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Research article

Promoting nighttime sleep in the intensive care unit: Alternative strategies in nursing

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ABSTRACT

Aim: To identify if complementary interventions impacted on conscious intensive care patients' perception of stress factors and quality of sleep.
Research methodology: A non-controlled clinical study was undertaken on conscious patients in an intensive care unit in central Italy.

Patients perception of stress factors and quality of sleep during the first night with usual medical and nursing treatments was measured using two questionnaires: the Stress Factors in Intensive Care Unit Questionnaire and the Modified Richards-Campbell Sleep Questionnaire.

During the second night two specific treatments were administered: (1) receptive musical sounds and (2) a massage using sweet lavender/lemon-scented almond oil.

The same variables were measured on the third day using the same questionnaires.
Results: The data of 74 patients were analysed. The patients' main concerns were "hearing unusual noises" (n = 46, 62.2%), "having people continuously working around the bed" (n = 53, 71.6%), "being worried" (n = 60, 81.1%) and "being unable to sleep" (n = 47, 63.5%). Fifty-three patients (71.6%) reported waking up in the middle of the night and 21 (28.3%) of them were unable to fall asleep again. Receptive musical sounds and massage using aromatherapy improved the quality of patients' sleep (t = 2.01, p = 0.047).
Conclusion: Complementary interventions may reduce patients' perception of stress and improve their sleep. Further research is now needed.

Implications for clinical practice

- The issue of poor quality sleep in patients admitted to the intensive care unit deserves greater attention.
- A more extensive use of complimentary interventions could improve the quality of sleep and promote the psychological and physical well-being of patients.
- The combination of receptive musical sounds and massage using aromatherapy may be an effective therapeutic strategy to improve the quality of intensive care unit patients sleep.
- Greater attention should be paid to the sensation of thirst, one of the main stress factors that impede sleep or cause re-awakenings.

Introduction

Sleeping is essential for life (Delaney et al., 2015). A reduction in sleep can cause psycho-physical fatigue with consequent detriment to efficiency and personal capacity. This, in turn, may lead to changes in intellectual and decision-making abilities (Matthews

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et al., 2016). A vicious cycle can be established, whereby worsening sleep patterns lead to greater stress and vice versa.

Multiple factors negatively affect critically ill patients sleep including back ground noise, staff conversation, alarms, television, telephones (Weinhouse and Schwab, 2006), lights from nurses' station, lights being switched on in an emergency and patient care activities (Wenham and Pittard, 2009). In order to allow patients to reach deep sleep, the night time noise level should not exceed 40 dBA (Hurtley, 2009). However, the average noise level in different types of ICUs ranges from 52 to 59 dBA, with the average maximum noise level between 79 and 84 dBA (Darbyshire and Young, 2013). When the noise from monitors, conversations and ventilators exceeds 80 dBA, patients exhibit a higher frequency of reawakening (Elliott et al., 2013). Low room temperatures usually disturb sleep, while high temperatures tend to favour sleep (Wang et al., 2015). Total sleep time is maximised in rooms with a neutral temperature (Bazuin and Cardon, 2011).

Celik et al. (2005) studied 60 intensive care unit (ICU) patients, and discovered that the sleep of each patient was disturbed on average 51 times during the night for ongoing treatment, particularly between the hours of 2am and 5am. In another study, which looked at the experience of ICU patients (Tembo et al., 2013), some patients stated that they could not sleep because of treatments that normally would have been carried out during the day.

Factors limiting sleep quality

Lack of adequate sleep can lead to a worsening of an ICU patient's condition (Elliott et al., 2011), which can lengthen hospital stay (Uhlig and Kallus, 2004). Disturbed sleep can negatively affect cognitive faculties and emotions, cardiovascular and respiratory function, immune response (Delaney et al., 2015) and metabolic function (Van den Berghe, 2000). Oberbeck (2004) identified elevated blood cortisol levels were associated with diminished sleep, indicating a stress response. All these factors increase ICU patients risk of infection (Friese et al., 2009), complications, prolonged hospitalisation (Parthasarathy and Tobin, 2004), and morbidity and mortality (Mostaghimi et al., 2005).

Complementary interventions to promote sleep

Whilst a large number of studies demonstrate complementary interventions are useful in promoting sleep in the general population (Neuendorf et al., 2015; Sarris and Byrne, 2011; Yeung et al., 2014), only few studies evaluate its effectiveness in the ICU population (Chen et al., 2012; Eliassen and Hopstock, 2011; Richards et al., 2003; Tracy and Chlan, 2011). What is available describes the use of music (Mofredj et al., 2016), massage (Pulak and Jensen, 2016), and aromatherapy (Bagheri-Nesami et al., 2015; Cho, 2013), however, very few studies describe nurses using these techniques (Cooke et al., 2012).

