, 2014). This instrument allows for a meaningful comparison that supports consumer choice, promotes the hospital's incentives to improve the quality of care, and enhances accountability. The 27-item survey has response options based on a 4-point Likert scale rating critical aspects of the hospital experience, including pain management. It has internal consistency reliability (coefficient $\alpha = .767-.876$), and experts have established its content validity. The medical center currently uses the modified survey question (MSQ), which is based on the adapted version of question numbers 13 and 14 of the HCAHPS survey to assess the patient's perception of pain management care. More specifically, in question number 13 patients are asked, "During this hospital stay, how often was your pain well controlled?" Similarly in question number 14, the patient is asked, "During this hospital stay, how often did the hospital staff do everything they could to help you with your pain?" The MSQ reads as follows: "Do you feel your pain needs are well controlled each time you require an intervention?" For the purpose of this EBP QI project, the survey question was administered as a Likert scale with options similar to the HCAHPS survey (never, sometimes, usually, and always). The survey question scores range from 1 to 4, with a higher score equating to greater satisfaction.

Mental Status

The MSE is a screening tool used by clinicians to evaluate a patient's mental status objectively (Synderman & Rovner, 2009). A full version of the MSE provides information regarding the patient's appearance, affect, motor activity, speech, perception, thought content, and insight. However, a brief MSE can be administered to attain information regarding the degree of the patient's attention span, organization of thought process, and long- and short-term memory (Synderman & Rovner, 2009). The most commonly used brief MSE in the clinical setting is the assessment of the patient's level of orientation to reality (person, place, and time), evaluating his or her cognitive and neuropsychological status (Synderman & Rovner, 2009). The standard questions asked are "What is your name?" "Where are you?" and "What year is it?" Based on the accuracy of each response the patient is assumed to be "oriented to

person, place and time." The MSE was used as a screening tool for potential participation in this EBP QI project. Prospective participants who were not alert and oriented to all three criteria were excluded from the project, as were those with a diagnosis of hepatic encephalopathy.

Data Collection Tool

The MT data collection (MTDC) audit tool (Fig. 1) was developed by the authors to collect data regarding the following items: (1) specific time the MT was implemented, (2) preintervention and postintervention NPRS scores, (3) administration of pain medication 4 hours before and 2 hours after the intervention, (4) preintervention and postintervention MSQ completion, and (5) number of iPad and earbud instructional training attempts, including length of time required for teaching. If analgesia was used during the intervention, the agent, dosage, route, and time it was dispensed was recorded on this tool. Deidentified patient demographic characteristics, such as age, gender, and ethnicity, were also recorded.

PDCA Log

A PDCA log was formulated and maintained during the 6 weeks of the intervention's implementation to track weekly challenges and allow for well-informed revisions. All data-collected measures by the four nurse champions were checked by the patient care director to address completion and consistency and to ensure proper deidentification of data before sharing this information with the authors. There were no missing data for the outcomes of interest.

Protocol

The intervention protocol consisted of three components: preintervention, intervention, and postintervention phases. The preintervention phase entailed informing identified patients fitting the inclusion criteria about the EBP QI project, attaining verbal consent, and using the orientation and alertness component of the MSE tool to assess their attentiveness and orientation to person, place, and time.

Among participants who provided verbal consent to participate, demographic data including age, gender, and ethnicity were collected by the nurse champions. The nurse champions then administered the MSQ to assess the patients' satisfaction with their pain management care. The demographic data, score, and completion of the MSQ were recorded on the MTDC tool.

The intervention phase consisted of patient training on the use of the iPad and earphones, which required a return demonstration to the nurse champion. The medication administration record was then assessed for analgesia use before the intervention, and if used, the agent, dosage, route, and time it was dispensed were recorded on the MTDC tool. Next, the NPRS (Ferreira-Valente et al., 2011) was administered 15 minutes before the application of the MT, and the score was recorded on the MTDC tool. The start and end time of the MT intervention was also recorded on the MTDC tool. At the completion of the MT session, the nurse champion reassessed the pain intensity score and recorded it on the MTDC tool. Participants were evaluated 2 hours after completion of the intervention to assess if pain medication was required, and if so, the agent, dosage, route, and time were recorded on the MTDC tool.

