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Factors associated with anxiety in critically ill patients: A prospective observational cohort study

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Authors' contributions

MIC made a substantial contribution to the design of the study, enrolment of patients, collection of data, data analyses, interpretation of data and wrote the manuscript. LA and MC were responsible for the design of the study and made a substantial contribution to the interpretation of data and writing of the manuscript. BM conducted the mixed model analysis and assisted with data interpretation and writing of the manuscript. MIC, LA, MC and BM revised the manuscript critically for important intellectual content. All authors read and approved the final manuscript.

Abstract

Background: Anxiety is an unpleasant emotion that most intensive care patients experience. This emotion is an important issue in intensive care settings because of its prevalence, adverse effects and severity. Little is known about the factors associated with state and trait anxiety during critical illness.

Objectives: To describe the patterns of state anxiety reported by intensive care patients, and identify factors associated with state and trait anxiety.

Design: Prospective observational cohort study.

Settings: One mixed intensive care unit in Brisbane, Australia.

Participants: Adults (n=141, ≥ 18 years), admitted to the intensive care unit for ≥ 24 hours; able to communicate verbally or non-verbally; understand English; and, open their eyes spontaneously or in response to voice.

Methods: Outcomes were state anxiety as measured by the Faces Anxiety Scale and trait anxiety as measured by the State-Trait Anxiety Inventory. Pre-intensive care factors tested for possible associations with both state and trait anxiety were: age, gender, marital status, employment status, level of education, smoking status, personality trait of optimism and evidence of mental health care/treatment. Intra-intensive care factors tested were: reason for admission to the intensive care unit, delirium, pain, airway status, hours of mechanical ventilation, severity of illness, days of stay in intensive care, exposure to corticosteroids, opioids, benzodiazepines, anxiolytics, antidepressants, beta-blockers, anesthetic agents and analgesics; length of sedation and analgesia and total doses of sedatives and analgesics.

Results: Of 141 participants, 98 (70%) were male with an average age of 54 (Standard Deviation [SD]: ± 15) years and stayed in intensive care for about 4 (Interquartile Range [IQR]: 3-7) days. The majority (n=115; 82%) of participants experienced state anxiety at least once during their stay in intensive care, with 57% reporting moderate to severe levels. Moderate levels of anxiety were predominantly reported from days 6 to 12 and then decreased. Trait anxiety in these participants (median 36 IQR: 29-47) was very similar to the Australian population. Factors related to state anxiety in intensive care were pain and trait anxiety. Factors associated with trait anxiety were trait optimism, state anxiety, evidence of mental health care/treatment and age.

Conclusion: This study provides a better understanding of contributing factors for anxiety in the critically ill. Trait anxiety and state anxiety were significantly associated with each other, namely, patients who were anxious by nature experienced higher levels of state anxiety, which persisted throughout their stay in the intensive care unit. Recognising the importance of state and trait anxiety assessments using validated tools and determining ways to manage anxiety in the critically ill are critical aspects of the intensive care nurses role.

Keywords

Critically ill, intensive care unit, risk factors, state anxiety, trait anxiety.

Introduction

Anxiety is an unpleasant emotion that most intensive care unit patients experience (Tate et al., 2012). This emotion comprises two components: state and trait. State anxiety alerts the individual of imminent danger enabling them to prepare and deal with the threat (Doenges et al., 2010). It helps the body to respond to stressful situations through physiological arousal and feelings of tension, apprehension, nervousness and worry. Trait anxiety is a more stable characteristic of an individual's personality. It is the tendency of a person to become state anxious (Spielberger, 1983, Spielberger, 1966, Spielberger and Reheiser, 2009).

Although state anxiety is a normal adaptive mechanism in human beings, it can become detrimental if it impairs an individual's ability to function (Steimer, 2002). State anxiety can progress to agitation or panic and even modify physiological function (e.g. promote the formation of gastric ulcers or dysrhythmias); becoming pathological and representing a clinical concern (Doenges et al., 2010, Moser and Dracup, 1996, Steimer, 2002). High levels of anxiety, particularly when sustained, are less adaptive and might contribute to the development of adverse emotional outcomes after the intensive care experience (Nelson et al., 2000).

A high prevalence of state anxiety has been identified in critically ill patients, especially in those requiring mechanical ventilation. In a descriptive study including 192 ventilated patients state anxiety was found in all of them, with low levels in 20% (n=38), moderate to severe levels in 62% (n=119) and high levels in 18% (n=35) of the patients (Chlan, 2003). In addition, a significantly higher prevalence of anxiety was reported in mechanically ventilated patients than in non-ventilated (74.2% versus 25.8% respectively, $p=0.02$) in seriously ill patients at risk of dying (Puntillo et al., 2010). In a

qualitative investigation exploring this emotion in 30 intensive care patients, all the patients exhibited anxiety at some stage during the study (Tate et al., 2011).

