

ICU Delirium: A concept analysis

Lian-Lian Tang^{1*}

¹MSn, Department of nursing management, The First Hospital of Qinhuangdao, Qinhuangdao, China.

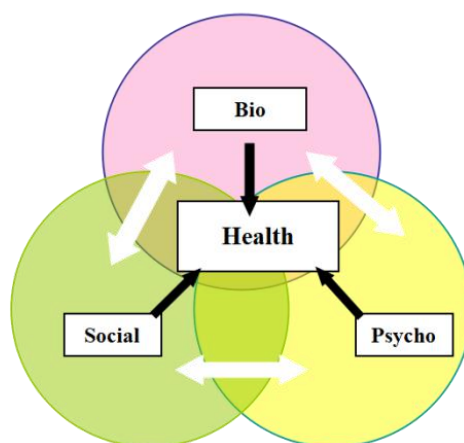
***Correspondence to:** Lian-Lian Tang, Department of Nursing Management, The First Hospital of Qinhuangdao, No.258, Wenhua Road, Haigang District, Qinhuangdao, China. Email: 44452020@qq.com Tel: 0086-13784496420

Highlights

This study identified the attributes of ICU delirium emerged from a number of literature: acute cognitive impairment, acute disturbance of consciousness, fluctuating inattention, and developed for a short period of time. The presentation of a model case and a contrary case has shown the differences related to attributes between effective or invalid ICU delirium.

Editor's Summary

Though a growing number of research publications made great contributions to understand ICU delirium, serious under-recognized issues still remain in healthcare providers globally. This study carry out an assessment, a professional judgment, and a concept analysis of ICU delirium.



Citation: Tang LL. ICU Delirium: A concept analysis. TMR Integrative Nursing, TMR Integrative Nursing, 2018; 2(1):18-26.

DOI: 10.12032/TMRIN20180310

Submitted: 13 February 2018, **Accepted:** 13 February 2018, **Online:** 7 March 2018.



Abstract

Objective: To explore and analyze the concept of intensive care unit (ICU) delirium. **Method:** Walker and Avant's strategy of analysis was adopted to this research. **Results:** ICU delirium is defined as the presence of an acute cognitive impairment, accompanied by a disturbance of consciousness with fluctuating inattention, and the array of dysfunctions only developed for a short period of time in ICU. The antecedents of ICU delirium include (1) the high severity of illness, (2) pain, (3) sedative use, (4) immobilization, (5) sleep deprivation and (6) unpleasant awareness. The consequences involve (1) promoting the risks of self-extubation and unplanned removal of catheters, (2) prolonging the length of ICU stay, (3) increasing the mortality of critical patients and (4) Some different ICU delirium assessment instruments are gathered. Confusion Assessment Method for Intensive Care Unit assessment tool (CAM-ICU) was the most popular diagnostic tool used by nurses. **Conclusion:** Concept analysis as an extension and development of nursing theory can create a linkage between practice and theory. It will create a knowledge foundation of ICU delirium and provide a theoretical basis to construct nursing theory. This study can help ICU nurses to understand and recognize ICU delirium. ICU nurses will be enlightened to develop effective interventions of ICU delirium to improve critical patients' clinical outcomes.

Key words: Delirium, ICU, Intensive Care, Concept analysis

摘要

目的: 探索和明析 ICU 谵妄的概念, 为 ICU 医护人员正确认识和理解 ICU 谵妄提供知识基础, 为构建护理理论创造理论基础。

方法: 本文采用 Walker 和 Avant 的分析步骤对 ICU 谵妄进行概念分析。

结果: ICU 谵妄的定义为患者突然发生的认知障碍和急性的意识混乱、并伴有注意力不集中的一系列异常症状, 一般异常症状仅持续几个小时或几天即可恢复正常。ICU 谵妄的前置因子包括危重的疾病、疼痛、镇静药的使用、约束制动、睡眠剥夺和患者的不良情绪。后果包括增加了非计划拔管的风险、延长了 ICU 住院时间、增加了危重患者的死亡率、加重了患者家属和看护者的焦虑。ICU 谵妄相关的评估和诊断量表较多, 其中 CAM-ICU 和 ICDSC 用法简便, 使用广泛。

结论: 概念分析作为护理理论的延伸和发展, 将护理理论和实践紧密地联系起来。本研究将有利于 ICU 医护人员在实践中正确地理解和认识 ICU 谵妄, 促进有效的谵妄干预措施的形成, 从而改善重症患者的预后。

关键词: 谵妄; ICU; 重症监护; 概念分析

Abbreviations: ICU, Intensive care unit; CAM, Confusion Assessment Method.

Competing interests: The author declares that there is no conflict of interests regarding the publication of this paper.

Copyright: © 2018 TMR Publishing Group. This is an open access article distributed under the terms of the Creative Commons Attribution Non Commercial license.

