Original Article

Efficacy of the Simulation-Based Education Approach Enhanced by Music on Anxiety, Physical Activity, and Respiratory Outcomes in Patients under Open Heart Surgery: A Randomized Three-Group Clinical Study

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Abstract

Background: Many patients with advanced cardiovascular disease need Coronary Artery Bypass Graft (CABG) surgery, indicating the importance of cardiac rehabilitation. Our study explored the combined efficacy of simulation (using demonstration and return-demonstration approach) with music on post-Open Heart Surgery (OHS) outcomes. **Materials and Methods:** This randomized, controlled trial was conducted at Imam Reza Hospital, Mashhad, Iran, on 90 patients awaiting OHS. The participants were allocated to 3 groups: education via simulation, education via simulation enhanced by instrumental music, and conventional instruction. Evaluations were performed pre-education and 2-days post-surgery using the activity measure for post-acute care (AM-PAC) "6-Clicks" Questionnaire, 18-item Nursing Outcomes Classification (NOC) index, and State-Trait Anxiety Inventory (STAI). JASP software (JASP Team, 2023, Version 0.17.3) was employed for statistical analyses, using RM-ANOVA and ANCOVA test. **Results:** The results revealed a significant effect in immediate post-intervention and 2-day follow-up periods across all outcome measures (all $p < 0.05$), except for activity. *Post hoc* tests demonstrated substantial variations in effect sizes between intervention and control groups. Both intervention groups had significantly greater impact than the control group, particularly the composite group, showing heightened effects in state and trait anxiety and respiratory scores ($p < 0.05$). **Conclusions:** The combined use of the simulation with rhythmic music in phase one cardiac rehabilitation notably improved post-surgical outcomes, outperforming the method without music. This approach shows promise as an effective instructional strategy in cardiac rehabilitation stages.

Keywords: *Anxiety, cardiac rehabilitation, high fidelity simulation training, music therapy, patient education*

Introduction

Cardiovascular disorders have significantly increased globally, nearly doubling from 271 million cases in 1990 to 523 million in 2019, becoming a major cause of death worldwide.[1] Within the context of Iran, the existing data underscores a rising trend in both the incidence and the resultant fatalities of these diseases.[2] Cardiovascular conditions are responsible for about half of all deaths and 20-23% of the total disease burden in the country.[3] Medical advancements, especially in angioplasty and cardiac surgeries, have decreased mortality rates from Coronary Artery Diseases (CADs) and improved patient life expectancy. Coronary Artery Bypass Graft (CABG) through Open Heart Surgery (OHS) is the leading treatment for 60% of severe cardiac conditions and often the only option to prolong life for many patients.[4,5]

Patients awaiting OHS frequently face preoperative anxiety, which can lead to delays in necessary procedures with potentially fatal outcomes. Anxiety can also cause physical concerns like hypertension and surgical bleeding, potentially triggering heart attacks in those with severe artery blockages.[6] Furthermore, OHS typically conducted via a median sternotomy incision is frequently linked to significant incisional pain. This discomfort, along with the pain associated with surgical drains, can impede critical functions like coughing, movement, and deep breathing, thereby elevating the risk of postoperative pulmonary complications,[7] pulmonary atelectasis, and hypoxemia.[8]

How to cite this article: Salehi M, Froutan R, Mazlom SR. Efficacy of the simulation-based education approach enhanced by music on anxiety, physical activity, and respiratory outcomes in patients under open heart surgery: A randomized three-group clinical study. Iran J Nurs Midwifery Res 2024;29:568-76.

Submitted: 28-Oct-2023. **Revised:** 09-Jun-2024. **Accepted:** 15-Jun-2024. **Published:** 04-Sep-2024.

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Access this article online

Website: https://journals.lww.com/jnmr

DOI: 10.4103/ijnmr.ijnmr_335_23

Quick Response Code:

To diminish the risk of adverse cardiac events and enhance Quality of Life (QOL) for patients, it is recommended to engage in Cardiac Rehabilitation (CR). This program is designed to facilitate recovery following cardiac interventions, including OHS.[9] CR significantly enhances cardiac surgery outcomes, reduces post-operative complications, and can prevent re-hospitalizations and lower medical costs. It also improves patients' healing perception and helps prevent affective disorders. Despite its importance, widespread implementation in healthcare centers remains a goal.[10,11] The program is structured into 3 pivotal phases. Evidence indicates that effective implementation of the initial phase of CR substantially improves post-operative patient outcomes.[12]

