

The application of a musical intervention in hemodialysis: patient satisfaction and appropriateness

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ABSTRACT

Introduction: For patients, hemodialysis represents a challenge in their living conditions, characterized by suffering, anxiety, depression, and a poor quality of life. Evidence-based non-pharmacological interventions can enhance the existential condition of patients. Music is an intervention with the potential to improve their psychological well-being.

Methods: This study aimed to evaluate the satisfaction and the appropriateness of a live music intervention during hemodialysis sessions. Both were measured using a 5-point Likert scale (from 1 to 5). Eleven musicians performed using instruments (guitar, flute, violin, accordion, Celtic harp, and oboe) for 30 minutes daily over six days.

Results: The sample included 122 participants: 89 patients and 33 healthcare providers. Among patients, 97.8% expressed satisfaction with the musical intervention, with an average score of 4.98 (SD = 0.447). Among patients, 98.8% found music during hemodialysis appropriate, with an average score of 4.93 (SD = 0.447). Among healthcare providers, 93.2% were satisfied, with an average score of 4.70 (SD = 0.810), while 97% considered the music intervention appropriate, with an average score of 4.76 (SD = 0.502). There was a significant association between satisfaction and appropriateness levels ($\chi^2 = 98.0$, $p < 0.001$). No undesirable effects or disruptions to healthcare activities were observed during the musical intervention. Qualitative observations revealed dynamics such as singing, hand clapping, rhythmic movements, smiles, laughter, a general atmosphere of well-being, and improved communication between patients and healthcare providers.

Conclusions: Live music during hemodialysis sessions appears to be an appropriate and satisfying intervention for patients and healthcare providers.

Keywords: Appropriateness, Complementary therapy, Hemodialysis, Music Medicine, Patient satisfaction, Quality of care

Introduction

After a diagnosis of kidney failure, individuals experience an existential and psychological state characterized by a profound change in their quality of life (1). To survive, patients are compelled to undergo long-term hemodialysis treatment, a condition that negatively alters cognitive and emotional states, influencing behavior and social relationships and contributing to the deterioration of mental health (2).

Habits, daily routines, work, hobbies, life plans, and familial and social relationships are deeply affected by this new phase of life, in which a crucial physiological function essential for survival is sustained solely through technology, so the hospital-based hemodialysis becomes an inescapable and restrictive necessity for survival (3).

During hemodialysis sessions, patients are confined to bed, making the perception of time a significant psychological variable (4). Time is perceived to pass more slowly, and each session can be both psychologically and physically draining (5). This slowness creates a sense of emptiness and an inability to find meaning in time spent on hemodialysis, which is seen as serving merely biological survival (6).

Patients are subject to the schedules imposed by technology in a hospital environment and in a distinctly different social context, which can lead to distress, a decline in quality of life, anxiety, altered self-image, fear of the future, and fear of death (7).

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In such a context, modern care necessitates the adoption of a holistic model that addresses the multidimensional nature of the individual (8). This approach requires attention not only to the organic aspects of hemodialysis patients but also to their psychological, social, relational, and behavioral dimensions factors that significantly impact treatment compliance (9).

To achieve patient-centered care that encompasses all these dimensions, it is crucial to identify evidence-based complementary interventions aimed at improving well-being and quality of life (10). A complementary intervention supported by significant scientific evidence is the use of music in dialysis care (11).

Music interventions in hemodialysis

In a recent systematic review and meta-analysis by Lin et al. (12), music therapy in patients undergoing hemodialysis significantly reduced anxiety, depression, stress, and adverse reactions associated with hemodialysis, all with strong effect sizes.

Several randomized controlled trials (RCT) have investigated the effects of music on patients undergoing hemodialysis. In the crossover RCT of Inayama et al. (13), listening to music reduced cannulation pain in patients on hemodialysis. In the RCT pilot study of Soliva et al. (14), music reduced scores on the anxiety scale and reduced scores on the depression scale. The RCT pilot study of Bro et al. (15) showed significant differences in immediate fatigue and anxiety in the music group compared to the control. The RCT of Burrai et al. (16) findings showed a statistically significant reduction in pain levels and an improvement in mood and itching levels and oxygen saturation due to the effects of live saxophone music.