Executive Editor: Jing Liang



Introduction

The term of “Delirium” has been used for almost 2000 years. “Delirium” is originally derived from Latin meaning “to be off the track” or “to go wrong” [1-2]. It was first used by Aulus Cornelius Celsus, who was a great medical writer lived in 25 BC to 50 BC approximately, to describe mental disorders [1]. A series of other terms were used by Celsus and Hippocrates, the father of traditional medicine, to name the clinical syndrome which is called “delirium” today such as *leros*, *paraleros*, *mania*, *paraphrosyne*, etc. [3]. However, most of them have missed their original meaning and only very few survived to be used for describing other mental disorders [1]. When time entered in the 20th century, delirium began to correlate with cognitive disorders [4]. Then another word - “onfusion” that was initially utilized to describe cognition impairment became a synonym of delirium and more favored by neurologists [1, 5].

During the last two decades, with a high increase of critical care utilization, the occurrence of intensive care unit (ICU) delirium became more and more common and serious. The incidence of ICU delirium was reported varying from 32 to 87% [6-9] and among mechanically ventilated patients the figure can reach up to 80% [10-13]. As its high prevalence, the amount of studies on ICU delirium showed a dramatically rising trend and a number of different terms appeared to define this syndrome such as ICU syndrome, ICU psychosis, acute confusional state, encephalopathy, acute brain failure etc [14-16].

Though a growing number of research publications made great contributions to understand ICU delirium, serious under-recognized issues still remain in healthcare providers globally [17-19]. Moreover, many adverse outcomes resulted by ICU delirium have been recognized [20-22]. Related cost of treatment on it is up to \$16 billion in the USA alone annually [23]. As a result, it is viewed as a significant public health issue [24]. Therefore, it is necessary to carry out an assessment, a professional judgment, and a concept analysis of ICU delirium, which can provide a good guidance for both research and clinical practice.

Methods

This research adopted the strategies of Walker and Avant’s framework for concept analysis [25]. Eight steps will be followed: (1) select a concept of interest; (2) determine the aim of the analysis; (3) review the literature to define the attributes of the concept; (4) combine the practice with theory to construct a model case and a contrary case in nursing; (5) identify the antecedents and (6) consequences of the concept from the literature; (7) define empirical referents; (8) describe a theoretical lens to embed the concept in a middle range theory.

Results

Defining attributes

The attributes of ICU delirium emerged from a number of literature: acute cognitive impairment, acute disturbance of consciousness, fluctuating inattention, and developed for a short period of time.

The first attribute is acute cognitive impairment. The cognitive disorder was included in the concept of delirium original in the 20th century [1]. The cognitive impairment in ICU delirium patients demonstrates four characters including memory impairment, disorientation, disorganized thinking, and perceptual disturbances suddenly. Firstly, the feature of memory impairment is the patients unable to recall what has happened or what has been said at the time of hospitalization [26]. Secondly, disorientation is that the patients are disoriented in both location and time, for example they think he/she is at somewhere other than hospital; or misjudge the time; or use the bed not theirs [26]. Furthermore, the thought of patient with delirium is disorganized or illogical and they are unable to make a coherent conversation with others. Their ideas are rambling and changed too frequently to follow [26]. This symptom can be diagnosed by testing the patient some simple logical questions such as “will the stone float on water?” or “will the leaves float sink in water?”. The patient often answers wrongly [26]. In addition, perceptual disturbances include hallucination, illusion or misinterpretations. The patient may think some static things were moving [26] or say they see something that was not exist there at all. Several studies revealed that the survivors from ICU delirium can recall fewer factual memories but more delusive content than non-delirious patients’ [27].

The second attribute is the acute disturbance of consciousness including an array of altered levels of consciousness ranging from lethargy, restlessness, agitation to combative behavior [28-29]. ICU delirium can be categorized into three subtypes as hypoactive, hyperactive and mixed-type according to the level of consciousness [28, 30]. Hypoactive style, also named psychomotor agitation, shows increased level of motor activity. This kind of patients has the signs of restless, tapping fingers, picking at bedclothes, or making non-purposeful movements frequently or fighting with the ventilator, even pulling or removing tubes, aggressive, violent, and immediate combative to the bedside staff [26]. Conversely, hyperactive style, called psychomotor retardation, shows decreased level of motor activity. The patients are often in the state of sluggishness, staring into space, staying at one particular posture for a while, or moving very slowly. Among of these three subtypes above, mixed subtype is the most common style in ICU delirium patients, hypoactive subtype ranks the second, while the hyperactive subgroup was most likely to happen unplanned extubation [30-31].

The third attribute is fluctuating inattention which means that the patient has difficulty to focus attention on something at some time. This symptom is characterized by being distractible easily or with difficulty in tracking what was being said [26]. The severity of this abnormal behavior is fluctuated in the onset process, with the unpredictable coming and going or increasing and



decreasing.

