

Patients' preferences, feelings, and benefits on Music-Based Intervention:**A Pilot Study in COVID-19 Hospitalization**Alessio Pesce ¹, Francesca Lantieri ²

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ABSTRACT

Introduction: COVID-19 patients survive in isolation with stringent measures of infection containment, leading to anxiety, fear, stress, loneliness, and depression. Music is recognized as useful to promote multiple health outcomes, including anxiolytic effects, pain-relieving, and relaxing effects that favour well-being and social interaction in healthcare settings.

Objective: This study aimed to determine the impact of a pre-recorded music-based intervention on the music perception in hospitalized COVID-19 patients. Music appreciation, evoked emotions, and self-reported effects were explored and compared before and after music-based intervention, also considering the gender of the patients.

Methods: This prospective study consisted of a pre-recorded music-based intervention administered to 272 patients hospitalized for COVID-19 by piping the music into rooms of inpatient medical area. Pre-recorded musical pieces were selected by a music therapist considering specific formal and parametric characteristics, with the purposes of distraction, entertainment, relaxation, and emotional support. The patients' opinions were collected using an ad hoc self-report questionnaire and a short data survey that followed the Consolidated Framework for Implementation Research (CFIR) guidelines.

Results: Music resulted to be the preferred entertainment activity during hospitalization by 84.6% of patients, with 96.6% of them expecting a positive effect and a very high grade of usefulness attributed to music before hospitalization and even higher afterwards. The music intervention significantly changed the patients' perception of music from everyday life to hospitalization ($p < 0.0001$). It proved successful in evoking pleasure and fun, which raised from 18.4% of everyday life to 41.1% during hospitalization. The usefulness of listening music to alleviate unpleasant feelings including anxiety, fear, loneliness, and low mood in COVID-19 disease, had a significant increase from 22.5% to 60.0% after the music intervention.

Conclusion: Music-based intervention, directed according to reference frameworks, provides self-

reported social and emotional support in hospitalized patients for COVID-19.

Keywords: Covid-19, music therapy, emotions, hospitalization, music medicine

INTRODUCTION

Music represents an interdisciplinary topic, transversal to medicine and the human sciences. It constitutes a non-pharmacological intervention aimed at multiple health outcomes, including anxiolytic, pain-relieving, and relaxing effects that promote well-being, sleep quality and social interaction in healthcare settings [1-7]. Hospitalized patients with COVID-19 survive in isolation with stringent infection containment measures, which lead to anxiety, fear, stress, loneliness, and depression, even to the point of evoking obsessive thoughts; in the most severe cases they compromise the prognosis, increasing mortality and adverse events. Music-based interventions, therefore, can also be used in psycho-social need in COVID-19 patients [1]. To date, research protocols are available in the hypothesis that music can reduce anxiety, depression or improve the quality of life in COVID-19 patients [8]. Therefore, studies to explore patients' perspectives and determine the effects of music-based intervention during hospitalization are needed to provide scientific evidence. Some authors [9] remark how essential the compatibility of musical pieces with people's preferences is and how these may vary depending on expectations at a specific moment, health conditions, or the healthcare environment. A crucial aspect in music-based interventions is the proper selection of musical pieces. Listening to specific types/genres of favorite music or sounds is likely to have an emotional impact based on patients' clinical conditions. Systematic reviews show that patients' music background and listening habits have been drastically underestimated, reported in only 7.7% of the studies conducted [10]. Only about 25% of studies have explored patient feedback on musical [10]. Personality plasticity, cognitive-affective components [11] and the clinical conditions of patients, especially respiratory system efficiency and symptom aggravation, show a close correlation with music preferences [9], stated even before COVID-19 disease. Therefore, it is crucial to explore the in-patients' music preferences, the utility that listening to music might have for them, and their feelings also in relation to COVID-19 before starting a music-based intervention. This knowledge would allow health and music professionals to

personalize the intervention and be able to demonstrate important correlations between habitual musical preferences and attitudes with those experienced by the patient as a result of listening to music. The literature generally admits methodological weaknesses in music-based interventions [10,12]. There is a lack of scientific rigor in music selection, in the involvement of music experts, and in reporting and describing the music pieces used [12]. Furthermore, music has rarely been selected to achieve specific effects according to the reference frameworks [10,12]. The opportunity to identify music mechanisms of action would allow researchers to advance beyond basic questions about efficacy and begin to answer questions about how, why, and for whom an intervention works [12]. For these reasons, we applied a music-based intervention to in-patients affected by COVID-19 after pre-inquiring their music preferences and have administered a questionnaire to investigate their appreciation for music both before and after the intervention. The music-based intervention was selected by a music therapist and integrated according to guidelines and [13] a consolidated framework [14].

Objective

This study aimed to determine the impact of a pre-recorded music-based intervention on the music perception in hospitalized COVID-19 patients. Music appreciation, evoked emotions, and self-reported effects were explored and compared before and after the music-based intervention, also considering the gender of the patients.

MATERIALS AND METHODS

Sample Recruitment and Clinical Setting

All adult patients with COVID19 admitted to the COVID-19 inpatient medical area of the Italian hospital Santa Maria Misericordia (Local Health Authority ASL2, Savona), between May 18, 2020 and February 18, 2022 were recruited. The inclusion criteria were age 18 years or older, ability to

understand, write and speak Italian, and written consent to the study. Patients with severe hearing and visual deficits, and with alterations of the state of consciousness, as assessed by the medical-nursing staff, were excluded. No exclusion criteria based on covid severity were applied. According to Italian rules at that period, no COVID-19 patient received visits from friends or family members during hospitalization. The study was conducted in accordance with the 1964 Helsinki Declaration and was approved by the Ethics Committee (May 18, 2020 - Protocol Number 10459); informed consent was obtained from all participants included in the study.