Different studies on the use of aromatherapy (Hwang and Shin, 2015; Lee et al., 2012) have demonstrated the relaxing properties of lavender (Karadag et al., 2017; Lytle et al., 2014) and the anti-stress properties of lemon scent (Ali et al., 2015; Hur et al., 2014; Navarra et al., 2015) in critically ill patients. Although the studies undertaken on ICU patients have demonstrated the effectiveness of complementary interventions in improving the quality of sleep (Hu et al., 2010), the evidence available to date is still extremely limited.

Aim

The aim of the study was to identify if complementary interventions impacted on conscious intensive care patients' perception of stress factors and quality of sleep.

Research questions

The study was designed to answer the following research questions:

1. What is the perception of stress suffered by conscious ICU patients?
2. What is the quality of sleep of conscious ICU patients?
3. Do complementary interventions impact on conscious ICU patients' perception of stress factors and quality of sleep?

Study design

The study was a non-controlled pre-post study design.

Methods

Setting

The study was conducted in an ICU in central Italy. The patient population included admission from medical and surgical wards and the emergency unit. Ten beds in the ICU were in a single room, divided by curtains to afford the patients some privacy. The nurses' station is situated in the centre of the room; this area is utilised as the nurse's and doctors' work area and is where the patient monitors are located.

Participant selection

All patients admitted during November and December 2016 (inclusive) were recruited into the study. Recruitment criteria included: all conscious patients, including ventilated patients or those with an artificial airway, with 1) a Glasgow scale rating $\geq$13, 2) a Ramsay sedation score $\geq$2 and 3) a hospital stay of more than two nights. Exclusion criteria included patients with neurological damage and previously diagnosed sleep disturbances.

Procedure

All patients spent the first night in ICU, undergoing the usual medical and nursing treatments according to individual protocols. During the second night of the patient's ICU stay, two specific treatments aimed at improving the quality of sleep were administered. The first was stimulation through receptive musical sounds. Each patient chose his/her favourite music from a digital music library or listening to relaxing sounds of nature. A digital MP3 player was used to reproduce the sounds, allowing each patient to listen through headphones. The second treatment, administered contemporaneously with the receptive musical sounds, was a feet and leg massage using sweet almond oil, with the added aromas of lavender and lemon. The massage was carried out by a nurse trained in the technique and assisted by a student nurse. The combined massage and aromatherapy lasted 20 min, while the musical sounds were left playing all night.

Data collection

During the second day of ICU, both the patient's perception of stress factors and quality of sleep during the first night were measured. Stress perception was evaluated using the "Stress Factors in Intensive Care Unit Questionnaire" (SEDAICU). This scale was developed in 2002 by an association of resuscitators, psychologists and nurses working in Italy (SEDAICU Group) based on the Novaes et al. study (1997). It consists of 33 items divided in four sections. Each item represents a potential stress factor and is rated in terms

of the degree of perceived stress, on a four-point Likert scale (1 = none at all, 2 = a little, 3 = quite a bit, 4 = a lot) and the stress factor frequency on a three-point Likert scale (never, sometimes, always). Whilst the SEDAICU was comprehensively presented by the SEDAICU group on their website when we began the study, it is no longer available; hence we also needed to evaluate the internal consistency and construct validity of the questionnaire.

The quality of sleep was measured using the "Modified Richards-Campbell Sleep Questionnaire" (Modified RCSQ), the most widely used in earlier studies (Kamdar et al., 2012; Richards, 1987; Shahid et al., 2011). The Modified RCSQ is made up of six items: 1) sleep depth, 2) sleep latency, 3) awakenings, 4) falling to sleep again, 5) sleep quality, and 6) noise. For each item, patients indicate a level using a coloured analogue scale with values from 0 to 100. A zero value reflects a negative perception of sleep and 100 a positive perception. Scores 1–20 indicate a very poor quality sleep, 21–40 a poor quality sleep, 41–60 an acceptable quality sleep, 61–80 a good quality sleep and 81–100 a very good quality sleep.

During the third day in the ICU, the patient's perception of stress factors and quality of sleep of each patient during the second night were measured using the same questionnaires.

