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Can Music Reduce Stress and Anxiety in the Operating Room Team? An Observational Study

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Abstract: *Background:* Music evokes positive emotions and reduces stress and anxiety. Operating Room (OR) staff face various challenges which can lead to high levels of stress. The aim of the study is to assess whether listening to music during intraoperative phases improves the work environment by reducing anxiety and stress in the entire surgical team. *Methods.* A prospective observational study was conducted from February to September 2023, involving medical personnel, nursing staff, and nursing students. They were divided into two groups: Group 1 with music during surgical procedures, and Group 2 without music. Participants were administered two validated instruments: the Zung Anxiety Self-Assessment Scale (SAS) to measure anxiety, and the Positive and Negative Affect Schedule to assess emotions generating stress. Additional items were included for demographics, job satisfaction, and the organization method. *Results.* Music did not impact anxiety but increased positive emotions while reducing negative ones. Music had an ancillary effect, highlighting the need for significant organizational interventions aimed at increasing operator satisfaction, including voluntary rather than mandatory assignments for nursing staff. *Conclusions.* Music appears to reduce stress in the intraoperative team when supported by a positive work environment in which assigned operators have chosen to work in the OR.

Keywords: music; stress; anxiety; operating room

Introduction

Music has the ability to evoke and regulate emotions, provide pleasure and comfort, and alleviate stress [1]. Several studies demonstrate that, in addition to reducing stress, music also reduces anxiety, improves sleep quality, decreases fatigue, enhances well-being, and alleviates pain [2–5]. Listening to music increases coping abilities and promotes relaxation after stressful events [6,7].

The use of music in workplaces has proven effective in reducing tension and improving mental state, performance, attention, and concentration. However, attention to volume and melody rhythm is crucial [8,9]. Through music, there is a reduction in fatigue during work activities [10].

Surgical intervention is a stressful exercise that requires expert execution of techniques and non-technical skills such as communication, teamwork, and quick decision-making under pressure [11]. In addition to these factors, there are often long working hours for operators, the need to treat patients with severe clinical conditions, and significant consequences in the event of an error. These situations

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can lead to high levels of stress [12]. Stress and the management of its effects on performance are common challenges for all operating room professionals [11]. Elevated perceived stress levels during surgical procedures not only negatively affect healthcare professionals but can also compromise patient safety and the quality of care [13]. Several studies indicate that patient safety failures result from human failures related to communication, teamwork, and the psychological health of professionals [14–16]. Professional well-being, anxiety, and stress management are among the determining factors that influence patient care [17,18].

Music, with its benefits, is significantly used in operating rooms worldwide to positively modify the environment where surgeons and the entire healthcare staff operate [11,19,20]. However, the literature is not yet unanimous on the benefits that music can have in these contexts. Some studies suggest that music has a distracting effect, especially in critical moments, associated with a reduction in auditory perception and speech [21,22] and an increase in the frequency of repeated requests [23]. In addition, some believe that music may "mask" alarms [24]. Conversely, other studies argue that music is generally a favorable part of the operating room environment [10,25,26], as it seems to improve calmness [19], stress autonomic reactivity [24,27], mood, and the performance of the surgeon and the entire assistive team [11,25]. Recent systematic reviews have highlighted that background music can improve the accuracy and speed of surgical interventions [9], reducing mental workload [28]. For these reasons, a significant portion of nursing and medical staff believes they appreciate their work more and achieve better results when music is played in the operating room [25].

The use of music as a tool of interest in managing stress and associated health issues must be measured [11]. Multiple validated questionnaires in the literature allow for investigating stress and anxiety levels in workplaces. The "Zung Anxiety Self-Assessment Scale" is a clinical tool used to analyze subjective anxiety [29], while the "Positive and Negative Affect Schedule" evaluates the positive and negative emotions of participants that typically generate stress [30].

The aim of the study is to assess whether listening to music during intraoperative phases improves the work environment by generating a reduction in anxiety and stress among surgeons and the entire operating room team. The study will investigate whether the use of music in the operating room can be an effective strategy to reduce stress and anxiety among healthcare professionals during surgical procedures. Additionally, the study will explore whether there are variables, aside from music, that may impact the reduction of anxiety and stress among operating room healthcare professionals.