To improve outcomes after OHS, comprehensive patient education is crucial.[13] The selection of educational strategies evidently influences patient learning and their readiness to modify health-related behaviors.[14] Simulation is a technique that replicates real experiences without actual events. Its main aim is to immerse learners in realistic scenarios, enhanced by feedback and debriefing, to complement real training.[15] Demonstration and Return-Demonstration (D-RD) techniques, where someone illustrates how something is performed, and then, the learner tries it themselves, can offer some of the benefits of simulations, but in a simpler and cheaper way.[16] On the other hand, music therapy offers a safe, easy, and cost-effective way to help patients after OHS, manage pain, anxiety, and depression. Music as an educational and rehabilitation tool can improve patients' mental state, which in turn affects their physical recovery. This makes it a valuable tool that deserves wider use in clinical settings.[17] These two interventions are combined through a multidimensional approach in order to improve overall patient outcomes. Previous researchers have examined the benefits of early cardiac rehabilitation on certain post-operative complications, but its full impact on pulmonary outcomes, anxiety, and physical activity has not yet been understood. Additionally, the potential synergistic effect of combining D-RD methods with therapeutic music in patient education and recovery remains unexplored. Thus, the present study investigated the joint impact of the D-RD method and music on post-OHS outcomes, including anxiety, physical activity, and respiratory function.

Materials and Methods

This randomized, control, and clinical trial (IRCT code IRCT20200413047050N1) were conducted at Imam Reza Hospital in Mashhad, Iran, during 2020-2021. The participants awaiting CABG surgery were divided into 3 groups. The first group received training through simulation, using D-RD approach. The second group received the same training, along with instrumental music. The third group served as a control for comparison. The eligibility criteria included willingness to participate and no history of prior heart surgeries or pulmonary disorders, no speech, vision, or hearing problems, no cognitive impairment that would interfere with learning, and no mobility restrictions. The exclusion criteria were emergency OHS, withdrawal from the study, instable hemodynamic, decrease in the level of consciousness, or death during the research period. The night before the surgery, patients who met the inclusion criteria were selected by the main researcher. He conducted a short interview with the patients and their companion, and while explaining the study in simple language (within 5 minutes), he provided the patient with a written informed consent form to read and complete. After the initial interview, the required questionnaires were completed by the patient or his companion. Then, based on the random sequence generated by SPSS software v. 28, the patients were assigned to the relevant groups. Subsequently, the patients were guided to the education/consultation room where they received the appropriate intervention according to their assigned group.

In a pilot study with 10 participants per group examining the primary outcome of anxiety and physical activity, the sample size was initially calculated using the formula presented below and considering a 95% Confidence Interval (CI) and 80% power, resulting in a recommendation of 27 participants per group. To account for potential attrition during the follow-up period, a 10% attrition rate was factored in, which led to a final sample size of 30 participants per group.

Using Stata software (version 18; StataCorp., College Station, TX, USA), participants were randomly assigned to 1 of 3 groups-primary intervention, secondary intervention, or control-via a randomized block procedure. To mitigate the risk of information exchange between groups, training sessions were scheduled at distinct times for each group. This approach utilized 1-week time blocks to separate the participants accordingly. The sequence, generated by a statistician, was kept in a sealed envelope. At the start of each week, the envelope was opened to determine the allocation of patients for that week's session. This process ensured that, after the discharge of the last patient, the subsequent week's sessions would involve a different group. This procedure was repeated until each group reached its predetermined sample size quota. This study was a single-blind research, the statistical specialist, and analysts were unaware of the allocation of subjects to the intervention or control groups.

The State-Trait Anxiety Inventory (STAI; Spielberger *et al*.)[18] is a widely used 40-item self-report questionnaire that measures two distinct anxiety concepts, state anxiety, and trait anxiety. State anxiety is a temporary emotional state characterized by subjective feelings of apprehension, tension, nervousness, and worry. It is assessed by the first 20 items of the STAI, which ask respondents to rate how they feel "right now, at this moment." Trait anxiety is a relatively stable personality trait that reflects a person's general tendency to experience anxiety. It is assessed by the

second 20 items of the STAI, which ask respondents to rate how they generally feel. Each item on the STAI is rated on a 4-point Likert scale ranging from 1 (not at all) to 4 (very much). The total scores for each subscale (state and trait anxiety) can range from 20 to 80.[19] The Persian version of the STAI-Y shows good internal consistency for both trait and state anxiety, and moderate convergent validity with the BAI for both measures (0.886 for trait anxiety and 0.846 for state anxiety).[20] In the present study, the internal consistency reliabilities were 0.92 for the state anxiety subscale, 0.90 for the trait anxiety subscale, and 0.94 for the total scale.