A high proportion of intensive care patients usually report moderate to high levels of anxiety despite receiving sedation and/or analgesia. In 106 Australian patients (89% ventilated) severe anxiety was reported by 35% of patients who received sedation (n=45) and 66% of patients who did not (n=61) (McKinley et al., 2004). Several years later, using similar measurement instruments, McKinley and Madronio (2008) reported lower levels of anxiety in 100 non-ventilated patients. However, more than a quarter (28%) of patients still reported moderate to severe anxiety, and half of them (14%) had received sedation (McKinley and Madronio, 2008).

The need for intensive care treatment is accompanied by several physical, psychological and environmental sources of distress. Physical sources of distress such as invasive mechanical ventilation, may lead to physiologically and psychologically distressing experiences since the patients are not able to verbalise their feelings, symptoms or wants. In fact, spells of terror, nervousness when left alone, and sleeping disturbances have been associated with endotracheal intubation (Rotondi et al., 2002). Psychological sources of distress such as confusion, fear, panic, and frustration are common while receiving intensive care (Tate et al., 2011). Examples of environmental sources of distress are noise, lights and lack of privacy (Puntillo et al., 2010, Yava et al., 2011). Despite the sources of distress during intensive care treatment being documented in the literature, there is little empirical research exploring sources of distress as potential risk factors for anxiety in the intensive care unit. Statistical approaches such as multivariate analysis to determine unique contributions and rule out the influence of confounding factors are needed.

Although there is some description of anxiety in the critically ill population, the majority of the evidence available provides information only about the state component. Recent reports have shown a relationship between trait anxiety and symptoms of anxiety, depression and posttraumatic stress disorder in intensive care survivors (Castillo et al., 2015a, Castillo et al., 2015b). These findings are in line with previous reports in other populations such as survivors of rectal cancer (Ristvedt and Trinkaus, 2009). As research in the field of psychology suggests that trait anxiety can be modified using tailored interventions, it seems beneficial to also explore trait anxiety in the intensive care patient (Clark et al., 2003, Jackson et al., 2012, Tang et al., 2009). Since trait anxiety has been associated with the development of adverse emotional outcomes, the investigation of anxiety in the critically ill patient is imperative.

In this current research, we aimed to describe the patterns of state anxiety reported by patients throughout their stay in the intensive care unit, and test a number of variables as risk factors for anxiety (state and trait) during critical illness. Factors were categorized into two groups: pre-intensive care factors and intra-intensive care factors. Pre-intensive care factors tested for possible associations with both state and trait anxiety were: age, gender, marital status, employment status, level of education, smoking status, personality trait of optimism and evidence of mental health care/treatment. Intra-intensive care factors tested were: reason for admission to the intensive care unit, delirium, pain, airway status, hours of mechanical ventilation, severity of illness, days of stay in the intensive care unit, exposure to corticosteroids, opioids, benzodiazepines, anxiolytics, antidepressants, beta-blockers, anesthetic agents and analgesics; length of sedation and analgesia and total doses of sedatives and analgesics. State anxiety and trait anxiety were considered as both outcome variables

and risk factor of each other. Other factors such as memories of endotracheal intubation, memories of anxiety, fear, panic as well as environmental factors were out of the scope of this research.

Methods

Participants in this analysis were enrolled in a prospective follow-up study that investigated anxiety, depression and posttraumatic stress symptoms in intensive care survivors over six months after discharge from the intensive care unit (Castillo et al., 2013, Castillo et al., 2015a, Castillo et al., 2015b). Participants (n=141) were from one closed mixed medical/surgical/trauma intensive care unit of a tertiary metropolitan public hospital located in Brisbane, Australia. This 25-bed intensive care unit provides 24-hour intensivist led care, with a registered nurse/patient ratio of 1:1. Data were collected prospectively between September 2012 and February 2013. The study protocol has previously been published (Castillo et al., 2013), but a summary of the methods is provided below. The current study is a preplanned sub-study analysis of this research.

Inclusion criteria were adult patients (≥ 18 years), admitted to the intensive care unit for ≥ 24 hours; able to communicate verbally or non-verbally; understand English; and, open their eyes spontaneously or in response to voice. As patients woke up and became interactive at different times, they were not recruited on a particular day of their stay in the intensive care unit. Patients were invited to participate in the project as soon as meeting the inclusion criteria and their assent (verbal or non-verbal) was sought prior to data collection in the intensive care unit. This was followed by written consent being sought once the patients were in the hospital wards, and able to provide informed consent. The relevant Human Research Ethics Committees approved this research.