Methods

Study Design

The study employed a prospective observational design with a non-probabilistic sample. Operating Rooms in three hospitals affiliated with a Healthcare Company in Northern Italy were recruited. Surgeons, nurses, and nursing students involved in providing direct patient care were included. The study focused on professionals working or assisting patients from February to September 2023.

The sample was divided into two groups: Group 1 used music during surgical procedures, and Group 2 did not use music during operating room activities. Data were extracted from a database created through the survey, following the administration of a self-administered questionnaire. At the end of the procedure, participants were provided with a link to access the online questionnaire. Anonymity was safeguarded for the sample, and responses could not be associated with individual professionals in any way. Emergency surgical interventions were excluded from the study.

Instruments

Data were collected through the Zung Anxiety Self-Assessment Scale [29,31] and the Positive and Negative Affect Schedule (PANAS-SF) [30].

The first questionnaire measures anxiety levels for those exhibiting anxiety-related symptoms. Each response uses a Likert scale ranging from 1 to 4 points, where 1 corresponds to "never" and 4

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corresponds to "most of the time or all the time." There are 20 questions, and the total score is obtained by summing the scores for each response. Each possible total score corresponds to a numerical score defined as the "Anxiety Index," which varies based on the total score. The Anxiety index is determined based on the Likert total score on a range from 20 to 100: Normal = < 45; Minimal = 45–59; Severe = 60–74; Extreme = > 75 [29].

The second questionnaire is one of the most widely used tools for assessing positive and negative affective states. The questionnaire consists of 20 adjectives, divided into two sections, with 10 composing the positive affect scale and 10 the negative affect scale. The positive affect section reflects the degree to which a person feels enthusiastic, active, and determined. The negative affect section refers to general unpleasant states such as anger, guilt, and fear. For each proposed item, respondents were asked to evaluate how closely that adjective reflected their mood at the time of the intervention, reporting the data on a 5-point Likert scale, where 1 indicates "very little or not at all," and 5 indicates "extremely." To interpret the results, scores were summed for each positive and negative affect term. Lower scores indicate lower levels of affect, while higher scores represent higher levels of affect. For the positive section, we have an average score of 33.3 ± 7.2, while for the negative section, we have an average score of 17.4 ± 6.2 [30].

In the demographic data section, questions were included on gender, age, marital status, profession, years of service in the operating room, and satisfaction with the work environment. For nursing staff, questions included post-basic training and whether assignment to the operating room was voluntary or mandatory.

A 15-minute time allocation was provided for questionnaire completion.

Ethical Considerations

The study received approval from the Ethics Committee (Protocol 0026393 dated 02/02/2023) and the Health Directorate of the Company. The study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

The collected data were organized using an electronic database and analyzed with the statistical software Jamovi 2.3.18. Descriptive statistical calculations were performed, including mean, median, standard deviation, frequencies, and percentages. T-tests and ANOVA analyses were conducted to identify significant differences with a 95% confidence interval. The internal consistency of both instruments was assessed using Cronbach's Alpha, and the sample adequacy was measured with the Kaiser-Meyer-Olkin (KMO) statistic.

Results

Overall, 122 professionals participated in the study, including 29.5% (n = 36) surgeons with an average age of 42.6±8.33, 11.5% (n = 14) anesthetists with an average age of 39.2±4.85, 22.1% (n = 27) instrument nurse with an average age of 43.1±11.4, 11.5% (n = 14) anesthesia nurses with an average age of 46.1±9.45, 13.1% (n = 16) ward nurses with an average age of 44.4±10.5, and 12.3% (n = 15) nursing students with an average age of 23.1±2.92. Regarding gender, 56.6% (n = 69) were female, and 43.4% (n = 53) were male.

Marital status data revealed that 41.0% (n = 50) of the sample were married, 18.0% (n = 22) were cohabiting, 36.1% (n = 44) were single, and 4.9% (n = 6) were separated. Regarding years of experience in the Operating Room, the mean values were approximately 16.0±11.1 for surgeons, 8.7±5.28 for anesthetists, 15.3±12.2 for instrument nurses, 14.5±13.1 for anesthesia nurses, and 18.0±11.2 for ward nurses. The students recorded an average of 1.5 months.