During the postintervention phase, the MSQ was readministered to patients to assess their satisfaction with the pain management process with the music intervention, and this score was recorded on the MTDC tool. Figure 2 contains a pictorial representation of the three phases of the intervention.

Code: _____ Gender: _____
 Age: _____ Ethnicity: _____

PRE-INTERVENTION PHASE

Modified Survey Question: Date: _____ Time: _____ Score: _____
 iPad Instruction: Attempt: _____

INTERVENTION PHASE

	Day 1	Day 2	Day 3
Date			
Analgesia use prior to MT: Yes/No Time administered			
Pre-MT NPRS score			
MT: Start time End time			
Post-MT NPRS score			
Analgesia use prior to intervention: Yes/No			
Analgesia use up to 2 hours post-MT: Agent Dose Route Time			

POST-INTERVENTION PHASE

Modified Survey Question: Date: _____ Time: _____ Score: _____

Figure 1. Music therapy data collection (MTDC) audit tool, developed to collect de-identified data inclusive of patient demographics (age, gender, and ethnicity); start/end time music therapy (MT) was administered; pre/post-intervention numeric pain rating scale (NPRS) and modified survey question (MSQ) scores; record analgesia usage up to four hours before and/or two hours after MT; number of iPad instruction teaching attempts.

Evaluating the Intervention

A preassessment and postassessment project design was used to evaluate the effectiveness of the MT intervention on the outcomes of interest with quantifiable data allowing for an expeditious approach to assess its efficacy (Engel & Schutt, 2014). The outcome measures included subjective pain scores, analgesic volume use, and patient satisfaction with pain management. The primary

outcome of interest was subjective pain intensity scores as assessed on the NPRS (Ferreira-Valente et al., 2011). Pain intensity scores were compared 15 minutes before and 30 minutes after the music intervention to evaluate the effectiveness of MT. The secondary outcome of interest examined analgesia volume usage before and after intervention to determine if there was a measurable reduction in analgesia use. The third outcome of interest was patient satisfaction with the standard pain management process compared

PRE-INTERVENTION	Identify ESDL patients during morning rounds	Apply inclusion/exclusion criteria to these patients	Attain verbal consent from patient	Administered MSE to assess orientation	Replace patient data with number codes	Collect demographic data: age, gender, ethnicity on MTDC audit tool	Administer MSQ, record score on audit tool
INTERVENTION	Provide equipment instructions, patient return demonstration required	Record number of teaching attempts on audit tool	Check MAR for pre-MT analgesia use, record on audit tool with time administered	Assess NPRS 15 minutes pre-MT, record on audit tool	Administered MT for 30 minutes, record start/end time on audit tool	Monitor patient for 2 hours post-MT assessing for analgesia use; record agent, dosage, route and time on audit tool	
POST-INTERVENTION	Re-administer MSQ, record score on audit tool						

Figure 2. Intervention protocol developed to provide a pictorial representation of the three phases of the intervention inclusive of the pre-intervention, intervention, and post-intervention.

with the supplemental MT intervention, with satisfaction measured during the preintervention (standard pain management process) and postintervention (with MT intervention) phases.

Data collection also included the mean number of iPad instruction training attempts and the amount of time needed by the nurse champions to teach the patient how to use the iPad device. If three or more attempts were observed by a nurse champion after the initial patient training on the use of the iPad and earbud, this signified the need for further instruction to promote patient comprehension (Tamura-Lis, 2013). Evaluation of intervention implementation was used in determining the feasibility of the intervention as well as input for adjusting administration of the implementation during the various PDCA cycles.