Pre-intensive care factors collected in the hospital wards using a set of questionnaires included: marital status, employment status and level of education, pre-intensive care medications (benzodiazepines, anxiolytics, antidepressants, corticoids,

opioids, and beta-blockers), smoking status, personality trait of optimism (Life Orientation Test-Revised), personality trait of anxiety (Trait component of the State-Trait Anxiety Inventory Form Y-2) and evidence of mental health care/treatment (Scheier et al., 1994, Spielberger, 1983). Participants who answered “Yes” to either of the following two questions was considered to have positive evidence of mental health care/treatment prior to the intensive care admission: (1) Have you ever visited a general practitioner or a mental health professional for symptoms of psychological distress or emotional problems? (2) Were you taking benzodiazepines, anxiolytics or antidepressant medications within the 12 months prior to the intensive care admission? Information about previous mental health history, pre-intensive care medications (corticoids, opioids and beta-blockers) and personality trait of optimism were collected because the literature suggests a possible association between these factors and adverse emotional outcomes after the intensive care experience (Bryant et al., 2009, Fletcher et al., 2010, Myhren et al., 2009, Schelling et al., 2001). Age and gender were collected from electronic patient notes held in the intensive care unit.

Intra-intensive care factors collected from electronic patient notes held in the intensive care unit included: type of admission (medical, surgical, trauma, cardiac surgery), delirium (Confusion Assessment Method – Intensive Care Unit), hours of mechanical ventilation (invasive and non-invasive), airway status (tracheostomy, endotracheal tube, natural), Acute Physiology And Chronic Health Evaluation III score, length of intensive care unit stay (days), length of hospital stay (days) and pain using the Critical-Care Pain Observation Tool (Cook et al., 2002, Ely et al., 2001, Gelinas et al., 2006, Gelinas et al., 2009). Data on drugs administered included exposure to corticosteroids, opioids, benzodiazepines, anxiolytics, antidepressants, beta-blockers,

anesthetic agents and analgesics; length of sedation and analgesia (hours of propofol, midazolam, morphine, fentanyl, ketamine, oxycodone infusion); and total doses of sedatives and analgesics (propofol, midazolam, morphine, fentanyl, ketamine, oxycodone and paracetamol).

The primary outcomes of this study were both components of anxiety (state and trait) in the critically ill patient. State anxiety and trait anxiety were also considered as a risk factor of each other. Levels of state anxiety were self-reported twice daily in the intensive care unit (morning 8-11 am and evening 4-7 pm) using the Faces Anxiety Scale (McKinley et al., 2004). These timeframes were selected because we wanted to identify any difference between morning assessments (usually busier intensive care unit environment) and evening assessments (usually quieter intensive care unit environment). We selected the Face Anxiety Scale because it is a practical tool, specially designed to measure state anxiety in intensive care settings. The Faces Anxiety Scale consists of a scale with five faces with each face representing a different level of anxiety. The score ranges from 1 (no anxiety) to 5 (extreme anxiety). The criterion validity of this scale was 0.64 ($p < 0.001$) in mechanically ventilated patients (Pearson's correlation coefficient between the self-report of anxiety on the Faces Anxiety Scale and clinical judgment of patient's anxiety) (McKinley et al., 2004).

Before approaching for the assessment of anxiety, the following information was recorded: airway status (tracheostomy, endotracheal tube, natural), mechanical ventilation status (invasive, non-invasive, non-ventilation), delirium status (Confusion Assessment Method- Intensive Care Unit), oxygen saturation, pain score and sedation (total dose of sedatives and analgesics as well as total hours of continuous infusion of sedoanalgesia). Then, the participants were shown the Faces Anxiety Scale and asked to

choose the face that better represented how much anxiety they felt at the moment of assessment. The answer could be provided by a verbal or a nonverbal response; i.e. they could point to the relevant face.

Trait anxiety was assessed using the Trait component of the State-Trait Anxiety Inventory for adults Form Y-2 (Spielberger, 1983). This assessment was performed when participants were in the hospital wards and sufficiently awake to be able to answer questions in this inventory. The State-Trait Anxiety Inventory is a self-report 20-items measure based on a 4-point Likert scale with scoring going from 20-80 with higher scores indicating greater levels of trait anxiety. The State-Trait Anxiety Inventory is a well-validated and recognised tool for the assessment of trait anxiety and has previously been used with survivors of critical illness at a similar time point in their recovery process (Jones et al., 2003, Kress et al., 2003). Trait anxiety was assessed in the wards and not in the intensive care unit for two reasons: completion of the State-Trait Anxiety Inventory requires a patient able to maintain attention for about 10 minutes: and, trait personalities are stable patterns of cognition, affect and behavior that are relatively consistent across time and situations (American Psychiatric Association, 2013). Thus, trait anxiety would have been unlikely to change in such a short period (between intensive care unit stay and assessment in the wards) and without a specific intervention to modify this personality trait. The principal investigator and the intensive care unit Research Nurse conducted the state anxiety assessments in the intensive care unit and assisted the participants (when needed due to physical impairment) with the surveys in hospital wards.