In the RCT of Eroglu et al. (17), the Benson Relaxation Technique combined with music therapy, for all subdomain scores of the Piper Fatigue Scale findings were significantly lower at weeks 4, 8, and 10 than those of the control group, and significantly lower on anxiety subscale scores than those of the control group at week 10. In the RCT of Melo et al. (18), findings showed a statistically significant reduction of anxiety scores, systolic blood pressure, diastolic blood pressure, heart rate, and respiratory rate after listening to music.

In the RCT crossover study of Burrai et al. (19), listening to live music was associated with improvements in systolic and diastolic blood pressure, better quality of sleep, fewer cramps, and reduced anxiety/depression, pain, and itching. The RCT of Imani et al. (20) after the music intervention showed a reduction in depression levels and a reduction in state anxiety.

A particularly noteworthy aspect is that the effects of music on hemodialysis patients persist over time, even long after the intervention. This was demonstrated in a recent study by Ba (21), which showed that after three months, scores on the Self-Rating Depression Scale and Self-Rating Anxiety Scale were significantly lower in the music group compared to the control group.

Neuropsychology of music

Among the various conceptual frameworks explaining the effects of music, the neuropsychological model is prominent.

In this model, the auditory system processes the music's waveform, temporal, tonal, and timbral elements (22). Neuronal encoding occurs primarily in the auditory cortex, influencing the executive control system, cerebellum, basal ganglia, and premotor cortex, with neuroplastic effects (23).

The brain interprets emotional nuances of sound via neural networks in the frontotemporal cortex, the same networks involved in understanding the affective content of human language. This explains the universal human reactions to certain musical elements, transcending age and culture. Neurochemically, music activates the dopaminergic reward system, involving areas rich in dopamine receptors.

Dopamine interacts with neurotransmitters like oxytocin and endorphins, released during social and solitary musical experiences, fostering relaxation and pleasure. The hypothalamic-pituitary-adrenal axis also responds, modulating attention and arousal through adrenaline and noradrenaline release (24).

Psychologically, the music shifts selective attention to gratifying sound stimuli, generating a cognitive and emotional state that may change the awareness of the external environment, offering a fulfilling multisensory experience (25).

Music during hemodialysis could also address existential dimensions, helping patients reconcile with their fragility, where life extension is provided by technology. Music's non-verbal communication also overcomes cultural boundaries, making it a viable intervention within transcultural hemodialysis care (26).

Music Methodology

The application of music presents two broad listening methodologies: 1) listening to recorded music and 2) listening to music performed live (27). From an operational perspective, music interventions can be categorized as 1) active, involving patient participation in music-making; 2) receptive, where patients consciously listen to music; 3) guided, conducted within a structured music therapy program; and 4) improvised, allowing patients to use creativity and expressiveness to produce sounds or music.

In this music intervention, the music was performed live, and the typology was receptive.

Objective

The study aimed to evaluate the feasibility and suitability of live musical interventions using various musical instruments during hemodialysis sessions, assessing the appropriateness of intervention and the satisfaction of patients, the satisfaction of healthcare professionals, and healthcare assistants.

Methods

The live music intervention was carried out for six days between 10:00 and 10:30 at the Complex Structure of Nephrology and Dialysis, Alghero Hospital, ASL n. 1 of Sassari, Sardinia, Italy. The setting for the musical intervention was an open-space environment. The variables measured were as follows:

1. General process indicator, measured by the ratio between the number of musical interventions carried out and the number of musical interventions scheduled. The established cut-off was 100%.
2. Process indicator "Level of Appropriateness" for patients, measured using a 5-step Likert scale weighted with numerical values from 1 to 5, with response types defined as: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), and Strongly Agree (5). The specific item measured was: "Express your level of agreement regarding the appropriateness of including musical intervention in daily care." The established cut-off required that 90% of the scores had to be equal to or greater than 4.
3. Process indicator "Level of Appropriateness" for healthcare professionals and healthcare assistants, measured using a 5-step Likert scale weighted with numerical values from 1 to 5, with response types defined as: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), and Strongly Agree (5). The specific item measured was: "Express your level of agreement regarding the appropriateness of including musical intervention in daily care." The established cut-off required that 90% of the scores had to be equal to or greater than 4.
4. Outcome indicator "Level of Satisfaction" for patients was measured using a 5-step Likert scale weighted with numerical values from 1 to 5, with response types defined as: Very Dissatisfied (1), Dissatisfied (2), Neutral (3), Satisfied (4), and Very Satisfied (5). The specific item measured was: "Express an evaluation of your degree of satisfaction with the musical intervention provided." The established cut-off required that 90% of the scores had to be equal to or greater than 4.
5. Outcome indicator "Level of Satisfaction" for healthcare professionals and healthcare assistants, measured using a 5-step Likert scale weighted with numerical values from 1 to 5, with response types defined as: Very Dissatisfied (1), Dissatisfied (2), Neutral (3), Satisfied (4), and Very Satisfied (5). The specific item measured was: "Express an evaluation of your degree of satisfaction with the musical intervention provided." The established cut-off required that 90% of the scores had to be equal to or greater than 4.

The data collection for these two indicators was carried out immediately after the musical intervention. The data collection methodology was conducted anonymously and in aggregate form. No data allowed for the identification of any individual, either directly or indirectly. No sensitive data were collected. Data processing was also performed anonymously and in aggregate form for the statistical analyses.

Based on organizational and economic feasibility (at no cost), the duration of a single musical intervention (30 minutes), the duration of the intervention days (6 days), and the variety of musical instruments used (6 different instruments), it was not methodologically sustainable to adopt music therapy protocols.

It should be noted that the objective was to obtain general indications regarding the feasibility of implementing structured musical interventions within care practices, with a focus on patient satisfaction and the appropriateness of musical interventions.

Intervention

The musical intervention was performed by nine musicians, including two guitarists, two flutists, two violinists, one accordionist, one Celtic harpist, and one oboist. The instrumentalists were affiliated with the "Giuseppe Verdi" Musical Art Institute of Alghero, the "Anni Verdi" Musical Cultural Association of Sassari, and the "La Chitarreria" Music School of Alghero. Each intervention lasted 30 minutes per day for six consecutive days, with a different musical instrument featured each day.

The musical approach was live, active, and improvisational, with the instruments played either solo or in duet mode. The musicians received training from the first author on various aspects, including 1) the objective of the intervention, 2) the type of setting in which they would perform, 3) the type of patients with whom they would interact, 4) the duration of the music; 5) The types of music to be performed; 6) Behavioral guidelines for the healthcare environment; 7) use of personal protective equipment.

Operationally, during the hemodialysis sessions, the musicians approached each patient individually, proposing if they wanted to listen to the music played for them, asking what type of music they preferred to listen to, or suggesting pieces from a well-known repertoire. The general guideline was to play music that was familiar and characterized by joyfulness, cheerfulness, relaxation, and dynamism.

Statistical Methods

For descriptive statistics, the analysis included frequency distribution, percentage distribution, mean, standard error of the mean, median, standard deviation, range, and the 95% confidence interval for the mean. To test for relationships between categorical variables, the chi-square (χ^2) test was used. To examine correlations between quantitative variables, the Pearson correlation coefficient (r) was applied. Statistical significance was set at the 0.05 level (two-tailed). The analysis was conducted using IBM's Statistical Package for the Social Sciences (SPSS).

