Assiut Scientific Nursing Journal
http://asnj.journals.ekb.eg http://www.arabimpactfactor.com
DOI:10.21608/asnj.2025.361988.2020 http://olddrji.lbp.world/indexedJournals.aspx
https://vlibrary.emro.who.int/journals/assiut-scientific-nursing-journal

Incidence and factors predicting delirium among critically ill patients

Rahma Marey Mohamed Mahmoud[1], Ghada Shalaby Khalaf Mahran[2] & Abdelraouf Mohamed Sayed Abdelraouf[3]
[1.] Teacher at Technical Secondary School of Nursing in Assiut, Egypt
[2.] Assistant Professor of Critical Care and Emergency Nursing, Faculty of Nursing, Assiut University, Egypt.
[3.] Lecturer of Anesthesia and Intensive Care Unit, Faculty of Medicine, Assiut University, Egypt.

Abstract:
Background: Critically ill individuals commonly develop delirium due to a variety of factors, recent surgical or invasive interventions, and multiple stressors such as psychological distress, mechanical ventilation, noise, lighting, frequent clinical procedures, and sleep disruption. **Study aim**: To assess the incidence of delirium among critically ill patients and examine potential predictive factors. **Research Design:** A descriptive, exploratory approach. **Setting:** This study was conducted in the intensive care units (ICUs) of Al-Eman General Hospital, Assiut. **Sample:** Ninety-four newly admitted male and female patients in the intensive care units at Al-Eman General Hospital participated in the study. **Tools:** Data collection involved four instruments: a general assessment sheet for critically ill patients, the Intensive Care Delirium Screening Checklist, the Richmond Agitation Sedation Scale, and a set of predictors for delirium among critically ill patients. **Results:** Delirium was observed in 51% of ICU-admitted patients, with highest prevalence among those aged >60 years. Gender distribution was nearly equal among affected patients. Sleep disruption showed a 100% association with delirium onset. Environmental factors also correlated significantly, with delirious patients more frequently exposed to subdued environments ($p<0.01$) and inadequate lighting ($p=0.002$). **Conclusion:** The study demonstrates a high incidence of delirium among ICU admissions. **Recommendations**: Implementation of protocolized delirium screening should be prioritized in critical care units, with particular attention to sleep hygiene and environmental modifications.

Keywords: Critically Ill Patients, Delirium, Incidence & Risk factor.

Introduction:
Delirium is an acute medical emergency with psychiatric manifestations, and it is found in a range of healthcare settings, with a particularly high incidence in intensive care units (ICUs) **(Huang et al., 2024).**

It commonly presents as difficulties with attention, various cognitive impairments, changes in motor functioning, sleep disturbances, and psychotic features **(Mukherjee et al., 2024).**

Other clinical signs can include sudden behavioral changes, memory loss, slurred or incoherent speech, difficulty concentrating, hallucinations, mood or personality shifts, and confusion **(Stewart, 2024).**

In most patients, delirium lasts only a few days, and it can be triggered by infections, certain medications, or disruptions in blood glucose levels **(Grover & Kate et al., 2019; Barr et al., 2013).**

In the critically ill population, delirium often arises due to underlying medical or surgical problems, recent invasive procedures, and exposure to detrimental factors such as psychological stressors, mechanical ventilation, noise, light, frequent patient care interventions, as well as drug-induced sleep disruption or deprivation **(Ekong et al., 2024).**

Multiple factors may increase the risk of ICU delirium, including being older than 65 years, inadequate oxygen levels in the brain, impaired cerebral oxygen utilization, chemical imbalances, certain types of medications (including sedatives or painkillers), alcohol use, and withdrawal from alcohol or nicotine **(Zaher et al., 2024).**

Delirium can take one of three forms: hypoactive, in which individuals feel fatigued, depressed, or move more slowly than usual; hyperactive, featuring restlessness, agitation, or aggression; and mixed delirium, where patients transition between hypoactive and hyperactive states. Some patients may present without any observable motor symptoms **(Tomczyk et al., 2024)**, in which case clinicians refer to delirium without motor symptoms. Across all delirium types, symptoms typically include confusion or disorientation, memory deficits, slurred or incoherent speech, difficulty concentrating, hallucinations, altered sleep patterns, and mood or personality changes **(Wattis & Curran, 2024).**