We performed power analysis *a priori* using G*Power to determine the sample size needed for this study (Faul et al., 2009). Multiple regression test (fixed model, R^2

increase) with a power of 80%, a significance level of $\alpha = 0.05$ and a medium size effect (0.15) were used. In addition, we expected a maximum of seven variables to be included in the final model and a mortality rate of 10%. Thus, the estimated sample size for this study was 104 participants.

The outcome variable “state anxiety” was derived from repeated measures taken during the participants’ intensive care unit stay (twice a day). In order to incorporate state anxiety into the multivariable modelling, it was essential to determine a single score that represented the entire intensive care unit stay. We extensively explored the first state anxiety measure in the intensive care unit and several aggregate variables (e.g. mean state anxiety and median state anxiety). However, we selected the mean value because it was the strongest at accounting for correlations amongst observations in the same cluster with an Interclass Correlation Coefficient of 0.53.

Distributions of continuous variables were assessed with frequency histograms and tests for normality. Relationships between each risk factor and the outcome variables (trait and state anxiety) were tested using appropriate inferential statistics (continuous, binary and nominal/ordinal risk factors used Spearman's correlation, Mann-Whitney U test, Kruskal-Wallis, respectively). Variables associated at P-value (p) ≤ 0.2 were considered in subsequent multivariable analyses.

Multiple linear regression was used to identify factors significantly associated with state anxiety. Model building used forward selection where variables significant at the bivariate level ($p \leq 0.2$) were added into the model one at a time, repeating this process until none improved the model. Variables not significant at the bivariate level but identified in the literature as important were tested in the final model. The same process was repeated to determine factors significantly associated with trait anxiety.

Regression diagnostics were performed informally (graphical) and formally (statistical) to verify the analysis met the assumptions underlying multiple linear regression. Diagnostic tests included assessing the normality and homoscedasticity of residuals, degree of multicollinearity amongst risk factors, the linearity assumption between the outcome variable and risk factors and identification of outliers. Statistical analyses were conducted using Stata version 13 (StataCorp, College Station, Texas) and SPSS version 21 (IBM Corp, 2013, StataCorp, 2013).

Results

Of 797 patients screened during the enrollment period 600 were excluded: 597 stayed in the intensive care unit for less than 24 hours, and three were younger than 18 years old. One hundred and ninety-seven patients agreed to participate in this study and reported on their levels of state anxiety during intensive care treatment. One hundred and twenty patients completed the State-Trait Anxiety Inventory in the wards (Figure 1). There were no significant differences in baseline demographics (age, gender, Acute Physiology And Chronic Health Evaluation III score, length of intensive care unit stay and hospital stay) or state anxiety between those who assented to intensive care data collection and those who completed the State-Trait Anxiety Inventory.

Participants were predominantly male (70%) and relatively young (mean 54.1 ± 15.3 years). The majority were in a relationship (61%) and worked (57%). Evidence of mental health care/treatment prior to the intensive care admission was reported by 37% of participants and just under a third (28%) smoked. Approximately half of the participants were admitted with medical diagnoses (49%), followed by surgical (21%), trauma (17%) and cardiac surgery (13%). Most participants received mechanical ventilation (82%) for about 52 (Interquartile Range [IQR]: 13-148) hours,

and sedation and analgesia with propofol (n=119, 84%), fentanyl (n=111, 79%), midazolam (n= 49, 35%) and morphine (n=37, 26%). Participants stayed in the intensive care unit for about four days and fifteen days in hospital.

Eighty-two percent (n=115) of participants reported state anxiety at least once during their stay in intensive care, with 57% (n=80) reporting moderate to severe levels. Because most of the participants had reduced consciousness during the first hours in the intensive care unit, they were able to report state anxiety status only half of their intensive care days. Participants reported moderate to severe state anxiety on 44% of these days. While the levels of state anxiety fluctuated over time, there was no significant difference between morning and afternoon assessments (2.4 Standard Deviation [SD] \pm 1.0 versus 2.3 SD \pm 1.0, $t(88) = 0.28$, $p = 0.779$). Moderate levels of anxiety were predominantly reported from days 6 to 12 and then decreased (Figure 2). The trait component of anxiety in these participants (median 36 [IQR: 29-47]) was similar to the Australian population (Crawford et al., 2011).

Factors associated with state anxiety on univariate analysis ($p \leq 0.2$) included: trait anxiety ($r_s = 0.32$, $p < 0.001$), evidence of mental health care/treatment ($r_s = -0.22$, $p = 0.01$), trait optimism ($r_s = -0.15$, $p = 0.1$) and pain ($\rho = 0.16$, $p = 0.06$). After multivariable model adjustment both trait anxiety and pain remained significant. Model results indicated trait anxiety as the largest contributor to state anxiety (beta=0.29) followed by pain (beta=0.18) (Table 1).

