Relationships between Comfort and Pain, Anxiety, and Social Support in Acute Respiratory Failure Patients with Non-invasive Ventilator Support

นิพนธ์ต้นฉบับ

Original Article

วสุรัตน์ นิยมรัตน์[1]*, เขมารดี มาสิงบุญ[2] และ วัลภา คุณทรงเกียรติ[2]

[1] นิสิตพยาบาลศาสตรมหาบัณฑิต สาขาวิชาการพยาบาลผู้ใหญ่

[2] สาขาวิชาการพยาบาลผู้ใหญ่

[1-2] คณะพยาบาลศาสตร์ มหาวิทยาลัยบูรพา อ.เมือง จ.ชลบุรี 20131

* **ติดต่อผู้นิพนธ์:** wasurat.ni@bph.co.th

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Wasurat Niyomrat[1]*, Khemaradee Masingboon[2] and Wanlapa Kunsongkeit[2]

[1] Student of Master of Nursing Science Program in Adult Nursing

[2] Adult Nursing Division

[1-2] Faculty of Nursing, Burapha University, Muang, Chonburi, 20131, Thailand.

* **Corresponding author:** wasurat.ni@bph.co.th

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาความสุขสบาย และความสัมพันธ์ระหว่างกับความสุขสบายกับความปวด ความวิตกกังวล และการสนับสนุนทางสังคม ของผู้ป่วยที่มีภาวะหายใจล้มเหลวเฉียบพลันที่ได้รับการใส่เครื่องช่วยหายใจชนิดไม่ใส่ท่อช่วยหายใจ **วิธีการศึกษา:** การศึกษาเชิงพรรณนาเพื่อหาความสัมพันธ์ เก็บข้อมูลด้วยการสัมภาษณ์ผู้ป่วยที่ถูกวินิจฉัยภาวะหายใจล้มเหลวเฉียบพลัน ที่รักษาในหอผู้ป่วยวิกฤตอายุรกรรม และหอผู้ป่วยวิกฤตหัวใจและหลอดเลือดในโรงพยาบาลเอกชนแห่งหนึ่งในเขตพัทยา คัดเลือกตัวอย่างคนไข้จำนวน 67 ราย เก็บข้อมูลด้วยแบบบันทึกข้อมูลส่วนบุคคล แบบสัมภาษณ์ความเจ็บปวด แบบสัมภาษณ์ความวิตกกังวล และแบบสัมภาษณ์ความสุขสบาย วิเคราะห์ข้อมูลด้วยสถิติพรรณาและสถิติสัมประสิทธิ์สหสัมพันธ์ของเพียร์สัน **ผลการศึกษา:** กลุ่มตัวอย่างรับรู้ความสุขสบายระดับปานกลาง (M = 99.85, SD = 15.72) และมีความปวดและความวิตกกังวลระดับสูง (M = 8.16, SD = 0.62, M = 10.33, SD = 1.95 ตามลำดับ) ความสุขสบายสัมพันธ์ทางลบระดับปานกลางกับความปวดอย่างมีนัยสำคัญ (r = -0.41, P = 0.001) สัมพันธ์ทางลบระดับมากกับความวิตกกังวลอย่างมีนัยสำคัญ (r = -0.90, P < 0.001) และสัมพันธ์ทางบวกระดับมากกับการสนับสนุนทางสังคมอย่างมีนัยสำคัญ (r = 0.89, P < 0.001) **สรุป:** ผู้ป่วยที่มีภาวะหายใจล้มเหลวเฉียบพลันที่ใส่เครื่องช่วยหายใจชนิดไม่ใส่ท่อช่วยหายใจมีการรับรู้ความสุขสบายระดับปานกลาง และสัมพันธ์ทางลบกับความปวดและความวิตกกังวล และทางบวกกับการสนับสนุนทางสังคม ดังนั้น ควรจัดการความปวดและลดความวิตกกังวลแก่ เพื่อให้ผู้ป่วยมีความสุขสบายมากขึ้น และเกิดความสำเร็จในการใช้เครื่องช่วยหายใจชนิดไม่ใส่ท่อช่วยหายใจ

คำสำคัญ: ภาวะหายใจล้มเหลวเฉียบพลัน, เครื่องช่วยหายใจชนิดไม่ใส่ท่อช่วยหายใจ, ความสุขสบาย, การสนับสนุนทางสังคม, ความวิตกกังวล