The Nursing Outcomes Classification (NOC) is an important research tool that shows the consequences and outcomes related to a patient's condition, behavior, and perception of nursing care. It includes clinical indicators used to assess and rank the patient's health status in relation to the outcomes achieved. This tool allows the nurse to assess the patient's current status and identify changes based on differences in scores over time. Recent studies in Brazil have shown that NOC is a useful tool for identifying effective nursing care practices. The NOC also assesses the individual's respiratory status. The clinical indicators related to this topic include 18 indicators: cough, breath sounds, respiratory rate, oxygen saturation percentage, use of accessory muscles, depth of breathing, abnormal breath sounds, respiratory rhythm, chest retraction, dyspnea with minimal exertion, sputum accumulation, dyspnea at rest, diaphoresis, drowsiness, pursed-lip breathing, cyanosis, restlessness, and nasal flaring. The indicators are scored on a 5-point Likert scale (severe, moderately severe, moderate, mild, none) for severity, with 1 indicating the most severe and 5 indicating the lowest level of severity. When a patient scores less than or equal to 4, they are at risk. The patient's final respiratory status score is determined based on the total scores of these 18 indicators.[21] In a study by Sadeghi *et al*. (2020),[22] the reliability of the Persian version of the tool was confirmed using the inter-rater agreement method with a correlation coefficient of 0.81.

The Activity Measure for Post-Acute Care (AM-PAC) "6-Clicks" Questionnaire is a standard tool for measuring the level of activity in post-acute care. It was developed by researchers at Boston University. The tool includes three domains: early mobility, daily activity, and functional cognition. In this study, only the early mobility domain was used. This domain of the tool consists of 6 questions, each with 4 difficulty ranges (unable or complete, much, little, none). A higher score indicates better physical activity. The scoring is as follows: the "unable or complete" option receives a score of 1, indicating that the patient is unable to perform tasks or is completely dependent on others. The "much" option receives a score of 2, indicating that the patient needs maximum to moderate assistance. The "little" option receives a score of 3, indicating that the patient needs minimal assistance from others. The "none" option receives a score of 4, indicating that the patient is independent and does not need assistance.

The interpretation of this tool is as follows: the final score of the 6 questions is added together to obtain the raw score. In addition, the raw score can be used to obtain the percentage-based score and the adjusted score using the standard table. The raw score of this tool ranges from 6 to 24, which is also reported as a percentage from 0 to 100. A higher percentage indicates greater mobility limitation. Additionally, based on the percentage of physical activity, there are 7 levels of physical activity limitation: none, very little, little, moderate, much, very much, and complete limitation.[21] The reliability of this tool was evaluated in a study by Jette *et al*. (2014)[23] using the Intraclass Correlation Coefficient (ICC) method, and the weighted kappa coefficient. The overall ICC score for the tool was 0.84 (with a 95% CI of 0.78-0.89), the ICC value for baseline mobility was 0.581 (with a 95% CI of 0.26-0.78), and for daily activity was 0.31 (with a 95% CI of 0.06-0.61). The weighted kappa value for the level of agreement ranged from 0.49 (with a 95% CI of 0.38-0.60) to 0.71 (with a 95% CI of 0.60-0.81) for baseline mobility and from 0.25 (with a 95% CI of 0.05-0.44) to 0.75 (with a 95% CI of 0.65-0.84) for daily activity. In a study by Sadeghi *et al*. (2020),[22] the validity and reliability of the Persian version of the tool were confirmed with a correlation coefficient of 0.93.

The educational content for the study, according to the protocol of the Ministry of Health, encompassed various key themes: 1. Impact of pulmonary complications on respiratory function; 2. Methods for deep, calm breathing; 3. Effective use of incentive spirometry; 4. Importance of and suitable techniques for coughing; 5. Systematic physical activities performed in supine, seated, and standing positions, including 3 sets of exercises: deep breathing and limb movements while lying down, exercises done while sitting up slightly in bed, and repeating all these exercises while sitting on a chair. Each set was performed at least 3 times a day, lasting between 15 and 20 minutes each time.

Intervention Group I: D-RD: An initial verbal presentation outlined the educational material, followed by the researcher's physical demonstration of the techniques (demonstration phase). Participants then replicated these techniques (return demonstration phase), with the researcher correcting any mistakes in real-time. This session, which took place in the education/consultation room on the day prior to the OHS, lasted between 45 and 60 minutes and was held in a friendly atmosphere with small groups, consisting of no more than 4 attendees.

Intervention Group B: D-RD Enhanced by Music: For participants in this second intervention group, the teaching approach employed mirrored that of the initial intervention group and in the same place. Yet, a distinguishing feature was the incorporation of a musical element throughout this phase. The selected musical piece was an instrumental

with a rhythmic undertone, characterized by its gentle and soothing nature, reminiscent of bird calls, and the serene sounds of ocean waves. It was carefully played in the background through a high-fidelity speaker system, creating an ambient atmosphere.