Analysis

Deidentified data were imported into IBM Statistical Package for the Social Sciences (SPSS) Version 22.0 (IBM Corp., Armonk, NY, USA) for analysis. To characterize the patient cohort, descriptive statistics (mean, standard deviation, median, range, frequency, and percentage) were computed for demographic variables (age, gender, and ethnicity). Bivariate analyses were used to measure the EBP QI project's impact on pain, patient satisfaction, and analgesia usage by comparing preintervention and postintervention scores on the NPRS and MSQ scores, as well as analgesia use before and after the intervention.

Ethical Considerations

This EBP QI project did not warrant Institutional Review Board oversight as per policy. It did not involve research and was not designed to contribute to "generalizable knowledge" but rather to improve the quality of patient care (United States Department of Health and Human Services, 2011). Signed written consent from participants was not required, but verbal consent was attained. All participants were informed of the project procedures, including steps taken to maintain privacy (e.g., deidentification of data by the nurse champion). Participants were told that involvement was optional and voluntary with no negative repercussions to the quality of their care if they chose not to participate.

Results

Patient Characteristics

A total of eight patients were enrolled to participate in the MT intervention. The mean age was 48 years (age range 42–56 years). All participants were male and self-identified as Hispanic (Fig. 3). Primary admitting diagnoses included pancreatitis (38%), sepsis secondary to urinary tract infection (13%), viral gastroenteritis (25%), and acute chronic obstructive pulmonary disease exacerbation (25%). Other comorbidities were polysubstance use (88%), chronic alcohol abuse (63%), hepatitis C (25%), and hepatitis B (13%).

Recruitment Response

Recruitment by the nurse champions occurred on weekdays, during the day shifts (8 AM to 9 PM) and over a 6-week period (June 26, 2016 to August 12, 2016). A total of 19 eligible participants were approached and invited to participate, thereby representing a 42% participation rate. The most common reason for nonparticipation was patient belief of the limited utility for MT with their pain relief. One unforeseen issue was the low census of patients with cirrhotic ESLD during the time the EBP QI project was implemented.

Age	
Mean (Range)	48 (42 to 56)
Gender	Percent
Male	100 %
Ethnicity	
Hispanic	100 %
Primary Diagnosis	
Pancreatitis	38 %
Sepsis- urinary tract infection	13 %
Viral gastroenteritis	25 %
COPD exacerbation	25 %
Other Co-morbidities	
Polysubstance abuse	88 %
Chronic alcohol abuse	63 %
Hepatitis C	25 %
Hepatitis B	13 %

Figure 3. Patient characteristics: demographics of the cohort (n = 8), inclusive of age, gender, ethnicity, comorbidities and primary diagnosis.

Intervention Fidelity

The MT intervention was offered and available to each participant for 3 consecutive days. All participants completed 1 day of the MT, with no patients completing 2 or all 3 days as a result of being off the unit at the time of the scheduled intervention or being discharged from the unit.

Pain Intensity

The primary outcome of pain intensity was evaluated using the NPRS. Pre-MT NPRS scores ranged from 4 to 7, with a mean score of 6. Post-MT NPRS scores ranged from 3 to 6, with a mean score of 5. Comparison of preintervention and postintervention mean NPRS scores identified an average 10% reduction (decrease from 6 to 5) in pain.

Analgesia Volume

The secondary outcome of analgesia volume use was tracked using the MTDC tool. Five of the eight participants (62.5%) were administered pain medication within 4 hours before the MT. Six participants (75%) requested pain medication after MT; however, two (25%) refused its requirement for the 2-hour duration. Therefore 25% of the participants did not request analgesia use within the 2 hours after the MT. Common pain medications prescribed on the unit consisted of morphine, hydromorphone, tramadol, and oxycodone.