Thirteen factors were significantly associated ($p \leq 0.20$) with trait anxiety on univariate analysis: age, evidence of mental health care/treatment, trait optimism, state anxiety, smoking, length of hospital stay, length of propofol infusion, total dose of propofol, total dose of midazolam, total dose of morphine, length of fentanyl infusion,

total dose of oxycodone and pain (Table 2). Several factors remained significantly associated with trait anxiety after adjustment including age, trait optimism, state anxiety, and evidence of mental health care/treatment (Table 3).

Discussion

This observational study showed that intensive care patients with mixed diagnoses suffer emotional distress during their intensive care admission. Despite our participants having similar trait anxiety levels to the Australian norms, the majority of participants experienced moderate to severe levels of state anxiety during intensive care treatment. The prevalence and severity of state anxiety found in our sample are comparable to the prevalence and severity reported in other studies (Chlan and Savik, 2011, Chlan, 2004, McKinley et al., 2004).

Our participants were able to report state anxiety status on half of their intensive care days because they were unconscious or too ill to be assessed the other half. Of the days of assessment, moderate to severe state anxiety was reported by almost half of the participants. Self-reported levels of state anxiety demonstrated minimal fluctuation from days 6 to 12, with average scores showing moderate levels over this period (Figure 2). During these days in the intensive care unit, participants might have been capable of perceiving stressors such as pain, noise and endotracheal tube and, therefore, their levels of state anxiety were higher. After day 12, participants may have become accustomed to the intensive care environment, staff and routine, resulting in a decrease in their anxiety levels. As participants in this study reported state anxiety after 24 hours of being in the intensive care unit, levels for the initial 24 hours are unknown. In addition, as this

component was only assessed during participants' intensive care unit stay, state anxiety levels after the intensive care discharge, but still in hospital wards, are also unknown. Despite these limitations, the information provided about state anxiety in this study is important because this is only the second study to describe patients' self-report of state anxiety throughout the intensive care stay.

Trait anxiety and state anxiety were significantly associated with each other. Participants who were anxious by nature experienced higher levels of state anxiety. This finding is consistent with the theory behind the anxiety concept developed by Spielberger (Spielberger, 1983, Spielberger, 1966, Spielberger and Reheiser, 2009). Given trait anxiety levels in our sample were similar to the ones found in the general Australian population, it is reasonable to suggest that anyone with high anxiety personality trait admitted to the intensive care unit is at greater risk of experiencing state anxiety during intensive care treatment. Measuring trait anxiety prior to admission to the intensive care unit in elective patients and as soon as possible after admission in emergency patients might help clinicians to identify patients at risk of experiencing high levels of state anxiety during intensive care treatment. During patients' intensive care stay, state anxiety should be assessed systematically, and clinicians should use this assessment to guide treatment in the intensive care unit.

Participants with lower levels of pain reported significantly less state anxiety. Because pain may be perceived as a very distressing symptom, it is not surprising that these two unpleasant symptoms were associated with each other in our participants (Puntillo et al., 2010). Effective strategies for pain management are fundamental to alleviate both pain and state anxiety in the critically ill (Puntillo et al., 2010). Trait anxiety and evidence of mental health care/treatment prior to the intensive care

admission were also significantly associated. The relationship between trait anxiety and general mental health in the intensive care population requires additional exploration.

Lower levels of trait anxiety were observed in older participants, suggesting a protective effect of ageing on anxiety outcomes. To our knowledge, this relationship has not previously been reported in the intensive care patient. However, there is evidence that age-related reduced prefrontal-amygdala structural connectivity is associated with lower levels of trait anxiety in healthy adults (Clewett et al., 2014).

Optimistic participants reported significantly lower levels of trait anxiety. The relationship between these two trait personalities has previously been reported in healthy participants and patients hospitalised for chronic diseases (Kepka et al., 2013, Raikonen et al., 1999). No study reporting this association in the intensive care patient was located. This finding is important because trait optimism was identified as a predictor of less anxiety and depression symptoms after one year in intensive care survivors (Myhren et al., 2010). Trait anxiety was also associated with anxiety, depression and posttraumatic stress symptoms over six months after discharge from the intensive care unit (Castillo et al., 2015a, Castillo et al., 2015b). In addition, the interaction between these two trait personalities in the development of adverse emotional outcomes in the intensive care survivor is yet to be tested. Thus, age, trait optimism and evidence of mental health care/treatment prior to the intensive care admission were all factors significantly associated with trait anxiety, which in turn together with pain were associated with state anxiety in the intensive care unit (Table 1 and 3).