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Abstract

Objective: To examine comfort and its relationship with pain, anxiety, and social support in acute respiratory failure patients with non-invasive ventilator support. **Method:** In this descriptive correlational research, we recruited 67 patients with acute respiratory failure admitted to the cardiac care unit and medicine intensive care unit of a private hospital, located in Pattaya, Chonburi province, Thailand. Data were collected using a set of questionnaires including demographic information, the Numerical Rating Scale (NSR) for Pain, the Thai Anxiety Scale, the Comfort, and the Social support questionnaires. Data were analyzed using descriptive statistics and Pearson' s product moment correlation. **Results:** Patients reported a moderate level of comfort (M = 99.85, SD = 15.72), and high level of pain and anxiety (M = 8.16, SD = 0.62 and M = 10.33, SD = 1.95). Comfort was significantly and negatively correlated with pain and anxiety (r = -0.41, P = 0.001 and r = -0.90, P < 0.001 respectively); while positively correlated with social support (r = 0.89, P < 0.001). **Conclusion:** Acute respiratory failure patients with non-invasive ventilator support experienced a moderate level of comfort, and it was related with pain, anxiety and social support. Pain and anxiety should be better managed so that comfort among the patients could be improved.

Keywords: acute respiratory patient, non-invasive ventilator, comfort, social support, anxiety

Editorial note

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Introduction

Acute respiratory failure (ARF) is a common and serious complication in hospitalized patients, which may be caused by several conditions including pneumonia, chronic obstructive pulmonary disease (COPD), adult respiratory distress syndrome (ARDS), and congestive heart failure (CHF). Although ARF is conventionally defined by an arterial oxygen tension of < 60 mm Hg, an arterial carbon dioxide tension of > 45 mmHg, or both, these thresholds serve as a guide to be used in combination with the history and clinical assessment of the patient.[1] In the past years, there has been an increase in the number of hospitalizations with a discharge diagnosis of ARF patients. In the US, the number of hospitalizations owing to ARF increased by 90% in 2009 (from 2001) with an in-hospital mortality rate of 33% to 37% among those who required invasive mechanical ventilator.[2] According to a report in Thailand, it was found that ARF was the third leading cause of death with an increase from 6.99 people per 100,000 in 2011 to 8.98 people per 100,000 in 2014.[3]

Invasive mechanical ventilation (IMV) is a lifesaving procedure and remains the cornerstone of supportive therapies for patients with ARF. However, IMV appears to be a cause of ventilator- associated pneumonia risk,

complications from endotracheal intubation and tracheostomy and ventilator-induced lung injury. Consequently, strategies for non-invasive ventilation (NIV) have become a tool in the treatment of ARF with high effectiveness and been recommended as the first-line ventilation modality for ARF.[4] The use of NIV has therefore increased significantly from the year 2002 (0.97%) to 2012 (4.37%) with greater benefits. When compared with IMV, the length of stay (LOS) was lower in NIV (15.5 and 10.1 months by average, respectively, *P*-value < 0.001) as well as mortality risk (0.29 and 0.17, respectively, *P*-value < 0.001).[5] The cost associated with NIV was also lower.

Although NIV is generally perceived as more beneficial for patients than IMV, it can also result in problems relating primarily to the appearance of nasal and oropharyngeal dryness, pressure sores where the nasal mask touches the skin, and ocular irritation due to air leakage and epistaxis. Most of the time, the discomfort is slight and well tolerated, but in some cases the discomfort could be excessive and lead to the discontinuance of the ventilation. Moreover, NIV intolerance may affect as many as 30 - 50% of patients. Despite the best efforts of skilled caregivers; discomfort remains responsible for 12 - 33% of NIV failure.[6] This means that the discomfort is related to the device and the ventilation modality adopted for NIV. Thus, the evidence has shown the strong link between NIV failure and poor outcomes. Patients who had failed NIV had a higher rate of hospital mortality than patients who were successfully treated with NIV (25.9% and 9.7%, respectively, *P*-value < 0.001). They also had a higher rate of in-hospital complications, a longer median hospital stay (10 and 6 days, respectively) and were less likely to be discharged home (53.0% and 67.2%, respectively).[7]

Comfort is an outcome that is highly desired by patients and hence represents an important goal of nursing care. Kolcaba defined comfort as the immediate state of being strengthened through having the human needs for relief, ease, and transcendence addressed in four contexts of experience including physical, psychospiritual, sociocultural and environmental ones.[8,9] Comfort Scale questionnaire was developed to quantify comfort.[8,9] Assessing comfort as a positive, holistic outcome enables nurses to direct their care in ways that are both goal-directed and measurable.