Study Design

This prospective study consisted of a pre-recorded music-based intervention and the administration of a questionnaire aimed at determining the perception of music in patients hospitalised for COVID-19, and their point of view on music listening in terms of their attitude toward music and the set of sensation associated to listening the music, during hospitalization, before and after the music intervention. Patients, upon their acceptance to participate in the study, were received an ad hoc self-report questionnaire and a short data survey, both in paper form. The questionnaire included 15 pre-treatment questions regarding the patients' attitude toward music in their everyday life and in the hospital setting and 3 post-treatment questions to be answered after the music treatment. The patients were instructed to fill in in only the pre-intervention questions before the music treatment and to complete the rest of the forms only after the music intervention. The afternoon following admission, a single 90-minute length music-based intervention was introduced in the in-patient rooms via piped music. On the same day, following the musical presentation, the two data sheets were collected. Patients who agreed to participate to the study but refused the music-based intervention due to their choice or clinical worsening, were still invited to fill in Q1-Q15 and short data record at their convenience or after the improvement of their health conditions (Figure 1).

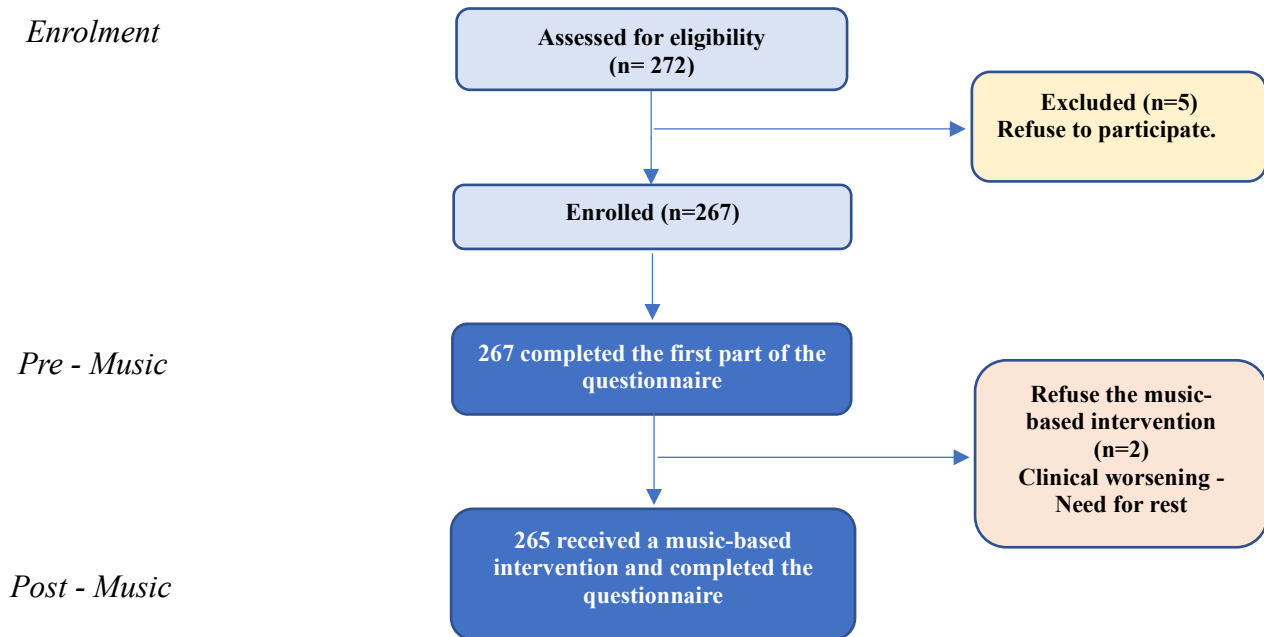


Figure 1. Flowchart of the study

Criteria for constructing the questionnaire

The present questionnaire was specifically constructed for this study to explore preferences, diffusion modes, utility, emotions evoked, and self-reported effects, also considering the gender, and to compare the point of view during hospitalization with what described by the patient after the music-based intervention. A preliminary questionnaire was constructed in 2013 and used for the first time on a sample of 55 patients to evaluate the point of view on habitual music listening and in hospitalization for cardiac catheterization [15]. The meaningful constructs, facade preferences and response categories that emerged from this previous study guided the initial design of the items for the present study. Based on this, an updated questionnaire was developed in 2020 following the adoption of the Consolidated Framework for Implementation Research (CFIR) to integrate a music-based intervention. According to the CFIR framework, to embody music into the hospitalization through piped music, it is necessary to explore the possibility of integrating music into the in-patient setting.