Although a number of risk factors were examined and tested, no other demographic (age, gender, marital status, etc.) or clinical (sedatives, analgesics,

mechanical ventilation, etc.) variables were significantly associated with state anxiety in the intensive care unit. Given that sedation is often administered to treat agitation and anxiety (Barr et al., 2013), it was anticipated that we would find a significant statistical relationship between sedation and anxiety, but this was not the case. Discrepancies between patients' self-reported anxiety and clinician's observations of anxiety might explain this lack of association (O'Brien et al., 2001). The management of anxiety in intensive care is often based on clinicians' detection of it, which is usually done through observation of physiological and behavioural manifestations (Tate et al., 2012). Unfortunately, clinicians' observations of physiological and behavioural manifestations of anxiety are limited since delirium and pain share similar physiological and behavioural characteristics with anxiety. These similarities may lead to erroneous symptom interpretation. It might be the case that the association between state anxiety and sedation was not found in this sample because sedation was not administered to treat anxiety.

These findings further underline the importance of the assessment of both components of anxiety (state and trait) in the critically ill patient. State anxiety can be easily assessed in the intensive care unit by the use of validated self-reported measures such as the Faces Anxiety Scale or the Visual Analog Scale-Anxiety (Chlan, 2004, McKinley et al., 2004). Trait anxiety could be an assessment performed when patients are able to respond to the trait component of the State-Trait Anxiety Inventory either by the bedside intensive care nurse or intensive care outreach nurses (who follow-up patients in the wards). The feasibility of trait anxiety assessment needs to be tested. Early assessment of state and trait anxiety in intensive care patients is vital to put in place simple non-pharmacological interventions to alleviate anxiety in the intensive care

unit, promote comfort and potentially reduce the risk of adverse outcomes during recovery. Music therapy, education, stress management, reassurance, encouragement or coaching and psychological interventions such as cognitive behavioural therapy are examples of non-pharmacological interventions that could be provided by intensive care nurses to reduce anxiety in intensive care patients and its potential detrimental consequences (Chlan et al., 2013, Moser et al., 2003, Peris et al., 2011, Tate et al., 2011). However, more research is needed in this area so that the effectiveness of these interventions in the intensive care context as well as their long-term effects in intensive care survivors can be established.

Our study was limited to adult patients who were ≥ 24 hours in a general intensive care unit and therefore only generalisable to patients who spend at least 24 hours in the intensive care unit. Although a sub-study, it was planned at the time of conception of the larger study (Castillo et al., 2013). While we assessed the levels of state anxiety, we did not explore the reasons why patients were anxious such as environmental factors. It might have been beneficial to collect this information in a qualitative or retrospective manner although there are some previous studies examining state anxiety in the intensive care unit that are available to aid interpretation of these data (Rotondi et al., 2002, Tate et al., 2012).

Conclusion

This study provides a better understanding of contributing factors for anxiety in the critically ill. Trait anxiety and state anxiety were significantly associated with each other, namely, patients who were anxious by nature experienced higher levels of state

anxiety, which persisted throughout the intensive care stay. It also demonstrates that it is crucial for intensive care nurses to recognise the importance of state and trait anxiety assessments using validated tools and determine ways to manage anxiety in the critically ill. Non-pharmacological strategies such as music therapy or psychological interventions have been shown to be effective in reducing anxiety in the intensive care patient, however, more research is needed to test the long-term effectiveness of these interventions in intensive care survivors.

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What is already known about the topic?

- Critically ill patients often experience anxiety during ICU stay
- Anxiety during critical illness has recently been associated with the development of anxiety, depression and posttraumatic stress symptoms after the ICU experience.

What this paper adds

- State anxiety persists throughout the ICU stay, with highest levels reported from day 6 to 12
- Factors associated with state anxiety during critical illness include trait anxiety and pain
- Factors associated with trait anxiety during critical illness include age, trait optimism, state anxiety, and evidence of mental health treatment
- Early assessment and management of anxiety during ICU treatment might help to reduce the risk of adverse emotional outcomes after critical illness.