Control Group: Participants were imparted with the educational content through the traditional face-to-face pedagogical method.

Research Outcomes: The explicit and implicit anxiety levels of participants across the 3 groups were ascertained employing the STAI. Their levels of activity measure were evaluated utilizing the AM-PAC "6-Clicks," and their pulmonary health status was determined through the comprehensive 18-criteria NOC scale. Evaluations were systematically conducted during 3 distinct periods: pre-educational intervention, immediately post-educational delivery, and a 48-hour interval subsequent to surgical intervention. The investigation of secondary outcomes focused on the prevalence of complications including postoperative hemorrhage, decreased Level Of Consciousness (LOC), hemodynamic instability, and patient death.

Statistical analyses were conducted employing JASP software (JASP Team, 2023, Version 0.17.3). The normality of numeric variables was assessed through the Kolmogorov–Smirnov test, along with descriptive measures of distribution, encompassing skewness (within ± 1.5) and kurtosis (within ± 2). Numeric variables were summarized using the mean (SD), while categorical variables were presented as frequency (percentage). The internal consistency reliability of outcome measures was evaluated using both Cronbach's Alpha (CA) and McDonald's omega (MDO), demonstrating robust internal consistency for the outcome scales (trait anxiety: CA = 0.91, MDO = 0.91; state anxiety: CA = 0.90, MDO = 0.91; activity: CA = 0.93, MDO = 0.93; respiratory: CA = 0.75, MDO = 0.75, all > 0.7).

Comparisons between groups, with regard to baseline measures and demographic variables, were executed through independent Analysis of Variance (ANOVA), supplemented by Fisher–Freeman–Halton exact tests where appropriate. Within-group comparisons across 3 measurements were performed utilizing Repeated Measures Analysis of Variance (RM-ANOVA), preceded by an assessment of the assumption of sphericity using Mauchly's test. In instances where deviations from this assumption were identified, corrections were applied based on the Greenhouse-Geisser method. The Holm *post hoc* test was subsequently conducted following significant RM-ANOVA outcomes.

To appraise intervention effects, Analysis of Covariance (ANCOVA) was employed, controlling for baseline measures and confounding variables encompassing age, gender, education, job, BMI, smoking, surgery hours, comorbidity, and vessel numbers (fully adjusted). Interaction effects of measurements within study groups were assessed using a two-way ANOVA with repeated measures. All analyses were conducted under the Intention-to-Treat (ITT) principle, and statistical significance was inferred at a threshold of $p < 0.05$.

Ethics considerations

This study was approved by the Ethics Committee of Mashhad University of Medical Sciences (code: IR.MUMS.NURSE.REC.1399.002). The principles of confidentiality and written informed consent were observed.

Results

A total of 120 patients were enrolled in this study. During the initial phase of eligibility assessment, 20 patients were deemed ineligible, with 16 individuals failing to meet the inclusion criteria and an additional 4 patients declining participation. Subsequently, 100 patients were allocated across 3 groups: D-RD (n = 34), D-RD enhanced by music (n = 33), and the control group (n = 33). A total of 10 individuals encountered some post-operative complications. They were excluded for various reasons: 3 participants passed away, 2 experienced decreased LOC, and 5 encountered hemodynamic instabilities. Ultimately, a comprehensive analysis was conducted on a cohort of 90 patients, evenly distributed among the D-RD (n = 30), D-RD enhanced by music (n = 30), and control (n = 30) groups, as shown in Figure 1.

Table 1 displays the patients' profile. The age range of the patients was 18 to 60 years. The findings indicate no significant differences between the intervention and control groups in terms of the demographic characteristics (all $p > 0.05$), confirming the comparability of these groups. The results demonstrated no significant differences between the intervention and control groups in any of the outcome variables (all $p > 0.05$ in the pre-educational intervention) [Table 2]. Table 2 provides a comprehensive overview of the results obtained from within-group comparisons of outcome variables within each distinct group. Notably, a significant temporal influence was evident for all outcome variables in both the intervention and control groups (all $p < 0.05$). Furthermore, the results of the Holm *post hoc* test indicated distinctive trends within the control group. Specifically, a significant reduction in trait anxiety, state anxiety, and activity levels was observed following 2 days of intervention (all $p < 0.05$), whereas no significant changes were observed immediately after the intervention (all $p > 0.05$). Conversely, a significant increase in respiratory variables was detected immediately post-intervention, although these measures exhibited a substantial decline after 2 days (both $p < 0.05$).