For nursing professionals, the study inquired about post-basic training related to the operating room. 7.0% (n = 4) reported not having post-graduate training, 36.8% (n = 21) indicated having a Master's degree, and 56.2% (n = 32) reported having company-specific training related to their role.

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Among nurses, 82.5% (n = 47) chose to work in the operating room voluntarily, while 17.5% (n = 10) were assigned to the role.

Regarding the division of the sample into groups, 66.4% (n = 81) belonged to Group 1, and 33.6% (n = 41) belonged to Group 2. The selection of groups was based on the organizational models that either included or did not include the use of music in the operating room.

Internal consistency was acceptable for SAS (α = 0.682) and good for PANAS-SF (α = 0.834). Sample adequacy was good for both instruments [SAS (KMO = 0.725); PANAS-SF (KMO = 0.825)].

In Table 1, although not statistically significant, PANAS-SF (Positive Score) indicates a positive effect on subjective well-being in the operating room professionals with music (34.2±6.14) compared to those without music(32.9±8,38), (Δ = +1.3). Similarly, for anxiety, which is normal for both settings and lacks significance, Group 1 recorded a lower value with 36 vs. 39. Regarding the negative effects of PANAS-SF (Negative score), the value is below the average score for both settings; however, Group 1 shows a slightly higher average score (15.4±5.58) compared to Group 2 (14.3±4.94), (Δ = +1.1) (p = 0.292).

Table 1. Comparison between Groups using SAS and PANAS-SF.

	Group 1 N = 81		**Group 2 N = 41**			
	Point Likert M±DS(Me)	Index	Point Likert M±DS(Me)	Index	t	p
SAS (Anxiety Index)	30.0±5.42(29.0)	37.6±6.74(36.0)	30.6±5.94	38.4±7.46(39.0)	0.637	0.525
PANAS-SF (Positive Affect Score)	34.2±6.14(35.0)	++	32.9±8,38	-	-0.952	0.343
PANAS-SF (Negative Affect Score)	15.4±5.58(14.0)	-	14.3±4.94	-	-1.058	0.292

++ (Positive Affect) = > 33.3; - (Positive Affect & Negative Affect) = < 33.3 & < 17.4.

In Table 2, the SAS showed normal anxiety levels for all professionals in both settings with no significant differences. However, in the first group, values < 40 index were recorded in medical staff, instrument nurses, ward nurses, and students. The highest value was recorded in anesthesia nurses with an index of 41. In Group 2, with the index value < 40, we find doctors, anesthesia nurses, and ward nurses. With scores above 40, instrument nurses and students are recorded.

Regarding PANAS-SF, feelings of enthusiasm, determination, and activism are found in both groups among surgeons, anesthetists, and medical students. However, Group 1 shows a greater positive effect than the second group on instrument nurses (32.8±6.18), (Δ = +1.2), anesthesia nurses (31.4±5.52), (Δ = +3.1), and ward nurses (Δ = +3.6). In fact, in Group 2, positive effects have an average score < 29.0 for anesthesia and ward nurses. PANAS-SF's Negative Affect Score in Group 1 highlighted a value of 17.6±5.32 among anesthesia nurses with a Δ (+3.3) compared to colleagues with the same role in Group 2 (Table 2).

Table 2. Effects of Music on Anxiety and Stress in Different Profiles in the Operating Room.

		Group 1				**Group 2**			
	Sample	N	Anxiety Index M±DS(Me)	F	*P*	N	Anxiety Index M±DS(Me)	F	*P*
SAS	Surgeon	29	38.6±5.75(38.0)	0.55	0.734	7	32.9±8.03(30.0)	1.14	
	Anesthetist	12	35.7±6.11(35.5)	4		2	37.5±12.02(37.5)		

 doi:10.20944/preprints202403.0022.v1

	Instrument Nurse	13	38.3±8.87(36.0)			14	42.1±6.98(43.5)	
	Anesthesia Nurse	10	38.5±7.26(41.0)			4	35.5±7.23(34.5)	0.420
	Ward Nurse	8	35.8±7.44(36.0)			8	38.4±5.68(39.0)	
	Students	9	36.6±6.73(35.0)			6	38.5±6.92(40.5)	