The purpose was to 1) understand the general appreciation and practical feasibility of the musical introduction, 2) explore the point of view of operators and patients to define the modalities of

integration in the healthcare setting and 3) investigate listening preferences before the experimentation. To this aim, the updated questionnaire, preliminary to the present one, was submitted to all the 33 healthcare professionals and to a limited sample of 25 patients before the start of the experimentation. They were asked to give their opinion on the questionnaire and fill in two short surveys to assess the overall comprehensibility of the questionnaire and collect the suggestions from patients and health professionals, aimed at improving the form and content of the questionnaire. Based on scientific evidence from the literature [1-7,10,12], the frameworks on music selection, and the suggestions that had emerged from patients and operators in the preliminary investigation, the final questionnaire was declined and then submitted to the different sample of 267 patients of the present study, together with the short survey. The final questionnaire, specifically constructed for this study, consists of 18 questions. The questionnaire is structured in two sections, the first, pre-intervention, with the aim of exploring the patient's habitual (8 questions, T0) and hospitalization perceptions (7 questions, T1) and the second to explore the patient's experience after the music-based intervention (3 questions, T2). For questions 1 to 18 the participants can choose one of the predefined answers that best describes his or her point of view, with the possibility, for eleven of these questions, to enter open answers different from the predefined ones. Socio-demographic data (nationality, sex) were collected by the short data survey that was administered by a separate sheet and that include the overall evaluation of the questionnaire by the participant. This short survey also includes the pre-post opinions about the music intervention through 5 Point Likert Scale Questions (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: strongly agree).

Intervention

A pre-recorded music-based intervention was developed in the pre-experimental phase when the preliminary version of the questionnaire was developed. During this phase, musical genres of

patients' preference on admission were explored. A music therapist structured an intervention based on the opinions of 25 patients. The music-based experimentation was designed using specific theoretical frameworks for music selection [10] and reporting intervention quality guidelines [13]. Pre-recorded pieces of music were selected considering specific formal and parametric characteristics with the purposes of distraction, entertainment, relaxation, and emotional support. The selection criteria, declined through the intervention reporting checklists by Robb SL et al. [13] reported on the Equator Network are detailed in Table 1. The piped music was transmitted into the single room of patient participating to the study via a player and an amplifier located in a workstation isolated from the COVID-19 wards. Ceiling speakers were used to prevent contamination through portable music players/earphones and in consideration of the poor management of portable devices or musical instruments due to medical ventilation devices.

Music Intervention Checklist
<u>A: Theoretical frameworks:</u> The rationale of the intervention is to experiment with distraction, relaxation, entertainment and emotional supports
<u>B.1: Music selection:</u> Selected by the investigator on the basis of patient preferences
<p><u>B.2: Musical Content:</u></p> <p><i>Relaxation:</i> <i>Once Upon a Time in the West - E. Morricone - TEMPO: 67 BPM, MEASURE 4/4, KEY D Major;</i> <i>In the beginning & let there be light Michael Oldfield - TEMPO: 82BPM, MEASURE: 4/4, KEY: B min</i> <i>Aria on the Fourth String by J.S. Bach - TEMPO: 62 BPM, MEASURE: 4/4 KEY: D</i> <i>Luna – Emiliano Toso - 432Hz acoustic tuned music</i></p> <p><i>Emotional Support:</i> <i>Minuet by Boccherini - TEMPO: 88 BPM, MEASURE: 3/4, KEY: A major</i> <i>La Primavera - Concerto in E Major Op.8 No.1 RV 269 "La Primavera": Allegro by A. Vivaldi-</i> <i>TEMPO: 85, MEASURE: 4/4 KEY: E Major</i> <i>Kalimba de luna - Tony Esposito - TEMPO: 111 BPM, MEASURE: 4/4, KEY: C</i> <i>Nel blu dipinto di blu - D. Modugno - TEMPO: 128 BPM, MEASURE 4/4, KEY: A# Major</i></p> <p><i>Distraction:</i> <i>Turkish March - W. A.Mozart - BPM: 133, MEASURE: 4/4, KEY: D major</i> <i>Azzurro - A.Celentano - TEMPO: 119 bpm, MEASURE:4/4, KEY: D major</i> <i>E tu - C. Baglioni - TEMPO: 65 BPM, MEASURE 4/4, KEY: F Major</i> <i>La gatta - G. Paoli - TEMPO: 100 BPM, MEASURE: 4/4, KEY: C major</i></p> <p><i>Entertainment:</i> <i>How Time Passes - M.Vandelli - TEMPO: 66, MEASURE: 4/4, KEY: FA</i> <i>Io vagabondo - I Nomadi - TEMPO: 65, MEASURE: 4/4, KEY: D</i></p>
<u>B.3. Music Diffusion Method:</u> Pre-recorded music piped through loudspeakers into the patient rooms. The amplification system is controlled remotely. Similarly, the volume control is set to 65

dB remotely, not adjustable by the participant.
B.4: Materials: Ceiling speakers to maintain communication in the care environment and prevent contamination with the use of portable music players/earphones. Poor management of portable devices or musical instruments considering medical ventilation devices.
B.5: Intervention strategy: Intervention based on pre-recorded music.
C: Intervention programme: Single 90-minute music session.
Q: Experimenter qualifications: Music therapist with 40 years of experience with disabled/elderly patients.
E: Fidelity of treatment: Through the theoretical framework of reference [10,14].
F: Setting: Single inpatient room, 30-40 dB electromedical instrument noise, external soundproofing.
G: Addressees: All patients hospitalised for COVID-19 receive pre-recorded music.