In the trait anxiety outcome within the D-RD group, a significant decreasing trend culminated in a score of approximately around 39 (both $p < 0.05$). Furthermore, for the composite group, a significant decreasing

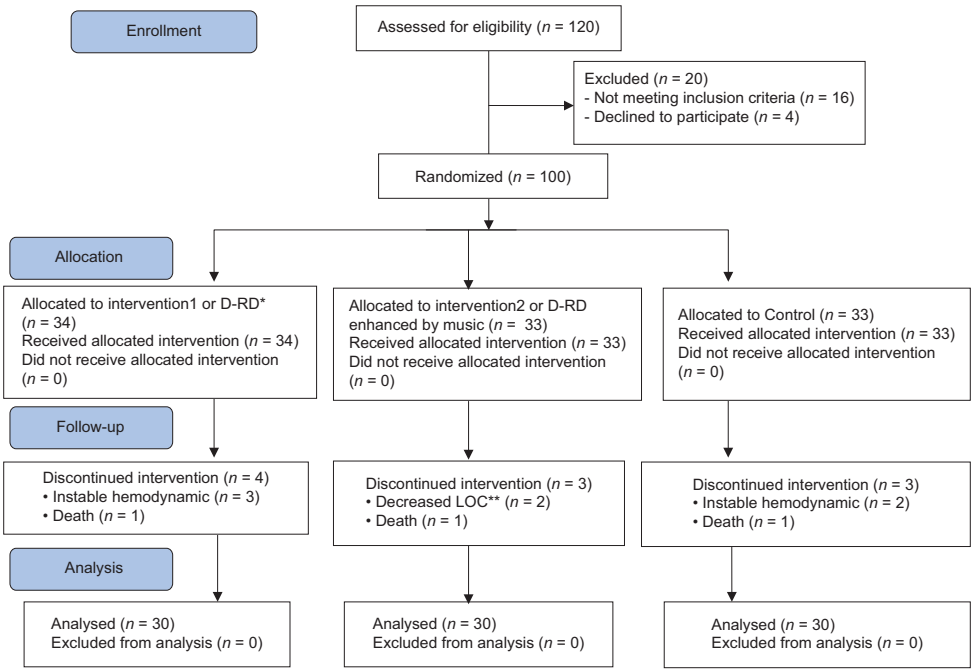

Figure 1: CONSORT flow diagram. * Demonstration and return-demonstration. ** level of consciousness

trend culminated in a score of approximately 36 (both $p < 0.05$). A similar pattern was observed for state anxiety outcome (all $p < 0.05$). The activity score remained relatively stable immediately after the intervention (both $p > 0.05$), yet a significant decline in values transpired within both intervention groups (both $p < 0.05$).

Additionally, within the D-RD group, the respiratory score demonstrated an immediate and significant increase post-intervention ($p > 0.05$) and remained steady at around 86 after a subsequent period. In contrast, the composite group displayed a consistent and significant upward trend in respiratory scores (both $p < 0.05$).

Table 2 presents the outcomes of the interaction analysis between measurements and groups. Remarkably, significant interactions were detected between measurements and groups for all outcome variables (all $p < 0.05$), underscoring distinctly disparate trends among the various groups [Figures 2-5]. The outcomes of ANCOVA are displayed in Table 2. The findings demonstrate a significant intervention effect for both the immediate post-intervention and the 2-day follow-up periods, across all outcome measures (all $p < 0.05$). An exception, however, pertains to the immediate intervention effect on the activity outcome, where no significant difference was observed ($p > 0.05$). Furthermore, *post hoc* tests revealed significant differences in the effect sizes of change between the intervention and control groups. Notably, both intervention groups displayed significantly greater impact compared to the control group. The composite group, in particular, exhibited heightened effects in state and trait anxiety, and respiratory scores (all $p < 0.05$). Conversely, the D-RD group demonstrated more pronounced influence on the activity outcome when contrasted with the composite group (both $p < 0.05$), while still maintaining a compatible effect size with the control group.

Discussion

This study assessed the impact of combining phase one cardiac rehabilitation with the D-RD technique and music on anxiety levels, physical activity, and respiratory function in patients undergoing OHS. The group experiencing the combined approach of D-RD enhanced by music showed a notable decrease in both state and trait anxiety post-intervention and surgery. This reduction was more pronounced in the music-enhanced group compared to the D-RD method alone. The integration of music with the D-RD approach seemed to amplify its effectiveness in reducing anxiety. However, despite the clear reduction in state anxiety within the music-enhanced group, statistical analysis revealed no significant difference between the music-enhanced group and the group using only D-RD ($p = 0.43$).