Early identification of delirium is crucial. ICU nurses should maintain vigilance for its onset and focus on both preventing and managing it **(Arockiam, 2023).** Critically ill adults require regular assessments for delirium using valid screening instruments, alongside predictive models that incorporate known risk factors at ICU admission and over the initial 24 hours of care **(Bhattacharyya et al., 2022).** Rapid detection and

therapy are essential to address potentially modifiable causes of delirium, thereby improving care quality and patient outcomes.

Significance of the study:

Delirium correlates with negative outcomes such as increased mortality, long-term cognitive decline, and the potential for post-traumatic stress. Approximately two-thirds of ICU patients develop delirium, with those on mechanical ventilation at greater risk. In 2015, Alberta reported that 41% of hospitalized adults in ICUs experienced delirium. More broadly, delirium appears in various healthcare environments, affecting an estimated 15–20% of general hospital admissions and up to 80% of critically ill individuals on mechanical ventilation **(Salluh et al., 2015; Zaal et al., 2015).**

Aims of the study:

To assess the incidence of delirium among critically ill patients and examine potential predictive factors

Research question:

- What is the incidence of delirium among critically ill patients?
- Which clinical and environmental factors predict delirium development in critically ill patients?

Patients and Method

Research design:

A descriptive exploratory research design was used to conduct this study which is defined as emphasizes on exploring and understanding the meaning which a person or group of people ascribe to a social or human problem **(Creswell, 2014).**

Setting:

The study was conducted in four intensive care units (general intensive care unit, medical intensive care unit, Cardiac care unit, and neurosurgery intensive care unit) at Al-Eman general Hospital, in Assiut.

Sample:

A Purposeful sample of 94 male and female who were newly admitted critically ill patients from the intensive care units (general intensive care unit, medical intensive care unit, Cardiac care unit, and neurosurgery intensive care unit) At Al-Eman general Hospital, in Assiut.

Sample size: 94 patients**.**

Exclusion criteria

These patients were excluded from the present study :

- Delirium prior to ICU admission
- Addict patient.

Data Collection Tools:

Tool I: critically ill patient's assessment sheet

This tool was created by the researcher after reviewing relevant literature **(Naved et al., 2011; Rafiee et al., 2020; Matteucci et al., 2020).** It consists of two parts:

1. **Demographic and Clinical Information:** This section collects key patient data, including identification code, age, gender, occupation, and educational background. It also documents clinical information such as the patient's current diagnosis, previous medical history, ICU admission and discharge dates, and total duration of ICU stay.
2. **Acute Physiology and Chronic Health Evaluation II (APACHE II) Score:** Based on the frameworks by **Naved et al. (2011)** and **Rafiee et al. (2020),** the APACHE II score comprises three main components:

- **Physiological Assessment:** The largest component evaluates 12 clinical parameters recorded within the first 24 hours of ICU admission. These include body temperature, heart rate, mean arterial pressure, respiratory rate, oxygen levels, arterial pH, serum sodium and potassium levels, serum creatinine, hematocrit, white blood cell count, and the Glasgow Coma Scale.
- **Age Adjustment:** Additional points (ranging from 1 to 6) are assigned based on the patient's age, starting from 44 years and above.
- **Chronic Health Status:** Points are also allocated for chronic and severe organ dysfunctions involving the heart, lungs, kidneys, liver, or immune system. This component reflects the long-term health burden on the patient.
- **Scoring system: The overall APACHE** II score ranges from 0 (indicating minimal severity) to 60 (indicating the highest severity), providing a comprehensive measure of the patient's physiological condition during critical illness.