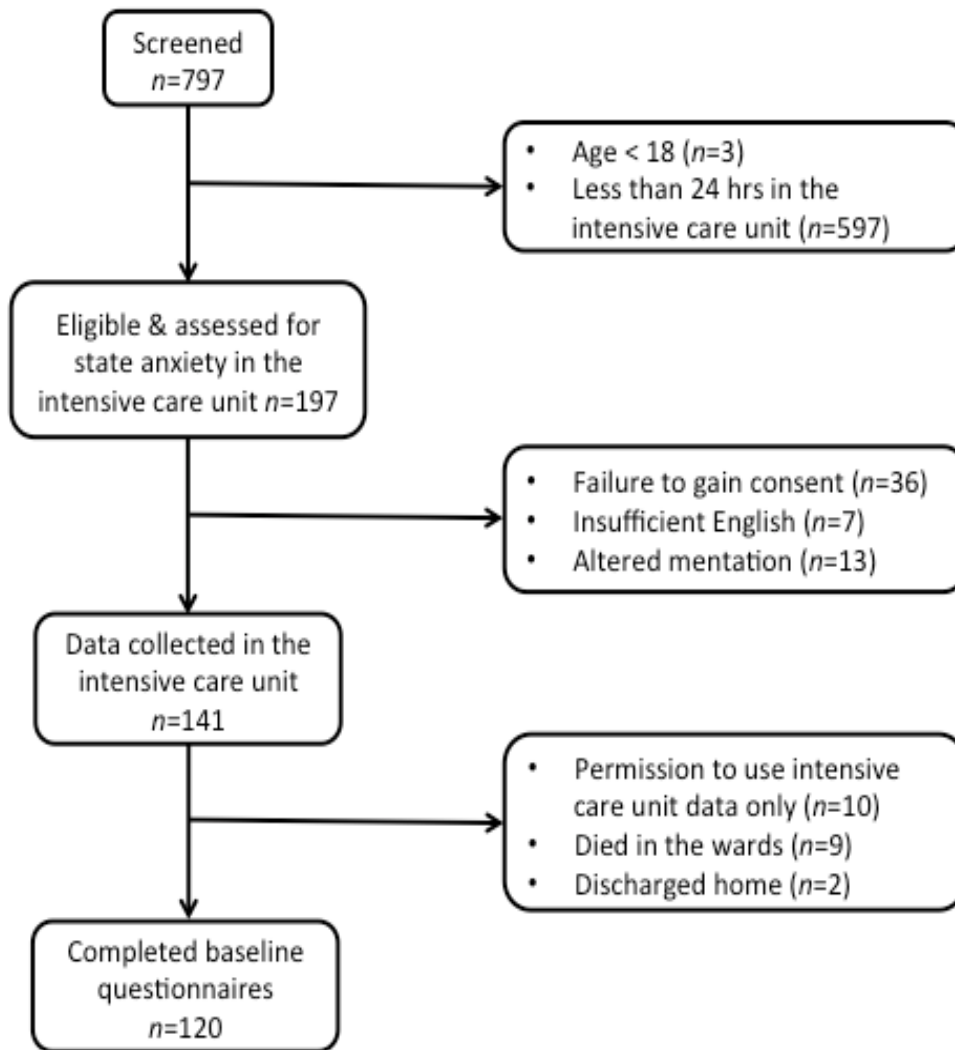
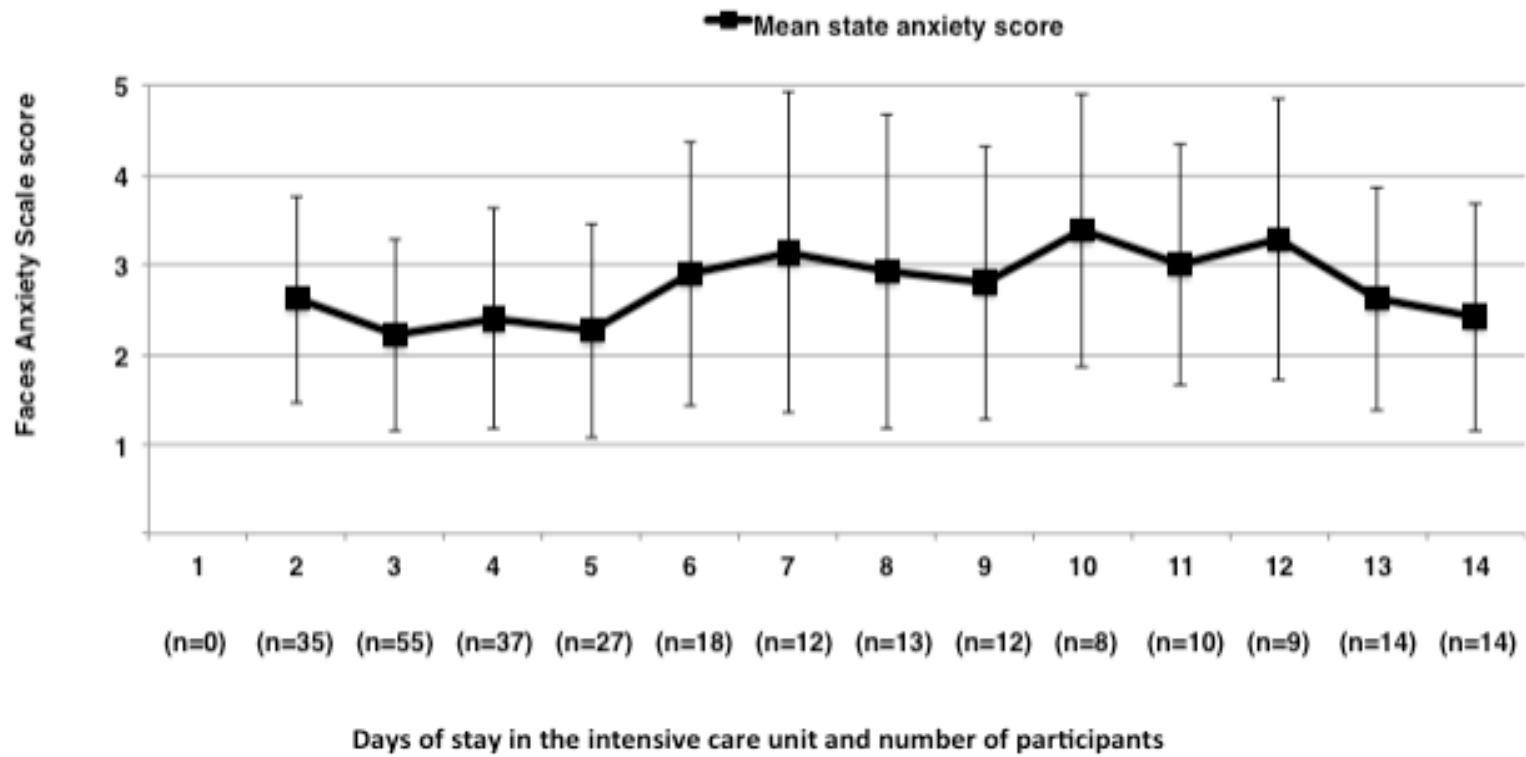