Subramanian *et al*.[24] found that a nurse-led intervention, including video-assisted education on disease management and exercises, using demonstration-return demonstration approach, for type 2 diabetes patients, significantly improved self-management, self-efficacy, and reduced blood glucose levels. Compared to standard care, patients receiving this 30-minute intervention showed notable benefits in their health outcomes, indicating the effectiveness of nurse-led educational programs in managing type 2 diabetes.[24]

In another study, which compared the educational outcomes of written/oral modalities against an integrative approach including physical demonstration (focused on the pMDI

Table 1: Demographic profile

Variables	D-RD* (*n*=30)	D-RD enhanced by music (*n*=30)	Control (*n*=30)	*p***
Gender				0.25
Male	18 (60.00)	23 (76.60)	23 (76.60)	
Female	12 (40.00)	7 (23.30)	7 (23.30)	
Marital status				0.95
Single	10 (33.30)	11 (36.60)	10 (33.30)	
Married	20 (66.60)	19 (63.30)	20 (66.60)	
Education				0.42
Illiterate	5 (16.60)	3 (10.00)	6 (20.00)	
Primary	12 (40.00)	14 (46.60)	15 (50.00)	
Diploma	7 (23.30)	8 (26.60)	5 (16.60)	
BSc	6 (20.00)	5 (16.60)	2 (6.70)	
Higher education	0 (0.00)	0 (0.00)	2 (6.70)	
Job				0.20
Labor	2 (6.70)	4 (13.30)	6 (20.00)	
Government	3 (10.00)	2 (6.70)	3 (10.00)	
Freelance	8 (26.60)	8 (26.60)	9 (30.00)	
Retired	1 (3.30)	7 (23.30)	2 (6.70)	
Unemployed	16 (53.30)	9 (30.00)	10 (33.30)	
Drug				0.79
No	21 (70.00)	23 (76.60)	23 (76.60)	
Yes	9 (30.00)	7 (23.30)	7 (23.30)	
Smoking				0.93
No	24 (80.00)	23 (76.60)	24 (80.00)	
Yes	6 (20.00)	7 (23.30)	6 (20.00)	
Hookah smoking				0.35
No	29 (96.60)	28 (93.30)	30 (100.00)	
Yes	1 (3.30)	2 (6.70)	0 (0.00)	
Insurance				0.32
Social security	12 (40.00)	10 (33.30)	7 (23.30)	
Veterans	1 (3.30)	0 (0.00)	3 (10.00)	
Education staff	10 (33.30)	14 (46.60)	14 (46.60)	
Private	4 (13.30)	1 (3.30)	1 (3.30)	
Comorbidity				0.39
No	11 (36.60)	6 (20.00)	9 (30.00)	
Yes	19 (63.3)	24 (80.0)	21 (70.0)	
Surgery				0.36
No	13 (43.30)	11 (36.60)	8 (26.60)	
Yes	17 (56.60)	19 (63.30)	22 (73.30)	
Age (years)	52.20 (11.28)	56.83 (3.83)	52.57 (11.98)	0.13
Height (cm)	172.83 (7.43)	172.93 (5.89)	171.10 (8.09)	0.54
Weight (kg)	73.67 (8.11)	71.47 (8.45)	69.70 (9.25)	0.20
BMI (kg/m^2)	24.72 (2.75)	23.90 (2.59)	23.86 (3.26)	0.43
Surgery hours	3.50 (0.59)	3.65 (0.66)	3.47 (0.51)	0.44
Vessels no	1.50 (1.23)	1.87 (1.04)	1.93 (1.26)	0.31
Ejection fraction	53.00 (6.10)	49.67 (7.54)	49.67 (8.50)	0.14

Data are expressed as *n* (%) and mean (SD) for categorical and numerical variables, respectively. *Demonstration and return-demonstration, **Fisher's exact test and ANOVA

technique), the intervention group exhibited a pronounced preference toward medical follow-ups. Notably, during an assessment 8 weeks subsequent to the intervention, 80% of the participants in the intervention group executed the technique correctly, in contrast to a modest 10% proficiency observed within the control group.[25] Further confirmation arises from studies revealing an enhanced efficacy in MDI utilization post-education via the demonstrative methodology,[26,27] coupled with an augmented retention of instructional content among cardiac-compromised patients.[28] These empirical findings, consistent with our research outcomes, emphasize the transformative