The fourth attribute is symptom developed for a short period of time that varies from hours to days. This is the main feature that differs from dementia, while the cognitive impairment of dementia is insidious and irreversible [32]. On the other hand, delirium may fluctuate and the levels of its seriousness can increase or decrease. Sakuramoto and colleagues conducted an observational study in a Japanese tertiary-care hospital and revealed that the median delirium duration was 1.0 day [33]. The research organized by van den Boogaard et al. in Netherlands reported that the median onset time of ICU delirium was 2.0 days [34]. In the research carried out by Abraham, et al. in United States found that the average delirium duration was 0.51 ± 1.1 days [35]. Though different studies obtain different figures, the same conclusion can be drawn is that ICU delirium just exists for a short period of time.

Definitions

Based on the preceding analysis, ICU delirium is defined as the presence of an acute cognitive impairment, accompanied by a disturbance of consciousness with fluctuating inattention, development over a short period of time in ICU.

Model case

A 58-year-old woman underwent endotracheal intubation and mechanical ventilation for 5 days in ICU. In the period of ventilation, she experienced sedation and analgesia. In the 6th day, the doctor assessed that she had the ability to breathe by herself and wean from the ventilation, but she needed to be observed in ICU for some time. After withdrew the endotracheal intubation, she was completely conscious and could communicate with nurse normally. At night of the 7th day in ICU, also the second day after removed the intubation, she appeared restless and agitated. She was oriented only to herself, and could not follow simple commands. The nurse gave her a little sedative, but it seemed useless. In the afternoon, her daughter came to see her. She could make some communication with her daughter but often showed inattention. By the evening of ICU day 8, the patient remained disoriented, she said she was in the toilet and defecated on the bed. She was agitated, confused, and combative. She performed the belligerent behavior and attempted to strike staff at her bedside. By 9 AM the following day, the patient was sitting in a bedside chair, reading a newspaper, and enjoying breakfast. Her mood was much improved, and she was oriented to person, place, year, and purpose of ICU admission. She was transferred out of the ICU in that afternoon.

Contrary case

Alexis was a pregnant patient with pregnancy hypertension syndrome. After cesarean delivery, she was transferred to ICU because of high blood pressure and the requirement for ventilator. She was conscious and much cooperated with treatment. She could answer nurse's question with nodding or shaking her hand. She could use

the pen to write her demand. The next day, her situation greatly improved. The doctor removed her endotracheal intubation. After that, she said thanks to the nurse and talk about her baby with them. One day later she was transferred to the general ward.

Antecedents

The antecedents of ICU delirium are the high severity of illness, pain, sedative use, immobilization, sleep deprivation and unpleasant awareness.

High severity of illness has been identified as an antecedent for the development of ICU delirium by some studies [6, 36-37]. The serious illness condition including atrial fibrillation, longer surgery time and serious electrolyte disturbance are all proved to be independent predictors of ICU delirium [38]. Moreover, mechanically ventilated patients showed a higher incidence of delirium compared with non-ventilated patients [38].

The second antecedent is pain. The pain was experienced by most critically ill patients during the time of ICU stay [39]. Nearly 50% ICU patients experienced significant pain [40]. Pandharipande, et al. and Ouimet, et al. investigated that the pain was associated with delirium positively [6, 41]. Pain is not only adding effects on the cognition, also causes agitation frequently. Moreover, some unclearly identified pain is one main reason of inappropriate sedative administration which is also another crucial cause of ICU delirium.

Sedative use has been recognized as a crucial cause of ICU delirium [42]. An observational research conducted by Ouimet, et al. found that there was a positive relationship between the development of delirium and sedative choice or sedative-induced coma [6]. Medication-induced coma is proved to be a certain and high risk factor for ICU delirium [6, 34, 43-44]. Benzodiazepines, narcotics, and some other psychoactive drugs have been proved to increase threefold to eleven-fold risk for the occurrence of ICU delirium [45-46]. Additionally, the amount and rate of adding sedative medications make the risk of delirium rise by four to ten times [45-46].

Immobility has been substantiated as an independent risk factor for the occurrence of ICU delirium [43, 47]. Hopkins, et al. examined physical exercise can improve neuropsychiatric outcomes for the post-intensive care unit patients [48]. Schweickert, et al. conducted a randomized controlled trial to verify that early performance of physical therapy could improve the delirium condition significantly [49]. The result showed that implementing passive exercises to unresponsive patients in ICU reduced the incidence of delirium by 21% and the duration of delirium by 2 days. Meanwhile, active physical practice given to interactive patients lowered the incidence by 53% and the duration by 4 days [49].

The occurrence of delirium has a great relationship with sleep deprivation [38, 50]. Poor quality of sleep was a common experience for critically ill patients in ICU [51-52]. Kerr and his colleagues investigated the sleep quality in ICU and found that sleep disorders and sleep deprivation are common and substantial problems in ICU



[53]. Patients' sleep was interrupted frequently by continuous machine alarms, lights, mechanical ventilator dyssynchrony, and medical operation. Studies demonstrated that the poor quality of sleep was significantly related to delirium occurrence in ICU [50]. Mattoo and his partners found that 80% of the delirium patients experienced moderate or severe sleep disorders and the elderly patients had a higher incidence [54]. In a recent study on sleep quality improvement in medical ICU involving both non-pharmacologic and pharmacologic sleep-promoting interventions, the incident delirium after sleep-promotion reduced by 20% with the shorter delirium duration [55].