Tool II: Intensive Care Delirium Screening Checklist

Developed by the researchers after consulting relevant literature **(Neziraj et al., 2011),** this checklist evaluates delirium based on eight items: inattention, disorientation, hallucinations, delusions or psychosis, psychomotor agitation or retardation, inappropriate speech or mood, sleep/wake cycle disturbances, and fluctuations in the above symptoms. Each item is scored as absent (0) or present (1). A total score of 4 or higher indicates the presence of delirium, while 0 indicates an absence of delirium. Scores from 1 to 3 suggest subsyndromal delirium, where some—though not all—delirium features are observable, leading to intermediate outcomes relative to delirium and non-delirium cases.

Tool III: Richmond Agitation Sedation Scale (RASS)

Adapted from **Sessler et al. (2002),** this tool measures a patient's anxiety and agitation levels. It uses a 10-point scale encompassing four levels of agitation or anxiety (+1 to +4, with +4 indicating combative

behavior), a single level for a calm and alert state (0), and five levels of sedation (−1 to −5, where −5 denotes an unarousable condition). The scale is applied in three steps: observing the patient, assessing the response to verbal stimulation, and assessing the response to physical stimulation.

Scoring system :

Agitation Scores:

- **+4:** Combative – Overtly violent; immediate danger to staff.
- **+3:** Very agitated – Pulls or removes tubes; aggressive behavior.
- **+2:** Agitated – Frequent, non-purposeful movement; fights ventilator.
- **+1:** Restless – Anxious or apprehensive but not aggressive.

Calm and Alert:

- **0:** Alert and calm – Awake, aware, and responsive to voice.

Sedation Scores:

- **−1:** Drowsy – Not fully alert, but sustained awakening to voice (eye contact >10 seconds).
- **−2:** Light sedation – Briefly awakens to voice (eye contact <10 seconds).
- **−3:** Moderate sedation – Movement or eye opening to voice but no eye contact.
- **−4:** Deep sedation – No response to voice, but movement or eye opening to physical stimulation.
- **−5:** Unarousable – No response to voice or physical stimulation.

Tool IV: Predictors of delirium among critically ill patients

Formulated by the researchers after reviewing pertinent studies **(Zaal et al., 2015; Park & Lee, 2018; Matteucci et al., 2020).** This tool identifies potential risk factors including underlying health conditions, invasive procedures, psychological stressors, noise, lighting, frequent patient care interactions, sleep disruptions, advanced age (over 65), particular medications (sedatives or painkillers), alcohol use, and withdrawal from alcohol or nicotine.

Methods

1. Planning and Tool Development (March–August 2024): The study idea was generated in early March 2024, accompanied by a thorough literature review, proposal formulation, and construction of the data collection tool, finalized by the end of August 2024.
2. Validity: A panel of five experts—comprising critical care nursing faculty members and critical care physicians from the Faculty of Nursing and Faculty of Medicine at Assiut University—assessed the face validity of the tools. Their feedback on the clarity, relevance, and arrangement of items was incorporated into the final versions.
3. Pilot Study: A pilot study with 10% of the total sample examined the feasibility and comprehensibility of the instruments. Since no major changes were required, these participants were included in the main study.
4. Reliability: The researcher evaluated the internal consistency of each tool using Cronbach's alpha through the SPSS program.

Ethical considerations:

1. The Faculty of Nursing's Ethics Committee at Assiut University approved the research proposal (date: 22/10/2023, number: 1120230696).
2. The study posed no risks to participants.
3. All procedures followed standard ethical guidelines for clinical research.
4. Informed consent was obtained from patients or their guardians after explaining the study's purpose.
5. Anonymity and confidentiality were guaranteed.
6. Patients were free to refuse or withdraw from the study at any time without providing a reason.
7. Privacy was maintained during data collection.

Field work

Data collection took place over a six-month period, starting in early March 2024 and ending in late August 2024. The researcher gathered information daily from patient admission until discharge. Official permission was obtained from the director of Al-Eman General Hospital in Assiut after clarifying the study's objectives. The assessment procedure involved:

- Using Tool I to record demographic details and calculate APACHE II scores,
- Implementing Tool II (Intensive Care Delirium Screening Checklist),
- Administering Tool III (RASS) to measure anxiety and agitation, and
- Reviewing Tool IV to identify predictors of delirium.