Data analysis

The data were analysed using the Statistical Package for Social Science version 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis using frequencies and percentage, were performed for nominal variables. The normally distributed continuous variables were analysed using mean (M) and standard deviation (±). Differences between the most common value that reflected the poorest sleep score during the first night to the score in the second night were analysed using the paired *t*-test (t) (Sullivan and Artino Jr, 2013). The correlation between variables measured by ordinal scales were analysed using Spearman rank correlation test (ρ). An alpha of 0.05 was considered to be significant. Cronbach's alpha was used to measure internal consistency of the questionnaire whilst factor analysis was performed to determine the questionnaire's construct validity. An alpha > 0.50 was considered acceptable for construct validity (Yong and Pearce, 2013).

Based on our earlier pilot study, which yielded an estimated standard deviation of the mean sleep score in ICU patients of 27, sample size was calculated. We hypothesised that the massage-aromatherapy and music therapy treatments would improve sleep quality by a 20-point difference in total mean sleep score between the first night and the second. This hypothesis was based on the previous studies in this field (Mofredj et al., 2016; Pulak and Jensen, 2016), which used a similar method of analysis to calculate sample size. Using an effect size of 0.8 and a p-value ≤ 0.05, the required sample size was calculated as 65 patients, but 72 patients were recruited after considering a 10% dropout rate.

Ethical considerations

The research protocol was submitted to and approved by the local Ethics Committee (Approval number 179.2015). Patients who agreed to enrol in the study provided written consent. Where patients expressed oral consent due to inability to write, written consent was gained retrospectively.

Results

During the study period 269 patients were admitted to the ICU and 91 patients met the inclusion criteria (Fig. 1). In total, 74 patients participated in the study. Of these patients, 31 (42%) were females, with a mean age of 72 ± 7.49 years, and 43 (58%) were males, with a mean age of 66 ± 6.6 years. Most patients were surgical patients (n = 47, 64%) (see Fig. 1). All patients who participated in the study were breathing spontaneously either by their own airway or a tracheostomy tube.

Participants listened to their chosen music or sounds from nature for seven hours, from 11 pm to 7 am; no patients asked for this to be stopped or for periods of silence.

Stress factors in intensive care unit questionnaire validation

The alpha coefficients for each item indicated a indicated a satisfactory degree of internal consistency as reported in Table 1. A factor analysis was conducted on the results of the questionnaire using the "SPSS" and "Monte Carlo Principal Component Analysis (PCA) for Parallel Analysis" software, with eigen-values >1. The results of questionnaire in the form of 33 items were subjected to PCA analysis followed by Varimax rotation. This extracted four factors: "environment", "feelings", "emotions" and "physical state" that accounted for 59% of the variance.

For Factor 1, "environment", five of the six relevant items had loadings of 0.66 or more. The item "relative's visiting time too short" had a loading of 0.31 and was removed from this factor.

For Factor 2, "feelings", seven of the eight relevant items had loadings of 0.61 or more. The item "the lack of loved ones (husband/wife/children)" had a loading of 0.27 and was removed from this factor.

For Factor 3, "emotions", all of the items (n = 8) had loading of 0.76 or more. Two unrelated items, "relative's visiting time too short" and "the lack of loved ones (husband/wife/children)", also had positive loadings for this factor and were added to this factor. For Factor 4, "physical state", all the 11 items had loadings 0.81 or more.

The factor analysis confirmed the grouping of items within four different categories, giving support to their conceptual foundation, and show a new placement for two items within the "emotions" subscale. Table 2 outlines the factor loadings for each item within each factor.

Stress factors in the intensive care unit

During the first night, the stress factors in the "Environment" category demonstrated participants perceived the most stressful item was "seeing healthcare staff very busy, stressed and in a hurry", which was perceived as "very" stressful (n = 39, 52.7%). In the same category, the item reported as occurring most frequently was "hearing unusual sounds and noises" (machine and monitor alarms) which were perceived as "always" present in the surroundings (n = 46, 62.2%) with 58% (n = 43) indicating this caused quite a lot of stress and 23% (n = 17) identifying it as being very stressful (see Table 2).

In the "Feeling" category, although "the healthcare staff talking, joking and discussing issues in loud voices" occurred sometimes (n = 59, 79.7%), it was considered very stressful (n = 51, 68.9%). Whilst the most frequently present item was "having people continuously working around their bed" (n = 53, 71.6%), only 20.3% (n = 15) found it very stressful.

In the category regarding "Emotions", "being worried/afraid" was perceived by patients as being the most stressful item, considered "very" stressful (n = 42, 56.8%), and deemed "always" present by the large majority of patients (n = 60, 81.1%).