Table 2: The effect of intervention and measurements on the outcomes

	Control	D-RD*	D-RD enhanced by music	Between group *p***	D-RD vs. Control	D-RD enhanced by music vs. Control
Trait anxiety						
Before	59.30 (5.70)****	56.90 (8.03)****	60.00 (6.14)****	0.17	-	-
After	57.43 (5.96)****	41.33 (10.43)****	41.03 (6.86)****	<0.001	<0.001	<0.001
2 days after	45.80 (8.69)****	38.83 (9.37)****	36.07 (4.94)****	<0.001	0.01	<0.001
Time effect *p****	<0.001	<0.001	<0.001	<0.001*****		
State anxiety						
Before	59.80 (8.10)****	59.37 (7.86)****	62.27 (8.91)****	0.34	-	-
After	57.03 (6.12)****	47.43 (9.49)****	45.00 (6.97)****	<0.001	<0.001	<0.001
2 days after	54.17 (9.21)****	40.40 (7.44)****	35.50 (3.21)****	<0.001	<0.001	<0.001
Time effect *p*	<0.001	<0.001	<0.001	<0.001*****	-	-
Activity						
Before	24.00 (0.01)****	23.80 (0.66)****	23.70 (1.21)****	0.33	-	-
After	24.00 (0.01)****	23.77 (1.10)****	24.00 (0.01)****	0.37	0.49	0.89
2 days after	14.90 (2.02)****	18.30 (2.10)****	20.37 (1.65)****	<0.001	0.002	<0.001
Time effect *p*	<0.001	<0.001	<0.001	<0.001*****		
Respiratory						
Before	80.73 (3.40)****	80.70 (1.86)****	81.50 (2.61)****	0.43	-	-
After	88.20 (1.16)****	85.33 (3.02)****	84.13 (3.79)****	<0.001	0.002	<0.001
2 days after	75.57 (5.92)****	85.67 (2.41)****	86.97 (3.44)****	<0.001	<0.001	<0.001
Time effect *p*	<0.001	<0.001	<0.001	<0.001*****		

Data are expressed as mean (SD) for numerical variables. *Demonstration and return-demonstration. **Between Group *p* value was obtained from ANOVA for before the intervention and ANCOVA for after and 2 days after the intervention (adjusted for demographic profile). ***Time effect *p* value was obtained from RM-ANOVA time effect. ****Different letters show significant differences between times within each group ($p<0.05$). ***** Interaction P value obtained from RM-ANOVA time*group interaction

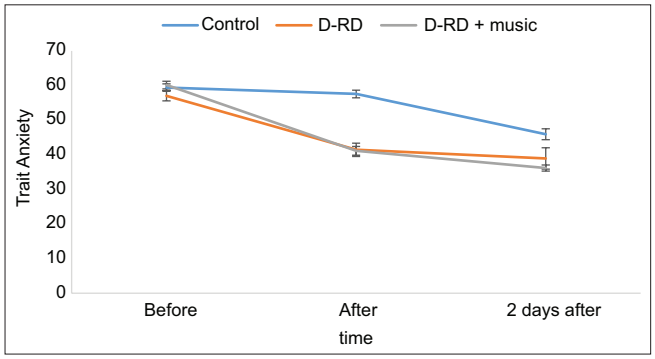

Figure 2: Trend of measurements within intervention and control groups for trait anxiety

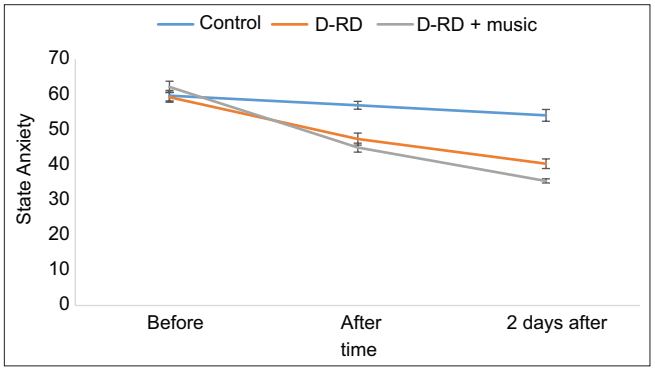

Figure 3: Trend of measurements within intervention and control groups for state anxiety

potential of the D-RD methodology in medical pedagogy. Current educational theories suggest that learners benefit optimally when they are actively engaged, facilitating successful learning experiences.[29] The D-RD teaching method enhances nurse-patient interaction, supports patient understanding, allows for immediate error correction, and offers a comprehensive learning experience. Systematic reviews confirm its effectiveness in increasing patients' knowledge about their conditions, improving adherence, and enhancing self-management skills.[30,31]