Figure 1. Participant flow through study



Faces Anxiety Scale scores from 1 to 5 (1-2 = low anxiety, 3-5 = moderate to severe anxiety)

Figure 2. Mean state anxiety score and standard deviation for the days of stay in the intensive care unit

Table 1. Multiple Linear Regression: Factors associated with state anxiety in intensive care patients (n=141)

| Variables | Unstandardised Coefficients | | Standardised Coefficients | Sig. | 95.0% Confidence Interval for B | |
|---------------|-----------------------------|------------|---------------------------|-------|---------------------------------|-------------|
| | B | Std. Error | Beta | | Lower Bound | Upper Bound |
| (Constant) | 1.204 | 0.317 | | 0.001 | 0.577 | 1.831 |
| Trait anxiety | 0.027 | 0.008 | 0.294 | 0.001 | 0.011 | 0.043 |
| Pain | 0.095 | 0.046 | 0.180 | 0.043 | 0.003 | 0.187 |

Table 2. Univariate analysis: association between variables significant at $p \leq 0.2$ and trait anxiety score (n=120)

| Variables/Trait anxiety score | <i>r</i> value and (<i>p</i>) |
|-------------------------------------|---------------------------------|
| Age | -0.26 (0.004) |
| Evidence of mental health treatment | 0.29 (0.001) |
| Trait optimism | -0.58 (<0.001) |
| State anxiety | 0.32 (<0.001) |
| Smoking | 0.30 (0.001) |
| Length of hospital stay | 0.18 (0.04) |
| Length of propofol infusion | 0.17 (0.053) |
| Total dose of propofol | 0.15 (0.09) |
| Total dose of midazolam | 0.18 (0.052) |
| Total dose of morphine | -0.16 (0.08) |
| Length of fentanyl infusion | 0.19 (0.04) |
| Total dose of oxycodone | 0.15 (0.094) |
| Pain | 0.17 (0.058) |

Spearman's rank correlation coefficients, Mann-Whitney U test, Kruskal-Wallis test were used with, respectively, continuous, binary and categorical risk factors

Table 3. Multiple Linear Regression: Factors associated with trait anxiety in intensive care patients (n=120)

| Variables | Unstandardised Coefficients | | Standardised Coefficients | Sig. | 95% Confidence Interval for B | |
|-------------------------------------|-----------------------------|------------|---------------------------|-------|-------------------------------|-------------|
| | B | Std. Error | Beta | | Lower Bound | Upper Bound |
| (Constant) | 62.369 | 4.209 | | 0.001 | 54.030 | 70.707 |
| Trait optimism | -1.549 | 0.181 | -0.563 | 0.001 | -1.908 | -1.190 |
| State anxiety | 2.235 | 0.728 | 0.204 | 0.003 | 0.792 | 3.678 |
| Age | -0.142 | 0.049 | -0.188 | 0.004 | -0.238 | -0.045 |
| Evidence of mental health treatment | 4.186 | 1.586 | 0.175 | 0.009 | 1.043 | 7.329 |

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