In the "Physical State" category, patients perceived "being thirsty" was the most stressful, considered "very" stressful (n = 65, 87.8%), and the most frequent and was perceived as "always" present (n = 53, 71.6%). At the same time, patients viewed

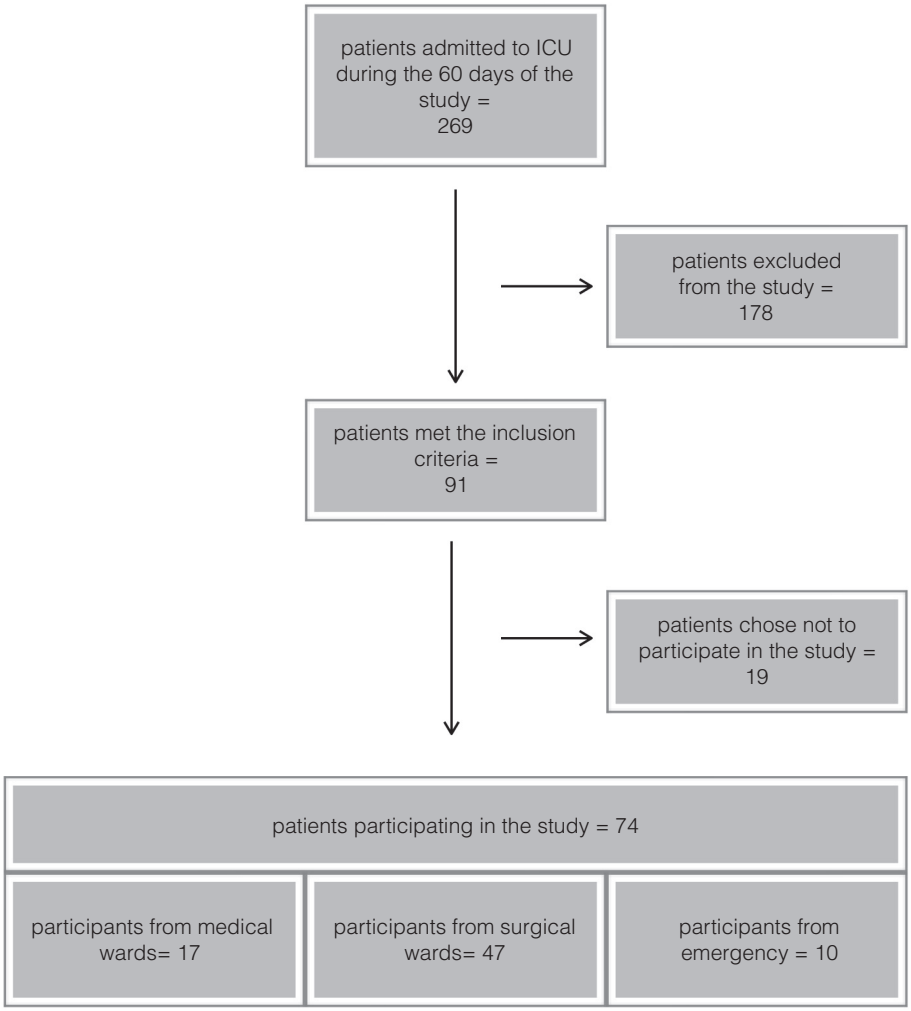

Fig 1. Participant selection flow diagram.

Table 1
Internal consistency and reliability check for the four sub-scales.

Sub-scales	Cronbach Alpha
1. Environment	0.65
2. Feelings	0.76
3. Emotions	0.53
4. Physical state	0.73

"not being able to sleep" as both "very" stressful (n = 29, 39.2%) and "always" present (n = 47, 63.5%).

After the combined massage-aromatherapy and the receptive stimulation through sounds and music, the stress factors show appreciable improvements in the perception of "unusual sounds and noises" (t = 2.14, p = 0.02) and their frequency (t = 2.21, p = 0.02), "hearing other patients suffering, crying or complaining" (t = 2.11, p = 0.03) and "healthcare staff talking, joking or discussing matters in a loud voice" (t = 2.43, p = 0.01).

Of the "Physical State" category, significant improvements were found in patients' perception of "having to watch the ceiling with the lights always on" (t = 2.36, p = 0.01) and "not being able to sleep" (t = 2.22, p = 0.02). No other improvements in stress factors were identified.

Quality of sleep in intensive care units

The Modified RCSQ indicated the quality of sleep during the first night in the ICU (Table 3). Sleep was described as "light" by 32 patients (43.2%). Regarding the time taken to fall asleep (sleep latency), 41 patients (54.8%) reported being unable to fall asleep and night time awakenings were reported by 53 patients (71.6%), with 21 of these (28.3%) being unable to fall asleep again. The quality of sleep during the first night was defined as poor by 42 patients (56.7%) with 17 patients (23%) reporting the noise level to be very noisy.