Comfort in health refers to a sense of relief of discomfort, to a state of tranquility and satisfaction, or to any feeling that makes life easy or pleasant.[8,9] Kolcaba defined comfort as three concepts namely relief, tranquility, and transcendence, which are related to physical, psychospiritual, environmental, and sociocultural contexts of comfort.[8,9] According to the literature, NIV complications may occur as a result of inappropriate pressure and flow. Pressure-related symptoms include discomfort and ear or sinus pain. Pain is an effect reflecting physical context of the patient's discomfort. A study by Carron and colleagues found that 10 - 30% of the patient suffered from pain on their noses and ears while using NIV.[10] The skin irritation caused the discomfort in 30 – 50 % of the patients. Pain and discomfort while on NIV could contribute to a failure of ventilator triggered by the patient-ventilator dys-synchrony, which could further lead to an inadequate gas exchange and the ultimate failure of NIV using.[11]

Another aspect of discomfort is anxiety. The study of Schmidt and colleagues found that there was a high level of anxiety in patients who used NIV (37%) in the ICU.[12] Anxiety is another unpleasant and uncomfortable feeling related to a certain source, as an effect pertaining to psychospiritual context of the patient's comfort. The study by Pinthong[13] also found that all 12 patients were anxious when using the NIV device for the first time due to their unfamiliarity with the machine and breathing discomfort. They could not communicate normally, which resulted in the feeling of annoyance and irritation. As a consequence, this could lead to NIV failure and the usage of IMV.[14]

Social support is another concept that helps enhancing comfort. Social support was defined as comfort intervening used in Kolcaba's comfort model. House (1981) clarified social support as social interactions between healthcare providers and patients which were classified into four types including emotional, information, instrumental, and appraisal support.[15] *Emotional support* involves both verbal and nonverbal communication of caring and concern. It includes listening, empathizing, reassuring and comforting, which can reduce feeling of personal inadequacy by communicating to the patient. *Information support* involves the provision of information used to guide or advise. Information may enhance perceptions of control by providing patients with ways of managing their illness and coping with symptoms. It also can help the patient understand causes of illness and course of treatment. *Instrumental support* involves the material goods or assistance with medical equipment. This kind of support provides tangible resources that the patient can use to exert control their experience. *Appraisal support* involves the

feedback and affirmation that could help the patient feel more encouraged and empowered.

Nurses and physicians are essential supporters for the hospitalized patients especially those with NIV. They provide 24-hour direct care and promote comfort on the patients. With their collaboration with the patients, it could influence the success of NIV.[16] As such, it appeared that patients were more interested in knowing how the NIV machine worked and the likely duration of the intervention or any other alternative intervention if available. These needs calls for informational support. Pinthong found that patients who used NIV need emotional, instrumental and informational support to manage their symptoms and to synchronize their breathing with the device resulting in lessening the feeling of discomfort by helping themselves.[13] They sought help from the medical team and wanted information about their condition and future. If a patient's need for support is not acknowledged, this may lead to the patient feeling uncomfortable.[17] Therefore, comfort in acute respiratory patient who received NIV had been influenced in every context by many factors. Understanding these factors could help the healthcare provider manage comfort for the patient more effectively. However, the number and scope of studies focusing on comfort in NIV patients are relatively scarce. Therefore, this study aimed to determine relationships between comfort with pain, anxiety, and social support in acute respiratory failure patients with NIV support. Results of this study could be useful to guide healthcare providers in promoting comfort in acute respiratory patient who received NIV and also elevating quality of care in clinical practice.

Methods

In this descriptive correlational research, a sample was composed of Thai adult patients who were diagnosed with acute respiratory failure and were admitted in the Cardiac Care Unit and Medicine Intensive Care Unit of a private hospital located in Pattaya, Chonburi province from April to June 2018. The inclusion criteria of the participants were 1) 20 years of age or older, 2) undergoing NIV for more than 48 hours and successful in weaning off NIV, 3) being hemodynamically stable, 4) being fully conscious 5) being able to communicate in Thai, and 6) agreeing to be interviewed.