		Group 1				Group 2			
		N	M±DS	F	*P*	N	Media	F	*P*
PANAS-SF (Positive Affect Score)	Surgeon	29	36.1±6.08			7	38.0±9.87		
	Anesthetist	12	33.9±5.85			2	37.0±12.73		
	Instrument Nurse	13	32.8±6.18	1.271	0.306	14	31.6±6.92	1.589	0.274
	Anesthesia Nurse	10	31.4±5.52			4	28.3±5.56		
	Ward Nurse	8	32.4±5.45			8	28.8±9.39		
	Students	9	35.2±7.24			6	37.3±5.47		
PANAS-SF (Negative Affect Score)	Surgeon	29	15.8±6.96			7	11.1±3.02		
	Anesthetist	12	12.8±2.25			2	12.5±3.54		
	Instrument Nurse	13	16.7±5.41	2.335	0.069	14	15.2±6.28	1.169	0.402
	Anesthesia Nurse	10	17.6±5.32			4	14.3±2.87		
	Ward Nurse	8	14.0±4.47			8	14.9±4.97		
	Students	9	14.3±4.42			6	15.7±4.37		

ASAS: Normal = < 45; Minimal = 45–49; Severe = 60–74; Extreme = > 75

PANAS—SF Positive Affect Score: Mean 33.3±7.2

PANAS—SF Negative Affect Score: Mean 17.4±6.2

The assignment mode in the Operating Room revealed a statistically significant difference in the negative effects measured by the PANAS. The nursing staff assigned involuntarily, compared to those with voluntary assignment, records a Negative Affect Score with a mean of 19.0±6.50 and a median of 21.0 (p = 0.027) (Table 3).

Table 3. Values of SAS and PANAS based on Nurses' Assignment Modes.

	Voluntary Assignment		Office Allocation			
	Me	M±SD	Me	M±SD	t	p
SAS (INDEX ANXIETY SCALE)	44.5	42.1±8.14	38.0	38.0±7.16	1.606	0.114
PANAS-SF (Positive Affect Score)	32.0	31.7±6.72	29.5	29.5±5.62	-0.974	0.334

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PANAS-SF (Negative Affect Score)	14.0	15.0±4.73	21.0	19.0±6.50	2.280	0.027*

* p = < 0.05.

The level of satisfaction with the work performed shows significant differences across all domains of the instruments. The Anxiety Index score and Negative Affect Score have significantly demonstrated an inversely proportional relationship to the increasing satisfaction of professionals. On the other hand, Positive Affect Score scores have been directly proportional to the increase in satisfaction ratings of the operators (Table 4).

Table 4. Values of SAS and PANAS based on Job Satisfaction of Personnel.

	1 n = 1	2 n = 6	3 n = 34	4 n = 46	5 n = 35	F	p
SAS (INDEX ANXIETY SCALE)						3.606	0.008**
Me	59.0	38.5	38.5	36	36.0		
M±SD	59.0±-	42.0±7.72	38.6±6.75	37.3±7.06	36.5±5.90		
PANAS-SF (Positive Affect Score)						3.742	0.007**
Me	30.0	29.0	31.5	36.0	36.0		
M±SD	30±-	30.7±7.89	30.6±7.07	34.8±6.76	36.2±5.90		
PANAS-SF (Negative Affect Score)						2.785	0.030*
Me	25.0	13.0	15.0	13.0	11.0		
M±SD	25.0±-	17.38.36	16.3±4.89	15.0±6.02	13.2±3.54		

* p < .05, ** p < .01.

The results from Table 4 are confirmed by the Pearson correlation index in Table 5. The Anxiety Index Scale (-0.242) and the Negative Affect Score (-0.278) show a negative correlation with the satisfaction that professionals perceive for the work environment ($p < 0.01$), whereas the Positive Affect Score records a significant positive correlation (0.314), ($p < 0.001$). The Index Anxiety Scale positively correlates with the Negative Affect Score (0.522; $p < 0.001$).