Furthermore, unpleasant awareness was attested to be an important antecedent for delirium [56]. The closed environment in ICU reduces the patients' communication with families, which results them in an isolated feeling. Endotracheal intubation makes the patient lose the ability to talk and the nurses increase the use of physical constraint, which can lead the patients to feel frustrated [56]. Serious disease, separation from families, receiving assorted treatment and catheters on body often make patients anxiety. These feelings generate unpleasant awareness and further cause them agitated [56]. Inouye with his colleagues conducted a study that required the care team members introducing themselves to patients and take measures to stimulate the patients' cognitive activities three times a day combined with providing visual aids and hearing protocol [57]. After implementing these measures, the incidence of delirium reduced by 40% [57]. A strategy incorporating listening to music and reading newspapers was proved to effectively reduce the incidence of delirium by 13% in an integrated ICU [58]. Hsieh, Ely and Gong suggested that encouraging visitors to ICU might be a useful strategy to reduce the incidence of delirium. So unpleasant awareness is positively associated with ICU delirium [42].

Consequence

ICU delirium is found to enhance the risks of self-extubation and unplanned removal of catheters, prolong the length of ICU stay, and increase the mortality of critical patients. Furthermore, the syndrome of ICU delirium can highly distress the patients' family members and caregivers.

Self-extubation and unplanned removal of catheters are the direct consequences of ICU delirium. The first reason is that they often try to pull the catheters on their bodies out without consciousness. Moreover, agitation and restlessness often result in pipes falling off accidentally. A research designed by Dubois, *et al.* (2001) demonstrated that patients with delirium were more likely to pull the tubes and catheters off than non-delirious patients [59]. A study reported that the incidence of unplanned pulling nasogastric tube off in ICU delirium patients was high to 51% and the endotracheal tube unplanned removal happened up to 28% [17]. It also reported that hyperactive subgroup happened unplanned removal of tubes and catheters most frequently [17].

ICU delirium is identified to be an essential factor to

prolong the length of ICU stay. The patients with delirium often need to be observed and cared more carefully because of their psychotic symptom. Therefore, considering the safety, the patients were often left for further observation in ICU. Moreover, the consciousness disturbance often makes it difficult to remove the ventilation because the patients can not cooperate well to the doctors' examinations and self-breath trials. A review on the studies of ICU delirium indicated that the duration of mechanical ventilation was extended longer than 1 day because of ICU delirium [17]. In the study carried out by Svenningsen and Tønnesen, the patients who were assessed at least one time positive CAM-ICU (Confusion Assessment Method for Intensive Care Unit assessment tool) score stayed in ICU 7 days longer than non-delirium patients [60].

In addition, ICU delirium is recognized to associate with mortality positively. The study conducted by Pisani, *et al.* suggested that for each day experienced delirium by an ICU patient, the six-month and one-year mortality risk would increase by 10% [61]. An international multicenter study demonstrated that ICU delirium was related to higher ICU (20% versus 5.7%) and hospital mortality (24 versus 8.3%) [62].

The patients' acute psychotic symptoms highly distress the families and caregivers. A research to investigate the experience of delirium patients revealed that delirium was an extremely distressing experience for the patient's spouse or caregivers, and the nurses who were taking care of the delirious patients [63].

Empirical referents

There are many instruments for assessing and diagnosing delirium. For ICU area, CAM-ICU (Confusion Assessment Method for Intensive Care Unit) and Intensive care delirium screening checklist are preferred by ICU health professionals due to the high sensitivity, reliability, efficacy, validity and do not require patients communicate verbally [64-66]. These two scales are easy to use by health professionals both with or without psychiatry education, such as ICU nurses [11, 67-69]. CAM-ICU was designed specialized for ICU patients developed from Confusion Assessment Method (CAM) created by Inouye for bedside use to diagnose delirium in general ward [26]. Intensive care delirium screening checklist created on the basis of Diagnostic and Statistical Manual of Mental Disorders-IV can be used by professionals and researchers to screen ICU delirium easily [70-71].

Moreover, there are some other scales to assess and measure ICU delirium from different aspects. The scale of Cognitive Test for Delirium focuses on evaluating the cognitive symptoms in ICU delirium patients only [72-73]. RASS, Motoric items of Delirium Rating Scale, Delirium Rating Scale-Revised-98 and Memorial Delirium Assessment Scale can be used for assessing consciousness and motor symptom [74-77]. Furthermore, there is also a Delirium Experience Questionnaire for examining the distress and anxiety of discharged patients with delirium experience [63].