After complementary interventions incorporating musical receptive sounds and massage using aromatherapy, significant improvements were observed in patients' perception of the quality of sleep: "depth of sleep" (t = 2.01, p = 0.04), "inability to fall asleep" (t = 2.16, p = 0.02), "awakenings" during the night (t = 2.66, p = 0.00) and the level of noise (t = 2.04, p = 0.04) thus supporting the findings related to stress factors. Analysis identified a significant positive correlation between "awakenings" and "unusual sounds" ($\rho = 0.67$); "awakenings" was associated with "healthcare professionals talking, joking and arguing in loud voices" ($\rho = 0.59$). In addition, there were significant positive correlation between "difficulty in falling asleep" and "being worried/afraid" ($\rho = 0.72$). A significant negative correlation was identified

Table 2
Stress factors in intensive care unit questionnaire.

	How stressful is this factor?								How often is this factor present?						
	1 None at all n (%)		2 A little n (%)		3 Quite a bit n (%)		4 A lot n (%)		Never n (%)		Sometimes n (%)		Always n (%)		Factor Loading (PCA)
	1st night	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	
1. Environment															
Hearing the phone ring	47 (63.5)	58 (78.4)	12 (16.2)	7 (9.5)	15 (20.3)	9 (12.2)	0 (0.0)	0 (0.0)	24 (32.4)	33 (44.6)	37 (50.0)	34 (45.9)	13 (17.6)	7 (9.5)	0.66
Hearing sounds and unusual noises (alarms on machines, monitor)	8 (10.8)	31 (41.9)	6 (8.1)	41 (55.4)	43 (58.1)	0 (0.0)	17 (23.0)	2 (2.7)	1 (1.4)	41 (55.4)	27 (36.5)	21 (28.4)	46 (62.2)	12 (16.2)	0.68
Having strange machines around them or IV infusions overhead	16 (21.6)	23 (31.1)	7 9.5)	32 (43.2)	37 (50.0)	10 (13.5)	14 (18.9)	9 (12.2)	20 (27.0)	25 (33.8)	41 (55.4)	37 (50.0)	13 (17.6)	12 (16.2)	0.69
Being in a room that is too hot or too cold	23 (31.1	26 (35.1)	10 (13.5)	15 (20.3)	29 (39.2)	26 (35.1)	12 (16.2)	7 (9.5)	43 (58.1)	43 (58.1)	27 (36.5)	31 (41.9)	4 (5.4)	0 (0.0)	0.71
Seeing healthcare professionals too busy, stressed or hurried	13 (17.6)	22 (29.7)	6 (8.1)	19 (25.7)	16 (21.6)	21 (28.4)	39 (52.7)	12 (16.2)	22 (29.7)	36 (48.6)	43 (58.1)	32 (43.2)	9 (12.2)	6 (8.1)	0.73
2. Feelings															
Healthcare professionals do not introduce themselves	70 (94.6)	72 (97.3)	2 (2.7)	2 (2.7)	2 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)	69 (93.2)	71 (95.9)	4 (5.4)	3 (4.1)	1 (1.4)	0 (0.0)	0.61