Table 5. Pearson Correlation.

	"Express your level of satisfaction regarding your job position?"	**INDEX ANXIETY SCALE**
SAS (INDEX ANXIETY SCALE)	-0.242**	—
PANAS-SF (Positive Affect Score)	0.314***	-0.089
PANAS-SF (Negative Affect Score)	-0.278**	0.522***

* p < .05, ** p < .01, *** p < .001

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Other independent variables, such as the post-basic training paths received by nurses, did not show significant differences in the Anxiety Index ($F = 0.64$; $p = 0.54$), Positive Affect Score ($F = 3.203$; $p = 0.07$), and Negative Affect Score ($F = 2.402$; $p = 0.14$).

The only indicator that yielded a positive result in the Anxiety Index (Index = 50; Raw Score = 40) pertains to married operators. In comparison to others with a Normal Index, they exhibit a statistically significant difference ($F = 6.356$; $p = 0.002$).

Discussion

The use of music in the operating room appears to promote positive emotions and reduce stress among healthcare professionals [25].

The data from the study did not reveal anxiety indicators in the healthcare staff; therefore, it was not possible to assess its positive effects, as documented in literature for patients [32,33]. However, lower SAS Likert scores were recorded in Group 1 compared to Group 2, even though the t-test did not show significant differences.

The study highlighted an organizational element that, when combined with music, could positively impact the stress levels of operators: the perceived satisfaction of operators with their work environment. The research revealed a direct proportionality between the Positive Affect Score and the professional's satisfaction. Literature confirms the relationship between these variables, especially for nursing staff [34]. Some studies show a connection between job satisfaction and staff mobility in organizations chosen by the professional. In fact, operating room nurses demonstrating a direct correlation with Positive Affect and an inverse correlation with Negative Affect are those who have voluntarily chosen to work in the operating room. Staff less satisfied with the work environment and nurses assigned to the operating room office scored above the threshold level in Negative Affect Score and below the threshold level in Positive Affect Score.

The research, therefore, seems to frame the use of music as an intervention that promotes a positive work environment. This aspect is more pronounced in settings where personnel are selected based on skills and motivation to work in the Operating Rooms. This combination appears to have a significant meaning in stress management in the operating room. This data seems crucial as it allows professionals to ensure good work continuity. As some studies in the literature assert, job satisfaction and the work environment are considered important factors in the operating room [35] precisely due to stress-related damage. If stress is not managed properly, it not only creates psychological problems for healthcare professionals but can also lead nurses and doctors to make mistakes and negatively impact patient safety [36–39]. Therefore, effective stress management in the workplace and the use of alternative strategies to cope with it are crucial.

Lastly, the study appears to highlight another finding: enthusiasm, determination, and activism are also evident in students. Student enthusiasm is a significant factor, as the literature considers it an essential component of student learning during internships in study programs. This positive affect allows students to apply theoretical knowledge and skills acquired in the clinical environment [40,41].

Limits

This study is not without methodological limitations. The first limitation relates to the sample size; indeed, it would be useful to replicate the study in multiple Healthcare Companies nationwide. A second limitation could be attributed to the sample selection method. Voluntary participation is likely to introduce selection biases, as those who chose to participate might have different perspectives and experiences compared to those who chose not to participate.

Conclusions

The study demonstrates that music certainly has a positive effect on the subjective well-being of healthcare professionals in the operating room, but this alone is not enough. The research has highlighted that this innovation should be coupled with a method of selecting nursing staff based on

 doi:10.20944/preprints202403.0022.v1

both skills and motivation. Additionally, healthcare organizations must strive to create a working environment that fosters satisfaction among the staff. These are the elements that have significantly contributed in the study to generating positive emotions and reducing the negative ones that lead to stress.

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Ethical Approval: The study received approval from the Ethics Committee of the University of Bologna (Protocol 0026393 dated 02/02/2023) and the Health Directorate of the Company. The study was conducted in accordance with the Declaration of Helsinki.

Conflict of Interest: Authors declare no conflict of interest. The manuscript has been read and approved by all the authors, the requirements for authorship have been met, and each author believes that the manuscript represents honest work.

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