The sample size of this study was calculated with a level of significance (α) of 0.05 and a power of the test of 80%. According to Burns and Grove[18], 52.7% of nursing research had an effect size that equals to 0.30 and there have been no studies similar to the present study, the use of a small effect size for sample size justification was supported. With the small effect size of 0.3 and a one-tailed test, a total of 67 subjects were needed. Sample size calculation was based on G* Power 3.1 software program.

Research instruments

Data collection was done using a set of questionnaires as follows. The **first part** collected participant's demographic and clinical history information from medical records by the researcher. The abstracted information included age, gender, marital status, education level, underlying disease, causes of acute respiratory failure, experience of non-invasive ventilator support, medications and any other treatments. **Part two** of the questionnaire assessed the participant's pain using the Numerical Rating Scale for Pain developed by Melzack and Katz.[19] The Thai version of the Numerical Rating Scale for Pain was tested in the study of Pianbanyat and Choowattanapakorn.[20] Based on 26 hospitalized patients with lung cancer completing the questionnaire, test-retest reliability was high with a Pearson's product moment correlation coefficient of 0.88.[20] In our present study, a high test-retest reliability was found with coefficient of 0.85. Using this pain questionnaire, the respondents were asked to rate their pain on a visual analogue scale (VAS) of 0 (no pain) to 10 (very painful) to best reflect the intensity of their pain. Ten is the highest score possible. The score of pain from the VAS was categorized into mild, moderate and severe pain (0 – 3, 4 – 6, and 7 – 10 points, respectively).[21]

In **part three**, the participant's comfort was measured by the Comfort Scale questionnaire for acute respiratory failure patients with non-invasive ventilator support. From its original version of Kolcaba[8,9], it was back-translated into Thai and tested for psychometric properties by Khamwong where a high internal consistency reliability was found with a Cronbach's alpha coefficient of 0.90.[22,] We modified the scale from Khamwong's work to fit the population of this study. The modified scale was examined for content validity by three experts. Later it was tested on a small number of individuals with characteristics comparable to the study sample and found to have a high internal consistency reliability with a Cronbach's alpha coefficient of 0.97. This comfort scale contains 24 questions comprising four contexts or domains of comfort. The

question in the first domain, i.e., physical comfort, was, for example, "my condition with NIV gets me down." In the second domain, i.e., psychospiritual comfort, a question of "I felt confident with the treatment" was an example. In the third domain, i.e., environmental comfort, an example question was "my room made me feel safe." Last, in the sociocultural comfort, a question of "I need to be better informed about my health and my condition" is an example. A 6-point Likert-type rating scale was used in the questionnaire starting from 1 for "absolutely disagreed" to 6 for "absolutely agreed" where score of negative statements were reversed. As a result, a total score ranged from 24 to 144 which could be categorized into low, moderate and high levels of comfort (24 – 64, 65 – 105, and 106 - 144 points, respectively).[23]

The fourth part of the questionnaire contained the Thai Hospital Anxiety and Depression Scale (Thai HADS) which was translated and tested by Nilchaikovit[24] from the original HADS questionnaire developed by Zigmond and Snaith.[25] The Thai HADS is a standardized questionnaire which has been used in many Thai populations. The Thai HADS has a high in internal consistency reliability with a Cronbach's alpha coefficient of 0.86. The Thai HADS is a self-reported rating scale of 14 items on a 4-point Likert-type scale ranging from 0 to 3. It was designed to measure anxiety and depression (7 items for each subscale). The possible total score of the whole scale is 0 - 42 points while that of each subscale is 0 – 21. Since this study focused on the anxiety aspect; only the seven items of anxiety subscale was included in the questionnaire and psychometrically tested in 10 individuals with characteristics comparable to the study sample. We found a high internal consistency reliability (Cronbach's alpha coefficient of 0.82) of the seven items of the Thai HADS. Based on the possible total score of 0 – 21 points, three levels of anxiety were categorized as mild, moderate and severe (0 – 7, 8 – 10, and 11 - 21 points, respectively).[23]