Having people working continuously around the bed	31 (41.9)	47 (63.5)	11 (14.9)	14 (18.9)	17 (23.0)	13 (17.6)	15 (20.3)	0 (0.0)	12 (16.2)	36 (48.6)	9 (12.2)	17 (23.0)	53 (71.6)	21 (28.4)	0.64
Health care staff that talk, joke and discuss issues in loud voices	7 (9.5)	38 (51.4)	6 (8.1)	28 (37.8)	10 (13.5)	8 (10.8)	51 (68.9)	0 (0.0)	6 (8.1)	57 (77.0)	59 (79.7)	13 (17.6)	9 (12.2)	4 (5.4)	0.65
Being awakened by healthcare professional	29 (39.2)	37 (50.0)	5 (6.8)	24 (32.4)	5 (6.8)	1 (1.4)	35 (47.3)	12 (16.2)	19 (25.7)	34 (45.9)	51 (68.9)	39 (52.7)	4 (5.4)	1 (1.4)	0.66
No explanation about the medical treatments	47 (63.5)	45 (60.8)	16 (21.6)	16 (21.6)	10 (13.5)	12 (16.2)	1 (1.4)	1 (1.4)	59 (79.7)	63 (85.1)	13 (17.6)	10 (13.5)	2 (2.7)	1 (1.4)	0.71
Hearing other patients suffering. crying or complain	7 (9.5)	39 (52.7)	8 (10.8)	25 (33.8)	22 (29.7)	9 (12.2)	37 (50.0)	1 (1.4)	20 (27.0)	47 (63.5)	51 (68.9)	27 (36.5)	3 (4.1)	0 (0.0)	0.75
Being treated by unknown doctors	63 (85.1)	65 (87.8)	8 (10.8)	9 (12.2)	3 (4.1)	0 (0.0)	0 (0.0)	0 (0.0)	4 (5.4)	35 (47.3)	4 (5.4)	29 (39.2)	66 (89.2)	10 (13.5)	0.77
3. Emotions															
Do not know what day or what time is it	40 (54.1)	46 (62.2)	31 (41.9)	25 (33.8)	2 (2.7)	2 (2.7)	1 (1.4)	1 (1.4)	57 (77.0)	66 (89.2)	15 (20.3)	7 (9.5)	2 (2.7)	1 (1.4)	0.76
Not knowing where you are and why	22 (29.7)	26 (35.1)	19 (25.7)	29 (39.2)	23 (31.1)	13 (17.6)	10 (13.5)	6 (8.1)	59 (79.7)	61 (82.4)	2 (2.7)	13 (17.6)	13 (17.6)	0 (0.0)	0.78
Little consideration of your religious beliefs	53 (71.6)	53 (71.6)	20 (27.0)	21 (28.4)	1 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)	71 (95.9)	73 (98.6)	3 (4.1)	1 (1.4)	0 (0.0)	0 (0.0)	0.84
Not knowing when you will receive a treatment	34 (45.9)	37 (50.0)	21 (28.4)	25 (33.8)	13 (17.6)	11 (14.9)	6 (8.1)	1 (1.4)	59 (79.7)	59 (79.7)	10 (13.5)	13 (17.6)	5 (6.8)	2 (2.7)	0.85
Being worried / afraid	0 (0.0)	42 (56.8)	7 9.5)	28 (37.8)	25 (33.8)	0 (0.0)	42 (56.8)	4 (5.4)	1 (1.4)	33 (44.6)	13 (17.6)	40 (54.1)	60 (81.1)	1 (1.4)	0.85
Having no control over yourself	36 (48.6)	38 (51.4)	12 (16.2)	13 (17.6)	9 (12.2)	15 (20.3)	17 (23.0)	8 (10.8)	12 (16.2)	19 (25.7)	57 (77.0)	52 (70.3)	5 (6.8)	3 (4.1)	0.88
Not having intimacy	51 (68.9)	55 (74.3)	16 (21.6)	15 (20.3)	5 (6.8)	2 (2.7)	2 (2.7)	2 (2.7)	52 (70.3)	51 (68.9)	21 (28.4)	17 (23.0)	1 (1.4)	6 (8.1)	0.89
Not being able to express your discomfort, not being able to speak	41 (55.4)	40 (54.1)	14 (18.9)	17 (23.0)	18 (24.3)	14 (18.9)	1 (1.4)	3 (4.1)	9 (12.2)	21 (28.4)	61 (82.4)	50 (67.6)	4 (5.4)	3 (4.1)	0.89