Biopsychosocial model applied in ICU delirium

Concept analysis is the foundation of nursing theory. Most of the nursing theories generated in the last two decades. Middle range theory can be viewed as an integration of some relevant thoughts focusing on a limited area of nursing practice. These theories consist of some concepts and illustrate the associations between these concepts in the model. Middle range theories rooted and grew in the nursing practice and were developed by the scholarly research. Meanwhile, they also provide guidance for both daily practice and academic research.

Biopsychosocial model is an important middle range theory which was first proposed by Engel [78] who is a psychiatrist. According to Engel, Frankel, Quill and McDaniel, biopsychosocial is an interdisciplinary model which supposes that health is associated with a complicated interaction of biological, psychological, and socio-cultural factors [79-81]. This theory illustrates the mechanisms of disease from biological aspect, physiological aspect, and social aspect respectively and analyze how they interact with each other to influence the disease development. The biological part of the theory mainly refers to that physiological factors were caused by the precipitated pathogens like germs and toxins. The psychological element was defined as mental and behavioral causes like the deficiency in self-control, emotional disorders, and negative awareness. The social component presumes that the social and environmental factors which including economic conditions, culture, technology, religion and so on are all important affecting factors on health. The model assumes that managing health problems needs to explore and handle different dimensional factors together (Figure 1).

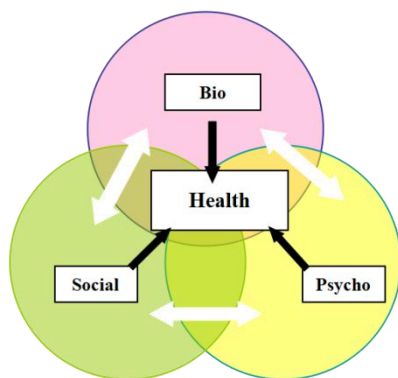


Figure 1 Biopsychosocial model

The concept of ICU delirium can be embedded in biopsychosocial model since it is a health problem which involves biological, psychological and social factors. As the section of antecedents stated, patients' baseline or predisposing physiological factors are the biological

factors. ICU environment, lack of communication and unpleasant awareness are social and psychological factors. These factors influence with each other and result in the complicated disease - ICU delirium happened. Above all, since the occurrence of ICU delirium is due to biopsychosocial factors, the effective prevention or intervention of ICU delirium should involve all of these factors comprehensively.

The biopsychosocial model explained that the failure of the interaction of biological, psychological and social factors could generate a health problem. However, it does not state how the disease influence the patients' physiology, psychology and social contact. Further research should be conducted to develop the theory constantly.

Conclusion

ICU delirium is characterized by an array of serious confusion symptoms that requires to be diagnosed and intervened as early as possible. ICU nurses available 24 hours a day bedside play the foremost role to detect delirium. Therefore, it is necessary for them to understand and recognize ICU delirium. This concept analysis which identified the antecedents, attributes and consequence of ICU delirium can help ICU nurses to create a foundation for knowledge of ICU delirium and provide an integral lens to understand it (Figure 2).

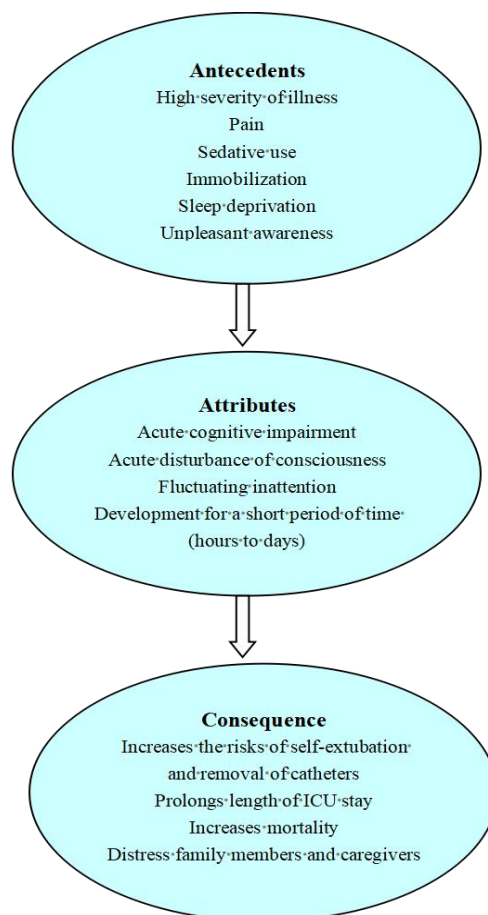


Figure 2 ICU delirium

According to the analysis, ICU delirium that is caused by complex interaction factors can result in many negative consequences for critical ill patients. In order to develop an effective prevention, ICU professional should consider biological, psychological and social factors comprehensively. Therefore, ICU nurses may be enlightened and facilitated by this analysis to develop effectively practical interventions to prevent the occurrence of ICU delirium.