In the **fifth part** of the questionnaire, the Social Support scale for acute respiratory failure patients with NIV support was included. In this study, we modified the social support questionnaire of Polchaiyo[26] which was developed from House's social support theory (1981).[15] Based on the work of Polchaiyo, this support social had a high internal consistency reliability (Cronbach's alpha coefficient of 0.88). In our study, we modified instrument and had three experts validate its modified content. We further psychometrically tested the modified social support scale with 10 individual with characteristics comparable to the study sample. The modified social support scale had a high internal consistency reliability (Cronbach's alpha coefficient of 0.92). The questionnaire had 18 positive questions consisting of four contexts specifically emotional concern, instrumental aid, information and appraisal. With a four-point rating scale ranging from absolutely not perceiving social support at all (0 point) to the most perceiving social support (3 points), the possible total score ranged from 0 to 54 which could be categorized into poor, moderate and strong support (0 – 18, 19 – 37, and 38 - 54 points, respectively).[23]

Human right protection

This research study was approved by the Human Research Ethics Committee, Faculty of Nursing, Burapha University, Chonburi province (Approval number: 06-01-2561; Approval date: March 12, 2018). The researcher informed the participants about voluntary nature, objectives and procedures of the research. They were also notified that they had the right to withdraw at any time with no negative consequence on the healthcare service rendered for them. They were asked to voluntarily provide the waiver informed consent. Once the consent was obtained, data collection was conducted. All data were kept in a secure and confidential manner. Only Summary Statistics, not individual participants information, were presented in research report and article.

Data collection procedures

After obtaining permission from the Hospital director, the researcher visited the Cardiac Care Unit and Medicine Intensive Care Unit and explained the data collection procedures to the head nurse and nursing staff. The researcher recruited participants according to the inclusion criteria. The protection of human rights was performed then the participants were interviewed using the questionnaire. During the interview, the researcher continuously assessed individual participants to verify if any unpleasant symptoms or discomfort. Medical attention was planned for those in need. One to two participants were interviewed daily, and 67 participants were successfully recruited as planned.

Statistical Analysis

Results were presented with descriptive statistics including mean with standard deviation and frequency with percentage. Correlations between study variables were tested with

Pearson's product moment correlation analysis. Normal distributions of scores of pain, anxiety, social support and comfort was tested and confirmed with histogram, scatter plot, and Kolmogorov-Smirnov (*P*-value > 0.05 with two-sided tests with α of 5%). In addition, the assumptions of Pearson's product moment correlation were met which included distribution normality, interval-level measurement of all study variables and liner relationships among study variables.

Results

The majority of 67 participants were men (71.6%). Most of the participants were in their 60 years or older with an average age of 64.19 years old (*SD* = 13.84). It was found that 86.6% of them were married and 50.7% had a high school education. In terms of their past medical history, 67.2% had an underlying disease, 23.8% had coronary artery disease and 22.4% had chronic obstructive pulmonary disease. Regarding respiratory failure, 61.2% of them had respiratory failure as a result of non-invasive ventilator support and 94% had never had a non-invasive ventilator experience (Table 1).

Table 1 Demographic and clinical status characteristics of acute respiratory failure patients with non-invasive ventilator support (N = 67).

Characteristics	N (%)
Gender	
Male	48 (71.6)
Female	19 (28.4)
Age (Years)	
30-39	5 (7.5)
40-49	2 (3.0)
50-59	12 (17.9)
60-69	25 (37.3)
70-79	14 (20.9)
≥ 80	9 (13.4)
Mean = 64.19; SD = 13.84; Median = 65; Min = 33, Max = 91	
Information	N (%)
Marital Status	
Single	7 (10.4)
Married	58 (86.8)
Divorce/Separated	2 (3.0)
Educational Level	
No education	2 (3.0)
Primary education	4 (6.0)
High school	34 (50.7)
Bachelor's degree	27 (40.3)
Underlying Disease	
No underlying disease	22 (32.8)
Hypertension	3 (4.5)
Diabetes	3 (4.5)
Coronary artery disease	16 (23.8)
Chronic Kidney Diseases	6 (9.0)
COPD	15 (22.4)
Other	2 (3.0)
Cause of non-invasive ventilator support	
Respiratory system failure	41 (61.2)
Circulatory system failure	20 (29.8)
Kidney failure	6 (9.0)
Experience of NIV usage	
Never	63 (94.0)
1 time	3 (4.5)
2 times	1 (1.5)

In terms of behavioral measures, these participants had a moderate level of comfort (mean = 99.85 ± 15.72 points; range of 65 – 120 points), high level of pain (mean = 10.33 ± 1.95 points), and high level of anxiety (mean = 8.16 ± 0.62 points) (Table 2). More importantly, the participants had a high perceived social support (mean = 47.55 ± 8.92).