Table 1. *Music-Based Intervention*

Statistical Analysis

Categorical data are reported as counts (N) and percentages (%) with 95% confidence intervals (95%CI, binomial exact calculation). We applied the Cramer’s V test to investigate if the usually preferred genre of music (classical, Italian, foreign language, etc.) correlated with the preferences during hospitalization (Q3 vs Q13). Categorical variants were compared by Chi-square test or by Fisher’s exact test when more appropriate. In particular, the Fisher’s exact test was applied to explore if the emotional effects (relaxation, happiness, crave, etc.) were different between what expected in usual settings and what was expected during hospitalization (Q8 vs Q17). The Fisher exact test was also used to compare if patients enjoyed music and the reasons why they listened to music (the utility of the music in terms of kind of sensations achieved: amusement, relief, etc.) in the three settings: usual life vs what expected during hospitalization vs what actually felt during hospitalization (Q1 vs Q14 vs Q16, and Q7 vs Q12 vs Q18, respectively). These tests were confirmed by the Cochran Q test to compare more than two groups for a binary outcome when considering only the two categorical “yes” or “no” answers. Also, the differences between females and males were investigated through the Fisher’s exact test, as well as the association between the genre of music preferred during the hospitalization and the emotional effect and the utility in terms

of sensation achievement. Finally, the level of appreciation of music measured by the Likert questions was compared before and after the music intervention by the Wilcoxon test, while the correlation was estimated by Spearman's rho; the differences between males and females were tested by the Mann-Whitney test. All tests were two tailed and considered significant with p-value (p) <0.05. Data were analyzed using 24.0 SPSS Software.

RESULTS

Analyzed Sample and Baseline patients' characteristics

Two hundred and seventy-two patients met the eligibility criteria, however five refused to participate in the study, declining the proposal because they did not want to answer the questions on the questionnaire. Among the participating patients, two refused the music-based intervention after answering the first questions of the questionnaire; one due to clinical aggravation and the other due to the need for rest. The flowchart of the study is depicted in Figure 1. Patients were mostly Italian (94.4%), 59.6% were males. For 95.1% of the participants, the questionnaire had a good (66.8%) or complete intelligibility (28.3%). Only 4.9% believed that the questions were fairly comprehensible. Answers regarding the usual everyday life are described in Table 2 (Q1-Q8). Usually, patients listened to music to get a pleasant distraction (69.7%) or to relieve from negative feelings (22.5%) and what achieved from listening to music was relax (41.6%) or leisure (18.4%).

Question (T0)	Given answers	N	Percent	[95%CI]
Q1. Do you generally like music?	Yes	250	93.6	[90.0, 96.3]
	No	1	0.4	[0.0, 2.1]
	I don't know	16	6.0	[3.5, 9.6]
Q2. Do you usually listen to music?	Yes	248	92.9	[89.1, 95.7]
	No	4	1.5	[0.4, 3.8]
	I don't know	15	5.6	[3.2, 9.1]
Q3. What type/genre of music do you usually listen to?	Pop Italian music	193	72.3	[66.5, 77.6]
	Foreign music	25	9.4	[6.2, 13.5]

	Classic music	41	15.4	[11.3, 20.3]
	Other	8	3.0	[1.3, 5.8]
Q4. How do you usually listen to music?	Radio	160	59.9	[53.8, 65.9]
	TV	74	27.7	[22.4, 33.5]
	CD	11	4.1	[2.1, 7.3]
	MP3s	7	2.6	[1.1, 5.3]
	Other	15	5.6	[3.2, 9.1]
Q5. In general, when you listen to music, what activity do you do?	Daily activities	180	67.4	[61.4, 73.0]
	Sport activity	7	2.6	[1.1, 5.3]
	Free time	64	24.0	[19.0, 29.6]
	During work	12	4.5	[2.3, 7.7]
	Other	4	1.5	[0.4, 3.8]
Q6. At what time of day do you usually listen to music?	Morning	25	9.4	[6.2, 13.5]
	Afternoon	5	1.9	[0.6, 4.3]
	Evening	24	9.0	[5.8, 13.1]
	Night	2	0.7	[0.1, 2.7]
	No particular moment	211	79.0	[73.7, 83.8]
Q7. Why do you listen to music?	Pleasant Distraction	186	69.7	[63.8, 75.1]
	Relieve unpleasant sensations	60	22.5	[17.6, 28.0]
	Expressing Emotions	21	7.9	[4.9, 11.8]
Q8. Which of the following emotions are conveyed to you the most by the music you usually listen to?	Calm/Relax	111	41.6	[35.6, 47.7]
	Happiness/Joy	46	17.2	[12.9, 22.3]
	Nostalgia/Desire	9	3.4	[1.6, 6.3]
	Interest/Expectation	7	2.6	[1.1, 5.3]
	Pleasure/Fun	49	18.4	[13.9, 23.5]
	Sadness/Melancholy	4	1.5	[0.4, 3.8]
	Excitement/energy	25	9.4	[6.2, 13.5]
	Love/Tenderness	8	3.0	[1.3, 5.8]
	Pride	4	1.5	[0.4, 3.8]
	Other	4	1.5	[0.4, 3.8]

Table 2. *Habitual listening to music*

Preferences specific to the hospitalization

Most of patients at the time of hospitalization would have preferred listen to music (84.6%) rather than other activities such as reading, watching TV, etc. Accordingly, the patients declared they

would like to listen to music during hospitalization (95.5%), granting that it would have a positive effect on them (96.6%), mainly through piped music (93.3%), and without any distinction in administration time (85.4%) (Table 3 Q9-Q15). The genre of music habitually listened highly correlated with the one desired during hospitalization (Cramer's $V = 0.928$, $p < 0.0001$), with only 6 patients preferring a genre of music different from the one usually preferred.