In an extensive cohort study (2006-2017), including 5,908 participants undergoing cardiac rehabilitation, findings indicated a notable prevalence of moderate anxiety in approximately 28% of the subjects. Moreover, this subset of individuals exhibited a diminished obligation to their cardiac rehabilitation regimen.[32] Thus, the need for effective methods to reduce anxiety, due to its negative impact on rehabilitation adherence, is highlighted. Studies have shown that incorporating music into rehabilitation can promote relaxation, reduce stress and anxiety, and improve mood. Music as a psychosocial intervention positively affects physiological parameters, like lowering blood pressure and heart rate. Research on the effects of music therapy on hospital-induced anxiety and QOL post-CABG surgery found that early integration of music therapy in cardiac rehabilitation significantly

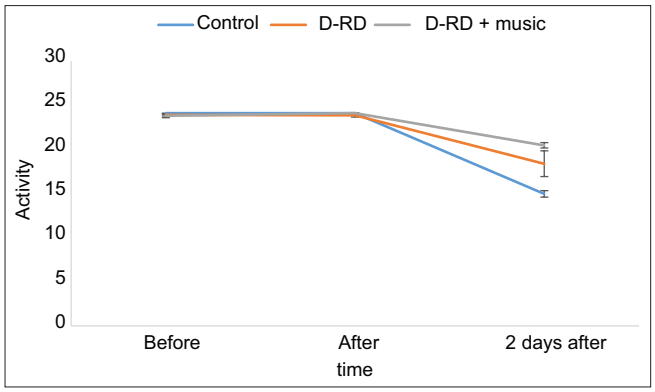

Figure 4: Trend of measurements within intervention and control groups for activity

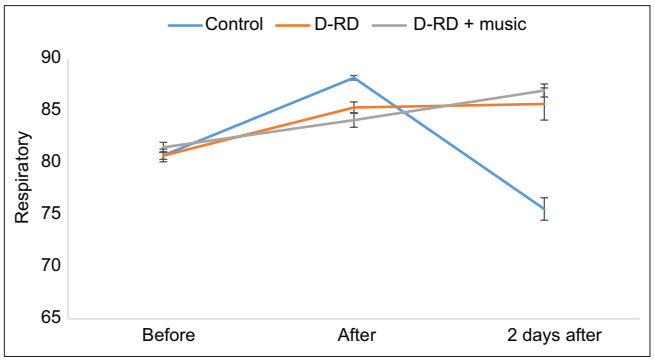

Figure 5: Trend of measurements within intervention and control groups for respiratory outcome

reduced anxiety, improving patient's QOL. These results support including music in cardiac rehabilitation protocols.[33] Mandel *et al*.[34] suggested that synergizing cardiac rehabilitation with music therapy led to a substantial decrement in anxiety levels in the subsequent four months, as compared with individuals who solely underwent the rehabilitation process. Similarly, another study by Clark *et al*.[35] showed that elderly individuals with cardiac conditions, when exposed to music during physical endeavors (predominantly walking-during cardiac rehabilitation), manifested an improved positive perception and tendency toward sustained physical activity. Our study findings are in line with existing research, emphasizing the significant role of music in promoting continued physical activity post-rehabilitation, particularly in comparison with non-musical methods. Music acts as a motivator, especially in physical activities, crucial for cardiac patients often facing reduced QOL, susceptibility to depression, and lack of interest in rehabilitation programs. The inclusion of music can be key in encouraging participation in physical activities.[36] Drawing from our research, the combination of music and rehabilitation not only alleviates patients' anxiety, but also improves their physical activities and enhances their respiratory indicators.

One of our limitation was using generic instrumental and sedative music, not tailored to individual preferences, potentially limited its therapeutic effectiveness. It lacked post-discharge follow-up, leaving the long-term effects of music therapy unknown. Additionally, the small sample size may have affected statistical robustness and generalizability, suggesting a need for a larger, more diverse participant group for conclusive results.

Conclusion

The D-RD method significantly influences anxiety, physical activity, and respiratory status, and its effectiveness is enhanced with music integration. Since no study has yet examined its effects on respiratory status with and without music, future research in this regard is highly recommended. Future studies should also consider QOL and depression, both short and long term, to fully understand the impact of rehabilitation teaching methods. For optimal patient outcomes in cardiac rehabilitation, adopting the D-RD method with music is advised to maximize the combined benefits. However, the study's external validity may be influenced by its specific setting, suggesting that the outcomes might need to be tested in diverse geographic and healthcare contexts to confirm their applicability universally.

Acknowledgments

We are grateful to the Research Deputy of Mashhad University of Medical Sciences and our dear patients for their cooperation.

Financial support and sponsorship

Research Deputy of Mashhad University of Medical Sciences

Conflicts of interest

Nothing to declare.

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