Results

The total number of subjects who responded to the indicators was 122, of which 89 were patients and 33 were healthcare professionals and healthcare assistants. In the patient group, 58 were male (65.2%) and 31 were female (34.8%), with a mean age of 65.4 years (SD = 11.4, 95% CI = 63.01-67.82). In the healthcare professionals and healthcare assistant group, 25 were male (75.8%), and 8 were female (24.2%), with a mean age of 51.1 years (SD = 6.5, 95% CI = 49.7-54.4). In terms of professional roles, 28 were nurses, 1 was a doctor, and 4 were healthcare assistants.

Regarding the general process indicator, which was measured by the ratio between the number of musical interventions performed and the number of scheduled musical interventions, the result met the scheduled cut-off, reaching 100%. All scheduled musical interventions were carried out.

As for the process indicator "Level of Appropriateness" for the item "Express your level of agreement regarding the appropriateness of including musical intervention in

daily care,” considering the scores from both patients and healthcare professionals and healthcare assistants, 98.7% of the scores were equal to or greater than 4, exceeding the scheduled cut-off by 8.7%. Table 1 shows the levels of appropriateness expressed by patients, healthcare professionals, and healthcare assistants.

TABLE 1 - Level of appropriateness for groups

Statistics	Patients n = 89	Healthcare Professionals and Health Care Assistant n = 33
Mean	4.93	4.76
Standard Error	.047	.087
Standard Deviation	.447	.502
CI95%	4.84-5.03	4.58-4.94
Median	5.00	5.00
Minimum	1	3
Maximum	5	5
Range	4	2

The results show that the average score is very high, reaching the maximum appropriateness value of 5 for both groups. Table 2 shows the distribution of scores by response type and by group.

TABLE 2 - Distribution of scores by response type and by group, item “express your level of agreement with the appropriateness of including musical intervention in daily care”

Response type	Patients n = 89	Healthcare Professionals and Health Care Assistant n = 33
Strongly Disagree	1 (1.1%)	0 (0%)
Disagree	0 (0%)	0 (0%)
Neutral	0 (0%)	1 (3%)
Agree	2 (2.2%)	6 (18,2%)
Strongly Agree	86 (96,6%)	26 (78,8%)

The results demonstrate that, for the vast majority of patients, healthcare professionals, and healthcare assistants, musical interventions during dialysis sessions were perceived as appropriate. There is no association between gender and the level of appropriateness ($p = 0.077$). There is no correlation between age and the level of appropriateness ($p = 0.687$). However, there is an association between the level of appropriateness and the level of satisfaction ($p = 0.000$), where high scores on the appropriateness scale were associated with high scores on the satisfaction scale.

Regarding the outcome indicator “Level of Satisfaction” for the item “Express an evaluation of your level of satisfaction with the musical intervention provided,” considering the scores from both patients and healthcare professionals and healthcare assistants, 98.7% of the scores were equal to or greater than 4, exceeding the programmed cut-off of level 4 by 8.7% for this indicator as well. Table 3 shows the levels of satisfaction expressed by patients, healthcare professionals, and healthcare assistants.

TABLE 3 - Level of satisfaction by group

Statistics	Patients n = 89	Healthcare Professionals and Health Care Assistant n = 33
Mean	4.89	4.70
Standard Error	.054	1.41
Standard Deviation	.510	.810
CI95%	4.78-5.00	4.41-4.98
Median	5,00	5
Minimum	1	1
Maximum	5	5
Range	4	4

The results show that the average score is very high, with both groups reaching the maximum satisfaction value of 5. Table 4 shows the distribution of scores by response type and by group.

TABLE 4 - Distribution of scores by response type and by group, item “express an evaluation of your level of satisfaction with the musical intervention provided”

Response type	Patients n = 89	Healthcare Professionals and Health Care Assistant n = 33
Very Dissatisfied	1 (1.1%)	1 (3 %)
Dissatisfied	0 (0%)	0 (0%)
Neutral	1 (1.1%)	1 (3 %)
Satisfied	4 (4.5%)	4 (12.1%)
Very Satisfied	83 (93.3%)	27(81.1)

The findings show that, for the vast majority of patients, healthcare professionals, and healthcare assistants, the musical interventions during dialysis sessions were perceived as very satisfactory. There is no association between gender and the level of satisfaction ($p = 0.203$), and there is no correlation between age and the level of satisfaction ($p = 0.954$). However, there is an association between the level of satisfaction and the level of appropriateness ($p = 0.000$), where high scores on the satisfaction scale were associated with high scores on the appropriateness scale.