Questions (T1)	Given answers	N	Percent	[95%CI]
Q9. If you were offered music during your hospitalization, when would be the ideal time for you?	Before care procedures	8	3.0	[1.3, 5.8]
	During care procedures	5	1.9	[0.6, 4.3]
	Before and after care procedures	18	6.7	[4.0, 10.5]
	After care procedures	5	1.9	[0.6, 4.3]
	Always	228	85.4	[80.6, 89.4]
	Never	3	1.1	[0.2, 3.3]
Q10. If you were offered music during your hospitalization, how would you prefer to listen to it?	Via earphones	13	4.9	[2.6, 8.2]
	Via piped music	249	93.3	[89.6, 96.0]
	Via live performance	2	0.7	[0.1, 2.7]
	Other	3	1.1	[0.2, 3.3]
Q11. What effect do you think music has on you during hospitalization?	Positive	258	96.6	[93.7, 98.5]
	Absent	9	3.4	[1.6, 6.3]
Q12. If you were offered music during hospitalization, how would it help you?	Relax/Amusement	149	55.8	[49.6, 61.9]
	Relieve Unpleasant Feelings (anxiety, fear, stress, loneliness, low mood)	94	35.2	[29.5, 41.3]
	Express emotions	21	7.9	[4.9, 11.8]
	Other	3	1.1	[0.2, 3.3]
Q13. Right now, if you were offered music, which type/genre would you prefer?	Pop Italian music	194	72.7	[66.9, 77.9]
	Foreign music	27	10.1	[6.8, 14.4]
	Classic music	40	15.0	[10.9, 19.8]
	Other	6	2.2	[0.8, 4.8]
Q14. Would you like such a service, based on your needs / taste in music?	Yes	255	95.5	[92.3, 97.7]
	No	2	0.7	[0.1, 2.7]
	I don't know	10	3.7	[1.8, 6.8]
Q15. Right now, what would you like	To read	10	3.7	[1.8, 6.8]

to do?	Watching TV	15	5.6	[3.2, 9.1]
	Listen to music	226	84.6	[79.8, 88.8]
	Take medicine to relax	14	5.2	[2.9, 8.6]
	Other	2	0.7	[0.1, 2.7]
Q19 (short survey). How useful do you think music could be during your hospitalization?	No use	2	0.7	[0.1, 2.7]
	Little use	1	0.4	[0.0, 2.1]
	Fair utility	20	7.5	[4.6, 11.3]
	Good Utility	135	50.6	[44.4, 56.7]
	Extremely useful	109	40.8	[34.9, 47.0]

Q20 short survey are reported in table 5.

Table 3. *Views on music listening during hospitalization.*

Perceptions experienced after music-based intervention

Answers given after the music treatment are reported in comparison with answers given before the treatment (Table 4). Patients who appreciated listening to music increased from 93.6% of the everyday life, to 95.5% in their perception of hospitalization, and up to 98.5% after hospitalization (Q1, Q14 and Q16), although the latter percentage is slightly inflated by the fact that two patients who didn't habitually like music refused the music treatment and therefore did not answer to the post treatment questions (Table 4). These differences reached the statistical significance when comparing "yes" vs "I do not know" across the three periods (the only two "no" answers were missing at the post treatment, Cochran's $Q=13.0$, $df=2$, $p=0.0015$). According to the high percentage of patients declaring that they liked music, the degree of usefulness attributed to music was very high both before and after hospitalization (median= 4 in both, on a score from 1 to 5) (Table 4). There were high and significant correlations between the two (Spearman's $\rho=0.631$, $p<0.0001$) and difference between the two periods did not reach the statistical significance (Wilcoxon Signed Ranks Test $Z = -1.821$, $p=0.0687$), although 23 patients gave a score below 4 before hospitalization (8.6%, two patients scored 1, one scored 2 and 20 scored 3), who reduced to only 9 patients giving a score of 3 (3.4%). The emotional effects usually conveyed by music were

significantly different from those conveyed during hospitalization (Q8 vs Q17, $p < 0.0001$), with happiness falling from 17.2% to 8.7% and excitement from 9.4% to 0, while amusement/entertainment raised from 18.4% to 41.1% (Table 4). Also, the reasons why the patients listened to music changed from the usual habits to the idea the patients had about hospitalization and to what they have actually perceived during the hospitalization (Q7 vs Q12 vs Q18, $p < 0.0001$): pleasant distraction went from 69.7% to 55.8% to 38.7%, while relief went from 22.5% to 35.2% to 60.0% (Table 4). Only 80 patients chose the same reasons for the three periods, mostly (90.0%) desired music for pleasant distraction.

Question	Given answers	Usual / everyday life (T0)		Specific to hospitalization (T1)		Post treatment (T2)		p-value	Test
		N	Percent	N	Percent	N	Percent [95%CI]		
Enjoy music (Q1, Q14, Q16)	Yes	250	93.6	255	95.5	261	98.5 [96.2, 99.6]	0.0015	Cochrane's Q=13, df=2
	No	1	0.4	2	0.7	0	0		
	I don't know	16	6.0	10	3.7	4	1.5 [0.4, 3.8]		
Preferred genre of music (Q3, Q13)	Pop Italian music	193	72.3	194	72.7	-	-	n.s.	Cramer's V=0.027
	Foreign music	25	9.4	27	10.1	-	-		
	Classic music	41	15.4	40	15	-	-		
	Other	8	3.0	6	2.2	-	-		
Reasons to listen to music (Q7, Q12, Q18)	Pleasant Distraction	186	69.7	149	55.8	103	38.9 [33.0, 45.0]	<0.0001	Fisher's exact test
	Relieve unpleasant sensations	60	22.5	94	35.2	159	60 [53.8, 66.0]		
	Expressing Emotions	21	7.9	21	7.9	3	1.1 [0.2, 3.3]		
	No answer			3	1.1				
Music utility/emotions conveyed (Q8, Q17)	Calm/Relax	111	41.6	-	-	102	38.5 [32.6, 44.6]	<0.0001	Fisher's exact test
	Happiness/Joy	46	17.2	-	-	23	8.7 [5.6, 12.7]		
	Nostalgia/Desire	9	3.4	-	-	9	3.4 [1.6, 6.4]		
	Interest/Expectation	7	2.6	-	-	14	5.3 [2.9, 8.7]		
	Pleasure/Fun	49	18.4	-	-	109	41.1 [35.2, 47.3]		
	Sadness/Melancholy	4	1.5	-	-	1	0.4 [0.0, 2.1]		
	Excitement/energy	25	9.4	-	-	0	0		
	Love/Tenderness	8	3.0	-	-	5	1.9 [0.6, 4.4]		
Pride/Trust	4	1.5	-	-	2	0.8 [0.1, 2.7]			