References

- Deksnyte A, Aranauskas R, Budrys V, *et al.* Delirium: its historical evolution and current interpretation. *Eur J Intern Med* 2012, 23:483-486.
- Egerod I. Intensive care delirium: the new black. *Nurs in Critical Care* 2013, 18:164-165.
- Adamis D, Treloar A, Martin FC, *et al.* A brief review of the history of delirium as a mental disorder. *Hist Psychiatry* 2007, 18:459-469.
- Lipowski ZJ. Delirium: how its concept has developed. *Int Psychogeriatr* 1991, 3:115-120.
- Berrios GE. Delirium and confusion in the 19th century: a conceptual history. *Br J Psychiatry* 1981, 139:439-449.
- Ouimet S, Kavanagh BP, Gottfried B, *et al.* Incidence, risk factors and consequences of ICU delirium. *Intensive Care Med* 2007, 33:66-73.
- Vasilevskis EE, Han JH, Hughes CG, *et al.* Epidemiology and risk factors for delirium across hospital settings. *Best Pract. Res. Clin. Anaesthesiol* 2012, 26:277-87.
- Wells LG. Why don't intensive care nurses perform routine delirium assessment? A discussion of the literature. *Aust Crit Care* 2012, 25:157-161.
- Moon KJ, Lee SM. The effects of a tailored intensive care unit delirium prevention protocol: A randomized controlled trial. *Int J Nurs Stud* 2015, 5:1423-1432.
- Limpawattana P, Panitchote A, Tangvoraphonkchai K, *et al.* Delirium in critical care: a study of incidence, prevalence, and associated factors in the tertiary care hospital of older Thai adults. *Aging Ment Health* 2016, 20:74-80.
- Fagundes JADO, Tomasi CD, Giombelli V R, *et al.* CAM-ICU and ICDSC Agreement in Medical and Surgical ICU Patients Is Influenced by Disease Severity. *Plos One* 2012, 7:e51010.
- Sharma A, Malhotra S, Grover S, *et al.* Incidence, prevalence, risk factor and outcome of delirium in intensive care unit: a study from India. *Gen Hosp Psychiatry* 2012, 34:639-646.
- Young J, Inouye SK. Delirium in older people. *BMJ* 2007, 334:842-846.
- Girard TD, Pandharipande PP & ElyEW. Delirium in the intensive care unit. *Critical Care* 2008, 12:43-58.
- Mcguire BE, Basten CJ, Ryan CJ, *et al.* Intensive care unit syndrome: a dangerous misnomer. *Arch Intern Med* 2000, 160:906-909.
- Justic M. Does "ICU psychosis" really exist? *Crit Care Nurse* 2000, 20:38-39.
- Morandi A, Jackson JC and Ely EW. Delirium in the intensive care unit. *Int Rev Psychiatry* 2009, 21:43-58.
- Panitchote A, Tangvoraphonkchai K, Suebsoh N, *et al.* Under-recognition of delirium in older adults by nurses in the intensive care unit setting. *Aging Clin Exp Res* 2015, 27:735-740.
- Forsgren LM. Delirium--awareness, observation and interventions in intensive care units: a national survey of Swedish ICU head nurses. *Intensive Care Nurs* 2010, 26:296-303.
- Ely E W, Shintani A, Truman B, *et al.* Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. *JAMA*, 2004, 291:1753-1762.
- Lin SM, Liu CY, Wang CH, *et al.* The impact of delirium on the survival of mechanically ventilated patients. *Crit Care Med* 2004, 32:2254-2259.
- Thomason JW, Shintani A, Peterson JF, *et al.* Intensive care unit delirium is an independent predictor of longer hospital stay: a prospective analysis of 261 non-ventilated patients. *Critical Care* 2005, 9:R375-381.
- Milbrandt EB, Deppen S, Harrison PL, *et al.* Costs associated with delirium in mechanically ventilated patients. *Crit Care Med* 2004, 32:955-962.
- Daniel F, Yi HY, Susanne HS. An Epidemiologic Analysis of Co-Occurring Alcohol and Drug Use and Disorders. *Alcohol Res* 2006, 29:100-110.
- Walker LO, Avant KC. Strategies for theory construct in nursing (5th ed). New Jersey. Prentice-Hall, 2011.
- Inouye SK, van Dyck CH, Alessi CA, *et al.* Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med* 1990, 113:941-948.
- Svenningsen H, Tønnesen EK, Videbech P, *et al.* Intensive care delirium-effect on memories and health - related quality of life - a follow-up study. *J Clin Nurs* 2014, 23:634-644.
- Lipowski ZJ. Current concepts-geriatrics: Delirium in the elderly patient. *N Engl J Med* 1989, 320:578-82.
- Liptzin B, Levkoff SE. An empirical study of delirium subtypes. *Br J Psychiatry* 1992, 161:843-845.
- Meagher DJ, Trzepacz PT. Motoric subtypes of delirium. *Seminars in clinical neuropsychiatry. Semin Clin Neuropsychiatry* 2000, 5:75-85.
- Morandi A, Brummel NE, Ely EW. Sedation, delirium and mechanical ventilation: the 'ABCDE' approach. *Curr Opin Crit Care* 2011, 17:43-49.
- Meagher DJ. Regular review - Delirium: optimising management. *BMJ (Clinical research ed.)* 2001, 322:144-149.
- Sakuramoto H, Subrina J, Unoki T, *et al.* Severity of delirium in the ICU is associated with short term cognitive impairment. A prospective cohort study.