Once correlations among study variables were tested, it was found that pain had a moderate negative relationship with comfort with statistical significance (*r* = -0.410, *P*-value = 0.001) among acute respiratory failure patients with non-invasive support. Similarly, strong negative relationship between comfort and anxiety was found with statistical significance (*r* = -0.901, *P*-value < 0.001) (Table 3). On the other hand, social support had a strong positive relationship with comfort (*r* = -0.893, *P*-value < 0.001).

Table 2 Scores of comforts, pain, anxiety and social support in acute respiratory failure patients with non-invasive support (N = 67).

Characteristics	Possible Score	Actual Score	Mean ± SD	Level	Correlation*	
					r	*P*-value
Comfort	24 – 144	65 – 120	99.85 ± 5.72	Moderate		
Pain	0 – 10	7 – 10	8.16 ± 0.62	High	-0.410	0.001
Anxiety	0 – 21	8 – 15	10.33 ± 1.95	High	-0.901	< 0.001
Social support	0 – 54	25 – 54	47.55 ± 8.92	High	0.893	< 0.001

* Pearson's product moment correlation coefficient between comfort and pain, anxiety, and social support.

Discussions and Conclusion

In this survey study on 67 patients with acute respiratory failure undertaking non-invasive support, the patients reported they had moderate level of comfort. In Kolcaba's comfort theory[8,9], four contexts of comfort (physical, psychospiritual, environmental, and social) affected each other. In physical context, patients with acute respiratory failure, lung disease is a pathological condition. Insufficient oxygenation and/or congestion of carbon dioxide will happen from failure of gas exchange.[27] These patients have difficulty breathing, and fatigue from more workload of breathing. This affects comfort in the

physical context and leads to mental distress, including anxiety about uncertainty and possibly resulting in death (psychospiritual context).[14] In the study of Carron and colleagues, 50% of patients with NIV support experienced discomfort from NIV pressure.[10]

Our present study showed that most of the patients (71.6%) were elderly and 68.2% of them had underlying disease, especially cardiovascular disease (23.8%) and chronic obstructive pulmonary disease (22.4%)[28]. It is possible that elderly patients with chronic diseases have adjusted themselves for chronic illness for a period of time so the patients are able to adjust and receive this therapy.[29] Although the NIV affected their comfort, the patients realized and understood the reasons and benefit of this treatment. Their respiratory distress has been relieved and they feel better. This fact may result in a moderate level of comfort in this study.

Results of our study showed that **pain** had a significantly moderate negative relationship with **comfort** among acute respiratory failure patients with non-invasive support (r = -0.41, P-value = 0.001). This could be explained that in acute respiratory failure patients with an NIV, the patients have to wear mask that connects to the ventilator which has air pressure and oxygen. The mask puts direct pressure on the patients' face which causes discomfort and pain. The results of this study showed that all of the participants had a high level of perceived pain (mean = 8.16 $\pm$ 0.62 points) which caused discomfort or lowered comfort level. According to Kolcaba's comfort theory, comfort of the physical context is one of the factors that affect the perception of the person's comfort, in which pain is a physical factor associated with reduced comfort.[8,9] In accordance with the study of Rocha and Carneiro, patients who wore NIV mask had discomfort from the mask pressing on their face.[30] Gay also found that 50% of patients had discomfort from pain while wearing a mask of a NIV type because the mask pressed on the face.[11] Those results were similar to ours.

In addition, the results of this study were similar to another previous study conducted by Chaiyawadee and colleagues.[31] They studied the experience of 12 adolescent patients who received ventilator by means of interview and found that the patients reported they suffered from excruciating pain from being disturbed and body stimulation during respirator insertion. This very much disrupted the patient's comfort.