	Other	4	1.5	-	-	0		
Utility of music (before music intervention) (Q19, Q20, Short survey)	No use	-	-	2	0.7	-	-	n.s.§
	Little use	-	-	1	0.4	-	-	Wilcoxon Signed Ranks Test
	Fair utility	-	-	20	7.5	9	3.4 [1.6, 6.4]	Z=-1.821
	Good Utility	-	-	135	50.6	145	54.7 [48.5, 60.8]	
	Extremely useful	-	-	109	40.8	111	41.9 [35.9, 48.1]	

§ Wilcoxon Signed Ranks Test, $p=0.0687$; Spearman's rank correlation $\rho=0.631$, $p<0.0001$

Percentage for everyday life and specific to hospitalization are reported also in tables 1 and 2 respectively, together with their 95% confidence interval (95%CI)

Table 4. *Perceptions experienced after music-based intervention.*

Not surprisingly, the music treatment was appreciated especially by the patients who preferred listening to music rather than other activities such as reading, watching TV, etc.: all the 266 patients that had declared they would have liked listening to music appreciated the treatment, while 4 patients out of 39 that would have rather preferred other entertainment activities were then not sure about the music treatment ($p<0.0001$). However, the patients who preferred other activities were mainly satisfied by the music treatment. Finally, there were some differences between males and females (Table 5). In particular, males tended to habitually listen to music more than females (96.2% vs 88.0%, $p=0.0161$) and through different playback sources ($p<0.0001$), in particular males preferred radio and females preferred television. Females usually tended to listen to music more to get a pleasant distraction, achieving relaxing sensations while males more to get relief from negative feelings ($p<0.0001$), achieving leisure ($p<0.0001$). Of note the answers specific to hospitalization showed, at opposite, that females were more expecting to get relief, while males were more expecting to get a pleasant distraction ($p<0.0001$), a trend confirmed at the post treatment evaluation ($p<0.0001$).

Females rated the utility of listening to music slightly less than males as for their hospitalization expectance ($p=0.0330$, Mann-Whitney test), but without any difference at the post treatment evaluation, when at opposite their appreciation was even higher than those by males, although not significantly different (Table 5).

Question	Given answers	Females		Males		p-value *
		N	Percent [95%CI]	N	Percent [95%CI]	
Q1. Do you generally like music?	Yes	97	89.8 [82.5, 94.8]	153	96.2 [92.0, 98.6]	0.0476
	No	1	0.9 [0.0, 5.1]	0	0.0 [0.0, 2.3]	
	I don't know	10	9.3 [4.5, 16.4]	6	3.8 [1.4, 8.0]	
Q2. Do you usually listen to music?	Yes	95	88.0 [80.3, 93.4]	153	96.2 [92.0, 98.6]	0.0161
	No	2	0.0 [0.2, 6.5]	2	0.0 [0.2, 4.5]	
	I don't know	11	0.0 [5.2, 17.5]	4	0.0 [3.5, 12.0]	
Q4. How do you usually listen to music?	Radio	40	37.0 [27.9, 46.9]	120	75.5 [68.0, 81.9]	<0.0001
	TV	55	50.9 [41.1, 60.7]	19	11.9 [7.4, 18.0]	
	CD	3	2.8 [0.6, 7.9]	8	5.0 [2.2, 9.7]	
	MP3	3	2.8 [0.6, 7.9]	4	2.5 [3.5, 12.0]	
	Other	7	6.5 [2.7, 12.9]	8	5.0 [2.2, 9.7]	
Q5. In general, when you listen to music, what activity do you do?	Daily activity	71	65.7 [56.0, 74.6]	109	68.6 [60.7, 75.7]	0.0211
	Sporting activity	1	0.9 [0.0, 5.1]	6	3.8 [1.4, 8.0]	
	Leisure time	33	30.6 [22.1, 40.2]	31	19.5 [13.7, 26.5]	
	During work	1	0.9 [0.0, 5.1]	11	6.9 [3.5, 12.0]	
	Other	2	1.9 [0.2, 6.5]	2	1.3 [0.2, 4.5]	
Q6. At what time of day do you usually listen to music?	Morning	6	5.6 [2.1, 11.7]	19	11.9 [7.4, 18.0]	0.0319
	Afternoon	2	1.9 [0.2, 6.5]	3	1.9 [0.4, 5.4]	
	Evening	5	4.6 [1.5, 10.5]	19	11.9 [7.4, 18.0]	
	Night	0	0.0 [0.0, 3.4*]	2	1.3 [0.2, 4.5]	
	No particular time	95	88.0 [80.3, 93.4]	116	73.0 [65.4, 79.7]	
Q7. Why do you listen to music?	Pleasant Distraction	82	75.9 [66.8, 83.6]	104	65.4 [57.5, 72.8]	0.0001
	Relieve unpleasant sensations	12	11.1 [5.9, 18.6]	48	30.2 [23.2, 38.0]	
	Expressing Emotions	14	13.0 [7.3, 20.8]	7	4.4 [1.8, 8.9]	
Q8. Which of the following emotions are conveyed to you the most by the music you usually listen to?	Calm/Relax	58	53.7 [43.9, 63.4]	53	33.3 [26.1, 41.2]	<0.0001
	Happiness/Joy	15	13.9 [8.0, 21.9]	31	19.5 [13.7, 26.5]	
	Nostalgia/Desire	6	5.6 [2.1, 11.7]	3	1.9 [0.4, 5.4]	
	Interest/Expectation	2	1.9 [0.2, 6.5]	5	3.1 [1.0, 7.2]	
	Pleasure/Fun	5	4.6 [1.5, 10.5]	44	27.7 [20.9, 35.3]	
	Sadness/Melancholy	3	2.8 [0.6, 7.9]	1	0.6 [0.0, 3.5]	
	Excitement/energy	10	9.3 [4.5, 16.4]	15	9.4 [5.4, 15.1]	
	Love/Tenderness	7	6.5 [2.7, 12.9]	1	0.6 [0.0, 3.5]	
	Pride	0	0.0 [0.0, 3.4*]	4	2.5 [0.7, 6.3]	
Other	2	1.9 [0.2, 6.5]	2	1.3 [0.2, 4.5]		
Q12. If you were	Pleasant Distraction	33	30.6 [22.1, 40.2]	116	73.0 [65.4, 79.7]	<0.0001