- Intensive Crit Care Nurs 2015, 31:250-257.
34. van den Boogaard M, Schoonhoven L, van der Hoeven JG, *et al.* Incidence and short-term consequences of delirium in critically ill patients: A prospective observational cohort study. *Int J Nurs Stud* 2012, 49:775-783.
 35. Abraham CM, Obremskey WT, Song Y, *et al.* Hospital delirium and psychological distress at 1 year and health-related quality of life after moderate-to-severe traumatic injury without intracranial hemorrhage. *Arch Phys Med Rehabil* 2014, 95:2382-2389.
 36. Pandharipande P, Shintani A, Peterson J, *et al.* Lorazepam is an independent risk factor for transitioning to delirium in intensive care unit patients. *Anesthesiol* 2006, 104:21-26.
 37. Pisani MA, Murphy TE, Araujo KL, *et al.* Benzodiazepine and opioid use and the duration of intensive care unit delirium in an older population. *Crit Care Med* 2009, 37:177-183.
 38. Zhang WY, Wu WL, Gu JJ, *et al.* Risk factors for postoperative delirium in patients after coronary artery bypass grafting: A prospective cohort study. *J Crit Care* 2015, 30:606-612.
 39. Erstad BL, Puntillo K, Gilbert HC, *et al.* Pain management principles in the critically ill. *Chest* 2009, 135:1075-1086.
 40. Ahlmann M, Walter O, Frank M, *et al.* Impact of systematic evaluation of pain and agitation in an intensive care unit. *Crit Care Med* 2006, 34:1691-1699.
 41. Pandharipande P, Cotton BA, Shintani A, *et al.* Prevalence and risk factors for development of delirium in surgical and trauma ICU patients. *J Trauma* 2008, 65:34-41.
 42. Hsieh SJ, Ely EW, Gong MN. Can intensive care unit delirium be prevented and reduced? Lessons learned and future directions. *Ann Am Thorac Soc* 2013, 10:648-656.
 43. Van Rompaey B, Elseviers MM, Schuurmans MJ, *et al.* Risk factors for delirium in intensive care patients: a prospective cohort study. *Crit Care* 2009, 13:R77.
 44. Ely EW, Girard TD, Shintani AK, *et al.* Apolipoprotein E4 polymorphism as a genetic predisposition to delirium in critically ill patients. *Crit Care Med* 2007, 35:112-117.
 45. Ely EW, Siegel MD, Inouye SK. Delirium in the intensive care unit: an under-recognized syndrome of organ dysfunction. *Seminars in Respiratory & Crit Care Med* 2001, 22:115-126.
 46. Inouye SK, Schlesinger MJ, Lydon TJ. Delirium: a symptom of how hospital care is failing older persons and a window to improve quality of hospital care. *American Journal of Medicine*, 1999, 106:565-573.
 47. Inouye SK, Charpentier PA. Precipitating Factors for Delirium in Hospitalized Elderly Persons: Predictive Model and Interrelationship With Baseline Vulnerability. *JAMA* 1996, 275:852-857.
 48. Hopkins RO, Suchyta MR, Farrer TJ, *et al.* Improving post-intensive care unit neuropsychiatric outcomes: understanding cognitive effects of physical activity. *Am J Respir Crit Care Med* 2012, 186:1220-1228.
 49. Schweickert WD, Pohlman MC, Pohlman AS, *et al.* Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. *Lancet* 2009, 373:1874-1882.
 50. Weinhouse GL, Schwab RJ, Watson PL, *et al.* Bench-to-bedside review: Delirium in ICU patients - importance of sleep deprivation. *Crit Care*, 2009, 13:234.
 51. Cooper AB, Thornley KS, Young GB, *et al.* Sleep in Critically Ill Patients Requiring Mechanical Ventilation. *Chest* 2000, 117:809-18.
 52. Gabor JY, Cooper A B, Crombach SA, *et al.* Contribution of the intensive care unit environment to sleep disruption in mechanically ventilated patients and healthy subjects. *Am J Respir Crit Care Med* 2003, 167:708-715.
 53. Kerr CW, Luczkiewicz DL, Holahan T, *et al.* The use of pentobarbital in cases of severe delirium: a case series. *Am J Hosp Palliat Care* 2014, 31:105-108.
 54. Mattoo SK, Grover S, Chakravarty K, *et al.* Symptom profile and etiology of delirium in a referral population in northern india: factor analysis of the DRS-R98. *J Neuropsychiatry Clin Neurosci* 2012, 24:95-101.
 55. Kamdar BB, King LM, Collop NA, *et al.* The effect of a quality improvement intervention on perceived sleep quality and cognition in a medical ICU. *Crit Care Med* 2013, 41:800-809.
 56. Reade MC, Finfer S. Sedation and delirium in the intensive care unit. *N Engl J Med* 2014, 370:444-454.
 57. Inouye SK, Bogardus Jr ST, Charpentier PA, *et al.* A multicomponent intervention to prevent delirium in hospitalized older patients. *N Engl J Med* 1999, 340:669-676.
 58. Colombo R, Corona A, Praga F, *et al.* A reorientation strategy for reducing delirium in the critically ill. Results of an interventional study. *Minerva Anesthesiol* 2012, 78:1026-1033.
 59. Dubois MJ, Bergeron N, Dumont M, *et al.* Delirium in an intensive care unit: a study of risk factors. *Intensive Care Med* 2001, 27:1297-1304.
 60. Senningsen H, Tønnesen E. Delirium incidents in three Danish intensive care units. *Nursing in Critical Care* 2011, 16:186-192.
 61. Pisani MA, Kong SYJ, Kasl SV, *et al.* Days of Delirium Are Associated with 1-Year Mortality in an Older Intensive Care Unit Population. *Am J Respir Crit Care Med* 2009, 180:1092-1097.
 62. Salluh JJ, Soares M, Teles JM, *et al.* Delirium epidemiology in critical care (DECCA): an international study. *Critical Care* 2010, 14:R210.
 63. Breitbart W, Gibson C, Tremblay A. The delirium