Patient Satisfaction

An overall 30% improvement in patient satisfaction was found when comparing preintervention (2.0) to postintervention (3.25) scores, suggesting improved patient satisfaction with the use of MT compared with standard pain management care.

Feedback from Nurse Champions

At the conclusion of the EBP QI project, a one-time, 30-minute group discussion was conducted by the primary author with the four nurse champions to gain their perspectives on the MT intervention. The nurse champions were questioned on the acceptability of the intervention, their perception of its effectiveness on pain control, and the challenges experienced with implementation.

Feedback obtained from the nurse champions was largely positive toward the use of MT for pain control. All four nurse

champions reported feeling comfortable with the implementation process of the intervention, reporting that it was feasible and acceptable to the patients and helped to improve patient-nurse communication. They also verbalized feeling empowered by having nonpharmacologic options for pain control in a patient population with limited alternatives, thus leading to an enhanced pain management care plan. Application of familiar measures used routinely on the unit for this EBP QI project was also reported to be very helpful to implementing the protocol. A recommendation for improvement by the nurse champions was to conduct a patient census review of the target population for the past 2 years to assess for monthly trends in high and low volume, thus providing informative data to avoid implementing projects during these low-volume periods.

Discussion

Pain can negatively affect the inpatient hospitalization experience; however, in patients with compromised metabolic pathways who are more vulnerable to medication side effects, pain control becomes even more challenging. The results from this EBP QI project suggest that a nurse-led, MT intervention adjunct to standard pharmacologic modalities reduced pain intensity and improved patient satisfaction with pain management in hospitalized patients with a diagnosis of cirrhotic ESLD and polysubstance abuse. To the best of our knowledge, this EBP QI project is the first to assess the effectiveness of MT on the outcomes of pain, analgesia use, and patient satisfaction regarding pain management for patients with cirrhotic ESLD. This EBP QI project is also one of the first to employ a set dose and frequency for the applied intervention, thereby contributing to standardization in its implementation. MT may also offer beneficial options that can affect the current opioid epidemic afflicting an estimated 2.1 million Americans (National Institutes of Health, 2014) by minimizing reliance on opioids for pain management in the cirrhotic ESLD population.

Findings from this EBP QI indicated a 10% reduction in pain intensity among participants with a single 30-minute MT application. Although the sample size for this project was small, the beneficial effect of the intervention with this dose frequency was noted in all participants. These results are consistent with the current evidence on the use of MT in a variety of patient cohorts (Bernatzky et al., 2011; Cepeda et al., 2006; Cole & LoBiondo-Wood, 2014; Costa et al., 2018; Guetin et al., 2012; Huang et al., 2010; Li, Zhou, & Wang, 2017). Similarities were also identified in the importance of self-selected music (Cole & LoBiondo-Wood, 2014; Guetin et al., 2012; Huang et al., 2010) as participants verbalized to the nurse champions that culturally familiar Latin music was most distracting to their pain and may have possibly improved their satisfaction with pain management care. Chronic cirrhotic pain can negatively affect the target population's hospitalization, length of stay, and quality of life (Chandok & Watt, 2010). Therefore the likelihood of any improvement in their pain intensity is regarded as clinically meaningful.

Findings from the analgesic usage data indicate that two out of the eight participants (25%) did not request pain medication after the MT. Patients with compromised metabolic pathways have extended durations of action of pain medications because of altered peaks and durations, causing changes in pharmacokinetic activity and drug accumulation (Chandok & Watt, 2010; Dwyer et al., 2014). Therefore it is likely that the results are due to a combined effect of the MT intervention and residual pain medication from the last analgesic dose. However, there is a need for evidence-based, combined modalities to manage pain, especially in patients with limited options (AHRQ, 2014; NIDA, 2014). Our findings were not consistent with results from other studies indicating that listening

to music reduced the need for frequent analgesic dosing post-intervention, with varying levels of effect in its magnitude (Bernatzky et al., 2011; Cepeda et al., 2006; Costa et al., 2018; Cole & LoBiondo-Wood, 2014). It is possible that our findings may have been affected by the limited sample size for this EBP QI project. Furthermore, we are among the first to report the results of a MT intervention for pain management among patients with cirrhotic ESLD. Until more data are gathered from similar projects, it is not possible to arrive at specific conclusions or generate practice recommendations.