offered music during hospitalization, how would it help you?	Relieve unpleasant sensations	62	57.4 [47.5, 66.9]	32	20.1 [14.2, 27.2]	
	Expressing Emotions	12	11.1 [5.9, 18.6]	9	5.7 [2.6, 10.5]	
	Other	1	0.9 [0.0, 5.1]	2	1.3 [0.2, 4.5]	
Q15. Right now, what would you like to do?	Reading	6	5.6 [2.1, 11.7]	4	2.5 [0.7, 6.3]	0.0045
	Watching TV	11	10.2 [5.2, 17.5]	4	2.5 [0.7, 6.3]	
	Listening to music	81	75.0 [65.8, 82.8]	145	91.2 [85.7, 95.1]	
	Taking drugs to relax	9	8.3 [3.9, 15.2]	5	3.1 [1.0, 7.2]	
	Other	1	0.9 [0.0, 5.1]	1	0.6 [0.0, 3.5]	
Q18. How did music help you?	Pleasant Distraction	23	21.5 [14.0, 30.2]	80	50.6 [42.3, 58.3]	<0.0001
	Relieve unpleasant sensations	83	77.6 [67.8, 84.4]	76	48.1 [39.8, 55.9]	
	Expressing Emotions	1	0.9 [0.0, 5.1]	2	1.3 [0.2, 4.5]	
Q19 (Short survey) Utility of music (before music intervention)	No use	1	0.9 [0.2, 5.1]	1	0.6 [0.0, 3.5]	0.0330 (Mann-Whitney test)
	Little use	0	0	1	0.6 [0.0, 3.5]	
	Fair utility	14	13.0 [7.3, 20.8]	6	3.8 [1.4, 8.0]	
	Good Utility	55	50.9 [41.1, 60.7]	80	50.3 [42.3, 58.3]	
	Extremely useful	38	35.2 [26.2, 45.0]	71	44.7 [36.8, 52.7]	
Q20 (Short survey) Utility of music (after music intervention)	No use	0	0	0	0	n.s. (Mann-Whitney test)
	Little use	0	0	0	0	
	Fair utility	4	3.7 [1.0, 9.3]	5	3.2 [1.0, 7.2]	
	Good Utility	52	48.6 [38.8, 58.5]	93	58.9 [50.8, 66.6]	
	Extremely useful	51	47.7 [37.9, 57.5]	60	38.0 [30.4, 46.0]	

* p-values are calculated using the Fisher's exact test, unless otherwise specified

Table 5. Gender Differences to questionnaire responses

DISCUSSION

This pilot study aimed to determine the impact of a pre-recorded music-based intervention on music perception in patients hospitalized for COVID-19. This study, in line with others [16], describes an almost total appreciation for music in everyday life. The COVID-19 patients included in this study liked music even more in the perspective of hospitalization, with a further increase in the overall liking after the music-based intervention. Particularly, this observation emerged in females with a 99.1% of appreciation and a reduction from 6.5% to 0.9% of undecided/negative answers after the treatment. This implies that the musical listening confirmed and exceeded the usual expectations