- experience: delirium recall and delirium-related distress in hospitalized patients with cancer, their spouses/caregivers, and their nurses. *Psychosomatics* 2002, 43:183-194.
64. Ely EW, Inouye SK, Bernard GR, *et al.* Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). *JAMA* 2001, 286:2703-2710.
 65. Ely EW, Margolin R, Francis J, *et al.* Evaluation of delirium in critically ill patients: validation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). *Crit Care Med* 2001, 29:1370-1379.
 66. Kose G, Bolu A, Ozdemir L, *et al.* Reliability and Validity of the Intensive Care Delirium Screening Checklist in Turkish. *Inter J Nurs Knowledge* 2015, 27:119-124.
 67. Devlin JW, Fong JJ, Schumaker G, *et al.* Use of a validated delirium assessment tool improves the ability of physicians to identify delirium in medical intensive care unit patients. *Crit Care Med* 2007, 35:2721-2724.
 68. Guenther U, Radtke F M. Delirium in the postanaesthesia period. *Curr Opin Anaesthesiol* 2011, 24:670-675.
 69. Neufeld KJ, Hayat MJ, Coughlin JM, *et al.* Evaluation of two intensive care delirium screening tools for non-critically ill hospitalized patients. *Psychosomatics* 2011, 52:133-140.
 70. Bergeron N, Dubois MJ, Dumont M, *et al.* Intensive Care Delirium Screening Checklist: evaluation of a new screening tool. *Intensive Care Med* 2001, 27:859-864.
 71. Neto AS, Júnior AN, Cardoso SO, *et al.* Delirium screening in critically ill patients: a systematic review and meta-analysis. *Critical Care* 2012, 40:1946-51.
 72. Hart RP, Best AM, Sessler CN, *et al.* Abbreviated cognitive test for delirium. *J Psychosomatic Res* 1997, 43:417-423.
 73. Hart RP, Levenson JL, Sessler CN, *et al.* Validation of a Cognitive Test for Delirium in Medical ICU Patients. *Psychosomatics* 1996, 37:533-46.
 74. Sessler CN, Gosnell MS, Grap MJ, *et al.* The Richmond Agitation-Sedation Scale: validity and reliability in adult intensive care unit patients. *Am J Respir Crit Care Med* 2002, 166:1338-1344.
 75. Trzepacz PT, Baker RW, Greenhouse J. A symptom rating scale for delirium. *Psychiatry Res* 1988, 23:89-97.
 76. Trzepacz PT, Mittal D, Torres R, *et al.* Validation of the Delirium Rating Scale-revised-98: comparison with the delirium rating scale and the cognitive test for delirium. *J Neuropsychiatry Clin Neurosci* 2001, 13:229-42.
 77. Breitbart W, Rosenfeld B, Roth A, *et al.* The Memorial Delirium Assessment Scale. *J Pain Symptom Manage* 1997, 13:128-37.
 78. Engel GL. The need for a new medical model: a challenge for biomedicine. *Sci* 1977, 196:129-136.
 79. Engel GL. The clinical application of the biopsychosocial model. *J Med Philos* 1980, 137:101.
 80. Engel GL. The clinical application of the biopsychosocial model. *J Med Philos* 1981, 6:101-123.
 81. Roy-Byrne PP. The Biopsychosocial Approach: Past, Present, Future. *Jama J the Am Med Assoc* 2004, 291:500.