(*continued on next page*)

Table 2 (*continued*)

	How stressful is this factor?								How often is this factor present?						
	1 None at all n (%)		2 A little n (%)		3 Quite a bit n (%)		4 A lot n (%)		Never n (%)		Sometimes n (%)		Always n (%)		Factor Loading (PCA)
	1st night	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	
Relative's visiting time too short	51 (68.9)	50 (67.6)	6 (8.1)	5 (6.8)	17 (23.0)	19 (25.7)	0 (0.0)	0 (0.0)	61 (82.4)	65 (87.8)	11 (14.9)	9 (12.2)	2 (2.7)	0 (0.0)	0.90
The lack of loved ones (husband/wife/children)	51 (68.9)	47 (63.5)	13 (17.6)	19 (25.7)	10 (13.5)	8 (10.8)	0 (0.0)	0 (0.0)	55 (74.3)	66 (89.2)	14 (18.9)	6 (8.1)	5 (6.8)	2 (2.7)	0.91
4. Physical state															
Having to continue watching ceiling with lights always on	30 (40.5)	51 (68.9)	17 (23.0)	12 (16.2)	23 (31.1)	10 (13.5)	4 (5.4)	1 (1.4)	24 (32.4)	39 (52.7)	31 (41.9)	35 (47.3)	19 (25.7)	0 (0.0)	0.81
Uncomfortable mattress or pillow	65 (87.8)	70 (94.6)	8 (10.8)	2 (2.7)	1 (1.4)	2 (2.7)	0 (0.0)	0 (0.0)	63 (85.1)	71 (95.9)	10 (13.5)	3 (4.1)	1 (1.4)	0 (0.0)	0.84
Not being able to sleep	5 (6.8)	55 (74.3)	14 (18.9)	12 (16.2)	26 (35.1)	3 (4.1)	29 (39.2)	4 (5.4)	14 (18.9)	65 (87.8)	13 (17.6)	6 (8.1)	47 (63.5)	3 (4.1)	0.85
Feeling the blood pressure cuff inflate often	31 (41.9)	27 (36.5)	16 (21.6)	12 (16.2)	8 (10.8)	15 (20.3)	19 (25.7)	20 (27.0)	45 (60.8)	49 (66.2)	13 (17.6)	17 (23.0)	16 (21.6)	8 (10.8)	0.86
Not being able to freely take the position desired	0 (0.0)	19 (25.7)	25 (33.8)	28 (37.8)	16 (21.6)	19 (25.7)	33 (44.6)	8 (10.8)	3 (4.1)	7 (9.5)	51 (68.9)	57 (77.0)	20 (27.0)	10 (13.5)	0.86
Having tubes in the nose or mouth that restrict movement	7 (9.5)	10 (13.5)	9 (12.2)	15 (20.3)	25 (33.8)	27 (36.5)	33 (44.6)	22 (29.7)	9 (12.2)	16 (21.6)	21 (28.4)	31 (41.9)	44 (59.5)	27 (36.5)	0.87
Having the sensation of not eating	15 (20.3)	42 (56.8)	14 (18.9)	23 (31.1)	18 (24.3)	7 (9.5)	27 (36.5)	2 (2.7)	4 (5.4)	9 (12.2)	25 (33.8)	23 (31.1)	45 (60.8)	42 (56.8)	0.91
To be hungry	13 (17.6)	22 (29.7)	16 (21.6)	17 (23.0)	21 (28.4)	29 (39.2)	24 (32.4)	6 (8.1)	12 (16.2)	6 (8.1)	41 (55.4)	24 (32.4)	21 (28.4)	44 (59.5)	0.91
To be thirsty	0 (0.0)	11 (14.9)	0 (0.0)	18 (24.3)	9 (12.2)	20 (27.0)	65 (87.8)	25 (33.8)	10 (13.5)	2 (2.7)	11 (14.9)	13 (17.6)	53 (71.6)	59 (79.7)	0.94
To have pain	25 (33.8)	33 (44.6)	22 (29.7)	29 (39.2)	0 (0.0)	7 (9.5)	27 (36.5)	5 (6.8)	31 (41.9)	59 (79.7)	30 (40.5)	13 (17.6)	13 (17.6)	2 (2.7)	0.95
Having needles inserted	21 (28.4)	23 (31.1)	9 (12.2)	29 (39.2)	11 (14.9)	10 (13.5)	34 (45.9)	12 (16.2)	49 (66.2)	62 (83.8)	23 (31.1)	12 (16.2)	2 (2.7)	0 (0.0)	0.95

Table 3
Richard-Campbell sleep questionnaire.

Visual Analog Scale	0–20 N (%)		21–40 N (%)		41–60 N (%)		61–80 N (%)		81–100 N (%)		*f*
	1st night	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	*1st night*	*2nd night*	
1. Sleep depth My sleep last night was: light sleep (0) deep sleep (100)	32 (43.2)	8 (10.8)	23 (31.2)	10 (9.5)	9 (12.1)	26 (35.2)	8 (10.8)	20 (27.0)	2 (2.7)	10 (13.5)	74 (100)
2. Sleep latency Last night, the first time I got to sleep, I: just never could fall asleep (0) fell asleep almost immediately (100)	41 (54.8)	2 (2.7)	13 (17.7)	3 (4.0)	7 (9.5)	11 (14.9)	12 (16.6)	27 (36.5)	1 (1.4)	31 (41.9)	74 (100)
3. Awakenings Last night, I was: awake all night long (0) awake very little (100)	53 (71.6)	2 (2.7)	11 (14.9)	7 (9.5)	4 (5.4)	11 (14.9)	4 (5.4)	30 (40.5)	2 (2.7)	24 (32.4)	74 (100)
4. Returning to sleep Last night, when I woke up or was awakened. I: couldn't get back to sleep (0) got back to sleep immediately (100)	21 (28.3)	0 (0.0)	13 (17.6)	3 (4.0)	17 (23.0)	6 (8.2)	16 (21.6)	9 (12.1)	7 (9.5)	56 (75.4)	74 (100)
5. Sleep quality I would describe my sleep last night as: a bad night's sleep (0) a good night's sleep (100)	10 (13.5)	1 (1.4)	42 (56.7)	4 (5.4)	13 (17.6)	13 (17.6)	7 (9.5)	22 (29.8)	2 (2.7)	34 (45.9)	74 (100)
6. Noise I would describe the noise level last night as: very noisy (0) very quiet (100)	17 (23.0)	0 (0.0)	22 (29.7)	5 (6.8)	18 (24.3)	12 (16.2)	10 (13.5)	24 (32.5)	7 (9.5)	33 (44.8)	74 (100)