The patients did not report any side effects due to the musical intervention, while healthcare professionals and healthcare assistants did not highlight any problems hindering care activities due to the presence of musicians.

From a qualitative perspective, the observation of the dynamics during listening to live music by patients, healthcare professionals, and healthcare assistants can be summarized in the following points: 1) singing; 2) clapping; 3) rhythmic body movements; 4) smiles and laughter; 5) a general climate of well-being; 6) greater communication between healthcare professionals and health care assistant and patients. Table 5 shows the dynamics expressed by body parts and verbal and non-verbal communication during the listening to live music by patients, musicians, healthcare professionals, and healthcare assistants.

TABLE 5 - Dynamics and communication with live music between patients, musicians, and professionals

Component	Verbal Communication	Non-verbal communication
Mouth	Singing	Smiles Laughter
Hands		Clapping
Whole body		Rhythmic body movements
Communication	Greater communication	Greater communication
General climate	General climate of well-being	General climate of well-being

Discussion

To the best of our knowledge, there are currently no studies specifically evaluating the application of music in the hemodialysis field regarding process indicators of appropriateness and outcome indicators of satisfaction. However, we can draw comparisons with studies that have examined similar aspects of music application in hemodialysis. The scores on appropriateness and satisfaction in this study can be related to the global dimension of quality of life in hemodialysis care, which encompasses factors such as pain, anxiety, depression, itching, cramps, fatigue, and insomnia.

The findings of this study are consistent with the RCT crossover study by Burrai and colleagues (16), where the performance of well-known musical pieces on the saxophone improved quality of life through significant reductions in pain, itching, and improvements in mood. Our results also align with the study by Soliva and colleagues (14), in which a live musical intervention featuring a popular music repertoire improved the quality of life of patients with significant increases in emotional well-being, vitality, and pain reduction. A second RCT by Burrai and colleagues (19) produced results consistent with ours. In their study, the live performance of a popular music repertoire through singing improved quality of life by significantly enhancing sleep quality, reducing anxiety, improving depression, and alleviating pain and itching. The study by Bro and colleagues (15) also demonstrated similar results, with live music interventions lasting 30 minutes a day improving quality of life by significantly reducing fatigue and anxiety. Our intervention’s results are in line with those of Hagemann and colleagues (28), whose study showed that listening to live music featuring voice, singing, and guitar significantly improved quality of life and helped prevent depressive symptoms. Finally, the study by Siletti and colleagues (29) confirmed our results within a dialysis population consisting of non-adults. In that study, 30 minutes of live music significantly reduced anxiety and depression, thus improving the quality of life for children undergoing dialysis.

Limitations

There are some limitations to our musical intervention. The first is the short duration of the interventions, limited to just 30 minutes per day. A second limitation is the brief

duration of the intervention period, which was only 6 days. Third, the musical interventions did not have the structured therapeutic intent of music therapy, which typically involves specific protocols and significantly longer intervention durations.

As stated in the objective, the measurements in this study involved two indicators: one process indicator (level of appropriateness) and one outcome indicator (level of satisfaction). Clinical outcomes in patients undergoing hemodialysis treatment were not assessed. To study the effects of music on such clinical outcomes, experimental clinical research with a randomized controlled study design would be required.

Conclusions

The introduction of a non-pharmacological complementary care intervention, represented by the performance of live music during hemodialysis sessions, showed positive general indications. Live music performance during dialysis sessions was perceived as both appropriate and satisfactory by patients, healthcare professionals, and healthcare assistants, with no unwanted effects or issues that could hinder care activities. Live music performance during hemodialysis sessions could potentially be implemented into daily care routines.

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