In terms of **relationship between comfort and anxiety**, a significant, negative correlation between the two measures was found among acute respiratory failure patients with a non-invasive support (r = -0.901, P-value < 0.001). Acute respiratory failure is a critical illness which must be treated urgently and requires hospitalization in a critically care unit.[32] We found that 94% of the participants had never known or never seen NIV before. They did not have any experience about this machine. Pinthong and co-workers found that acute respiratory failure patients with an NIV faced anxiety from uncertainty and not knowing about treatment plan.[13] These patients had never experienced or been treated this way before. This affected their psycho-spiritual comfort, which had an effect on the perception of the patient's comfort.[8,9]. Furthermore, in the study of Christensen and colleagues, they interviewed 15 patients with NIV support and found that all of the patients were concerned about their unpredictable change of symptoms.[33] They had never heard of this type of ventilator before and wanted to know how to deal with their symptoms. They could not predict if their symptoms would improve or not. All of these uncertainties related to anxiety which could further had a strong effect on the comfort in these patients.

The relationship between comfort and social support was strongly and significantly positive with comfort among acute respiratory failure patients with a non-invasive support (r = 0.893, P-value < 0.001). According to Kolcaba's theory[8,9], comfort is the feeling of being relaxed (calm) that occurs when a person is well-respected and their needs were responded. Providing treatment and nursing care were considered responses from physicians and nurses to encourage patients' comfort, which could also be considered a social support. A study of Pinthong and colleagues found that the patients had discomfort while they used NIV.[13] They also found that the patient tried to manage their discomfort and had effort to synchronize with the NIV. The information that they received from the nurses and physicians about the disease and the treatment plan helped the patient to realize about the importance of the NIV. Patients will try to maintain their ability to care for themselves, including daily activities as measured by the Activity of Daily Living. In addition, getting help from physicians and nurses made the patient feel certain, safe, relaxed and more comfortable.

Results of this study revealed that acute respiratory patients with NIV perceived a high level of social support from health care team. According to House (1981), social supports the patients received could be classified as emotional, information, instrument and appraisal support.[15] There is a bedside nursing care system in critical care setting to provide professional help and support, as well as to provide consultation to the patient. This made the patient felt ensure while they were hospitalized and did not feel alone (Emotional support). The physician and nurse would provide patients with information about the reason and benefit of this therapy, some possible complications that may be encountered and update on the progress of the condition (Information support). In additional, the bedside nurse would assist in the provision of treatment facilities including bed position adjustment, mask position adjustment, and board or paper for communication while using NIV (Instrument support). Eventually, the nurse and physician would give time for the patients to express their feelings or opinions and to engage in treatment planning. At the same time, the patients were also encouraged when they were able to breathe with the ventilator effectively (Appraisal support).

From the supports mentioned above, patients with acute respiratory failure with NIV acknowledged that they had received support and care from the healthcare team in the four aspects of social support resulting in a positive correlation between the two concepts. The patients had been promoted through all the contexts of comfort, including physical, psycho-spiritual, environmental and sociocultural comfort. According to the findings of the present study, this Kolcaba's comfort theory concept was proven.[8,9]

In conclusion, our study found that the patients' comfort level was moderate during the NIV use. Pain, anxiety, social support had relationships with comfort. Individuals who had acute respiratory failure with NIV support reported that they had a moderate level of comfort, high level of pain, high level of anxiety, and high level of social support. There were relationships between comfort and pain, anxiety and social support. Findings from this study were strong evidences and beneficial to clinical practice. Transferring research findings to improve quality care for individuals who had acute respiratory failure with NIV support are needed. The healthcare team should perform a regular assessment on the patient's comfort, pain and anxiety. Nursing care should be planned to aim at providing the patient comfort in NIV support period. The researcher also recommended that there is an urgent need for training the nurse on pain and anxiety management in order to help the patient better control their pain and anxiety effectively. There is also a need to provide information about NIV use, patient's condition, and treatment plan. Family visiting time should be more flexible. Continuous evaluation of effectiveness of nursing care on maintaining the comfort is highly recommended.

This study was with some limitations. The study was not planned to evaluate the family support. Future research should focus more on family support for individuals who had acute respiratory failure with NIV support. In addition, development of nursing intervention or nursing guidelines to focus on pain and anxiety management to promote comfort among this acute illness population is recommended.

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