Data on patient satisfaction indicated a 30% improvement in self-reported satisfaction of pain management care with the addition of the MT intervention. These results were consistent with the studies reviewed reporting the positive effect of MT for improved patient perception and satisfaction with both hospitalization experience and pain management care (Cole & LoBiondo-Wood, 2014; Gooding et al., 2012; Walworth, Rumana, Nguyen, Jarred, 2008; Yinger & Standley, 2011). The results of this EBP QI project also relate to the evidence in highlighting the association between patient satisfaction and pain management and its significance in influencing the global perception of the individual's hospitalization (American Academy of Pain Medicine [AAPM], 2014; Cole & LoBiondo-Wood, 2014; Gooding et al., 2012; Walworth et al., 2008; Yinger & Standley, 2011). Most interesting, although the participants had a moderate decrease in their pain intensity outcome with the MT, their rating on the MSQ was notably improved after intervention. This may be related to the nurse-led, patient-centered care approach allowing patients to verbalize their pain experience with a multimodal response from the nurse champion. This finding is valuable to stakeholders at an organizational level because there is evidence to suggest that inadequate patient pain control as operationalized with the NPRS is highly correlated with measures of patient satisfaction (AAPM, 2014). Presently, the Centers for Medicare and Medicaid Services (2013) reimburse 30% based on incentives that are dependent on the quality of the patient's hospital care experience. Evidence has indicated that nurses are the greatest influential attribute in patient satisfaction (Craig, Otani, & Herrmann, 2015). Therefore leadership should focus on more EBP nurse-led interventions like MT to improve these outcomes (Craig et al., 2015).

Feasibility and Acceptability of MT

The results from this EBP QI project indicate that a nurse-led MT intervention conducted on a busy inpatient unit was feasible. Self-selected music and cultural preference were essential elements of the applied intervention and important factors that facilitated favorable results for pain control in this patient cohort. Similar findings have been reported with other patient cohort studies (Cole & LoBiondo-Wood, 2014; Guetin et al., Huang et al., 2010). Another factor that assisted in the success of this intervention was the use of a music application that offered an extensive choice of musical genres, including international options. The use of earbud headphones was also beneficial because it allowed for the filtering of excessive noise and disruption within the busy clinical setting, providing a focused experience of the intervention (Hsu et al., 2012; Minkley, 1968). Additionally, using instruments already in use on the unit, providing education and training for the nurse champions to promote acceptability and enhance cognizance on MT, and using a collaborative approach in formulating the intervention protocol were valuable components of the EBP QI project. Challenges during the execution of the MT intervention were patient acuity and staff turnover rate, with an influx of new graduate nurses. Future nurse-led MT intervention projects should not only begin with a comprehensive organizational assessment, but also assess if other

projects are being performed on the unit to take into account the additional workload of the project.

Conclusions

Undertreated pain is common in patients with ESLD because of fear of possible toxicity, thereby leading to increased suffering and the rendering of suboptimal care. MT allows for a non-pharmacologic modality that lowers the risk of opioid toxicity in a vulnerable population. It has the potential to provide pain management with a patient-centered approach, addressing both the physiologic and psychological components of pain, allowing for the deliverance of holistic patient care for the ESLD patient population. MT gives health care providers pain management options that avoid a sole reliance on opioids. Given the addiction profiles of cirrhotic ESLD patient cohorts, MT may also play some role in addressing the present opioid crisis, one of the largest health care crises facing the United States today. Hence, findings from this EBP QI project offer a solid foundation for a formal efficacy study that can lend recommendations for translation to practice.

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