between "quality of sleep" and "difficulty in falling asleep" ($\rho = -0.39$) and between "quality of sleep" and "hearing unusual sounds" ($\rho = -0.59$).

Discussion

The treatment offered in the study was by no means invasive and, in contrast to most pharmaceutical treatments, has no collateral effects. This certainly contributed to the high degree of acceptance by the patients contacted. Most patients had undergone surgery due to surgery being the most predominant activity, with the hospital being the national referring centre for surgical cases. Factor analysis validated the questionnaire used in the final analysis.

Similar to other studies (Elliott et al., 2013; Weinhouse and Schwab, 2006), the presence of unusual sounds (machine and monitor alarms) was considered to be the most evident and greatest stress factor in the ward. Such a finding demonstrates the impact that noise connected with ICU technology has on patients. Alarms, which clearly act to safeguard the survival of patients, were at the same time a stress factor in our study. Similarly, the presence of healthcare professionals working around beds while talking, joking and even arguing in loud voices was considered very stressful. The nursing/medical treatment given to patients, even at night, is undeniably indispensable. However, even when limited to the minimum necessary, it still interferes noticeably with patients' quality of sleep.

Among the physical stress factors, patients perceived being unable to sleep as the main stressor present, which highlights the importance of this stressor in limiting patients' overall well-being. As noted, the lack of sleep can lead to a difficult to break vicious circle that is detrimental to health and healing (Delaney et al., 2015). Our findings confirm those of numerous studies (Kjeldsen et al., 2017; Puntillo et al., 2014; Puntillo et al., 2010; Siami et al., 2013), that the feeling of thirst is perceived as being present quite often (Arai et al., 2013).

The results obtained using the Modified RCSQ assessing sleep quality support those of earlier studies, indicating just how serious the problem of poor quality sleep is for ICU patients (Friese et al., 2007; Hardin, 2009; Little et al., 2012; Parthasarathy and Tobin, 2004; Ritmala-Castren et al., 2017).

According to Zimmerman et al. (1996), patients perceived that massage, aromatherapy and receptive musical sound, reduced their awakenings and afforded sounder sleep. In our study the sound and music stimulation via headphones likely served the double purpose of fostering relaxation and a lower sleep latency period, while at the same time, functioning as a sound barrier, isolating patients' from noises around them that could interrupt sleep.

Limitations

The study included mostly surgical patients and hence further research is needed on medical ICU patients. No intubated patients were included in the study limiting generalisability of the results to ICUs where intubated patients reflect most of the ICU patient population. Findings showed the patients had less pain during the second night; at the same time, patients may have found the ICU environment more familiar during the 2nd night, all factors that may have influenced the quality of sleep perceptions.

In view of the findings, a randomised controlled trial in this field could prevent bias and distortion of the study results and improve the quality of evidence.

Conclusions

The study identified complementary techniques using receptive musical sounds and massage using sweet lavender/lemon scented

almond oil improved the quality of ICU patients sleep. However, one noteworthy finding is that thirst emerged as an important stress factor affecting sleep, an issue beyond the reach of the treatment reported. A complimentary technique should be found to address the problem of thirst and added to the use of combined massage-aromatherapy and receptive musical sound. Such a multi-pronged approach could improve the results attained even further and greatly aid ICU patients in getting a good night's sleep. This is a subject planned for future research.

Authorship declaration

All authors listed meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors. All authors have read and approved the final version of the manuscript.

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Ethical statement

- this material has not been published in whole or in part elsewhere;
- the manuscript is not currently being considered for publication in another journal;
- all authors have been personally and actively involved in substantive work leading to the manuscript, and will hold themselves jointly and individually responsible for its content.

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