towards music, particularly in females, who showed a slightly lower preference for music than males in their habitual life. This observation provides support for the importance of music presence during hospitalization and potential benefits in COVID-19 patients. This study also shows that habitual preferences are closely related to those in the in-patient setting and should therefore be considered in order to direct music-based interventions [10,12-14]. The preference for Italian pop music reflects the cultural and musical background of the participants, considering their Italian origins and the high average age. Regardless of the usual musical medium, and in line with other studies [22], participants preferred piped music in the in-patient setting, while only 0.7% and 4.9% of them liked live music or music via earphones, respectively. It is conceivable that piped music represents a socially accepted medium in the care setting and that live music may represent an unrealistic novelty, especially given the restrictions and isolation during hospitalization. However, it must also be considered that the use of medical devices such as masks or helmets for ventilation makes it difficult or impossible to set up a system of music diffusion via earphones. Likewise, there are further complications in the hygienic handling of diffusion devices/music instruments in a COVID-19 environment, which must ensure minimal contamination of surfaces by microorganisms [23]. These limitations might have mitigated, in fact, the clear preference for piped music. The habitual listening to music was shown to find its place in numerous daily life activities (during free time, sports, or work). Similarly, the patients were willing to enjoy music at any time during hospitalization, being the preferred entertainment activity in hospital compared to other proposals, such as reading, watching TV, or taking drugs to relax. This may suggest the possibility to extend music not only to the in-patient rooms but also to the corridors, to the rooms used for clinical care services, and to the common spaces. The experimental intervention impacted the perception of the effects attributed to music. Feelings of pleasure and enjoyment were experienced by more than double the participants compared to the usual condition. Not surprisingly given the patients' situation, happiness and joy decrease from 17.2% to 8.7% and the exciting/energizing effect was not

perceived by anyone post-intervention. Similarly, the reasons that motivated the patients to listen to music were significantly different between everyday life, the hospitalization perspective, and the post intervention. The usefulness of listening music to alleviate unpleasant feelings including anxiety, fear, loneliness, and low mood had a significant increase after the music intervention. Furthermore, the degree of usefulness experienced with the intervention was greater than that usually perceived, even if the very high level of appreciation already in everyday life did not allow us to detect a statistically significant increase. No participant experienced little or no benefit from the intervention. The pre-recorded music was specifically designed according to general patient preferences and frameworks for entertainment and mood improvement, considering the need for emotional support in disease. In the literature, for example, it has been widely demonstrated that musical rhythms between 60 and 80 bpm or the use of musical instruments that are tuned to A432(Hz) can assist physical and emotional relaxation with a decrease in sympathetic nervous system activity, thus decreasing adrenergic activity, neuromuscular arousal, cardiovascular and respiratory rhythms, tension, metabolic rate, gastric acidity, motility, and sweat gland activity [10]. In this study, in line with findings in the literature, the effects of music listening can be traced back to the rationale with which the music was selected [10]. In fact, music selected to promote distraction, relaxation, entertainment and emotional support predominantly elicited relaxation and pleasure, recognised to distract, and alleviate unpleasant feelings such as anxiety, fear and stress. To confirm this, sadness, melancholy, love, nostalgia, and pride were evoked to a limited extent by listening to music. These findings support the directionality of the music-based intervention according to specific frameworks. Scientific rigour in music selection, the involvement of music experts, and the use of reporting guidelines can determine specific listener-perceived effects and allow for adequate replicability of the intervention. These data are in line with other studies that suggest that music-based intervention induced greater satisfaction and compliance in the patient pathway [18]. Awareness and recognition of the usefulness of music by the patient can in fact

mitigate the decision-making processes of care and self-care. Structural changes can improve the environment and even encourage interaction between operators and patients [24]. However, economic, and organizational aspects must be considered in order to integrate this kind of service. In this study, the design of a piped intervention based on pre-recorded music tracks, according to scientific frameworks, required limited costs for the music setting by a professional and the copyright licenses, given that the in-patient area already had ceiling-mounted audio diffusion media. Also considering that the use of the music playback devices avoided any risk of infection from contamination, the safety of the intervention, in addition to the cost-effectiveness, was evident. Other studies have already amply demonstrated the benefits in terms of cost-effectiveness in multiple contexts and with different music playing methods [25,26].

CONCLUSION

This pilot study explored in-patients' preferences, utility that comes from music, usages, and expectation from the effect of music in COVID-19 patients, before and after music-based intervention, and was carried out in response to a lack of studies in the literature and methodological weaknesses of publications. In this study, music was the most welcome activity during the hospitalization. The experimental intervention, directed according to reference frameworks, significantly impacted on the utility, on the evoked emotions, and on the self-reported effects of music during hospitalization for COVID-19. This result provides support for the intervention with pre-recorded music as an integrated standard in treatment protocols to meet the need for social and emotional support in hospitalized patients for COVID-19 and possibly in similar settings of hospitalization in isolation.

Limitations

It was not possible to recruit patients younger than forty years of age. This made it impossible to

evidence some generational differences between the participants. A similar consideration regards the lack of heterogeneous in nationality. In addition, participants could not enjoy parental visits during their hospital stay due to COVID-19 restrictions, limiting the comparison with the more general situation of parental social support. Other clinical variables such as anxiety levels, loneliness in the healthcare relationship [27,28], psycho-physical distress and respiratory complications, which could have impacted the perception of the music experienced, were not considered. In the literature, there is ample evidence that patients with high levels of anxiety and distress obtained greater benefit from music [1,3,6,18,29-32], so although the aim of this study was not to measure changes in health outcomes, a correlation between high levels of psycho-physical distress on admission and musical perceptions related to the need to alleviate unpleasant feelings is likely. Preferences, beliefs, and attitudes towards the different genre of music, also in the context of socio-demographic characteristics should lead future study. The catchiness, use of melody, rhythm, and ease to understand of lyrics should be explored as well. Future randomised controlled trials using the same framework should be considered, to determine its effects on healthcare outcomes in multiple populations with similar needs for social and emotional support. The appropriate use of music may also be aimed at improving recovery time and reducing the need for medication to treat COVID19-induced psycho-physical distress [1,33,34]. Hopefully future studies will consider patients' perceptions as a crucial factor in determining the specific psychophysical effects of music. Based on this knowledge it will be possible to structure, implement and systematically replicate music in healthcare environment.

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Conflict of interest

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Authors' contribution

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