Statistical analysis:

Data were sorted and coded, then arranged in dedicated charts for each patient. SPSS version 26 was utilized for data analysis. Results were expressed in tables and figures using frequencies, percentages, means, and standard deviations. Pearson's test was employed to investigate relationships between qualitative variables. Significance was established as follows:

- $p > 0.05$ = Not significant
- $p < 0.05$ = Significant
- $p < 0.01$ = Highly significant

Results:

Table (1): Percentage distribution of studied patients regarding their demographic data (n=94).

Sociodemographic		Frequency	Percent
Age grouping	< 18 yrs	4	4.3
	18 - < 30 yrs	14	14.9
	30 - < 40 yrs	3	3.2
	40 - < 50 yrs	9	9.6
	50 - <60 yrs	23	24.5
	> 60 yrs	41	43.6
Gender	Male	54	57.4
	Female	40	42.6
Diagnosis	**Respiratory**	39	
	CNS	19	
	Renal	43	
	GIT	33	

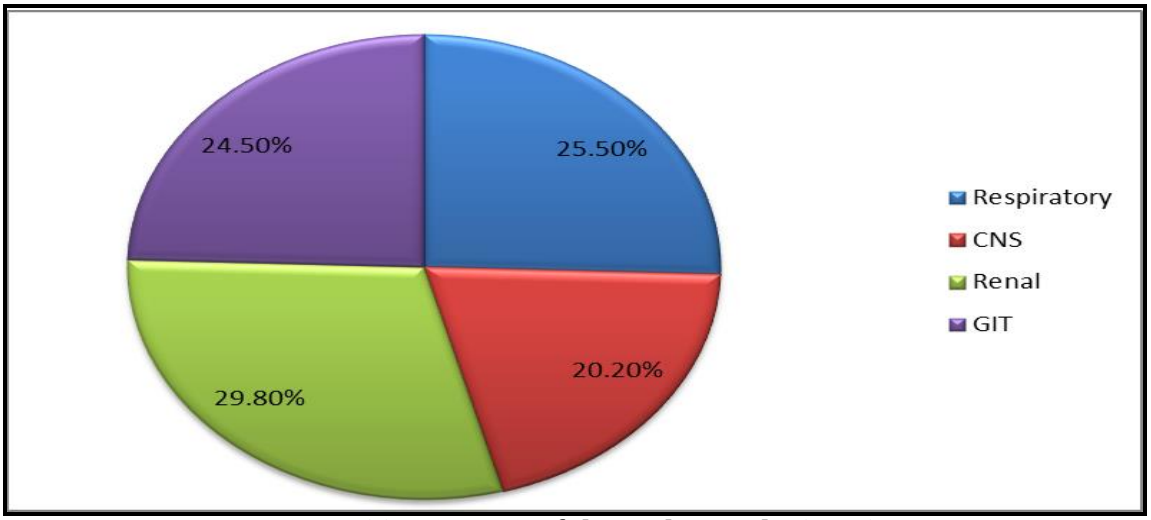

Figure (1): Diagnosis of the study sample. (n=94)

Table (2): Percentage distribution of studied patients regarding association between Respiratory history and the presence of delirium

Variable			Delirium		P value
			Yes	No	
Respiratory history	**COPD**	Count	5	3	0.46
		% within delirium	10.4%	6.5%	
	Asthma	Count	5	5	
		% within delirium	10.4%	10.9%	
	Others	Count	5	10	
		% within delirium	10.4%	21.7%	
	No	Count	33	28	
		% within delirium	68.8%	60.9%	

Table (3): Relationship between CNS history and the presence of delirium

Variable			Delirium		P value
			Yes	No	
CNS history	**Stroke**	Count	13	8	0.05
		% within delirium	27.1%	17.4%	
	Others	Count	4	0	
		% within delirium	8.3%	0.0%	
	No	Count	31	38	
		% within delirium	64.6%	82.6%	

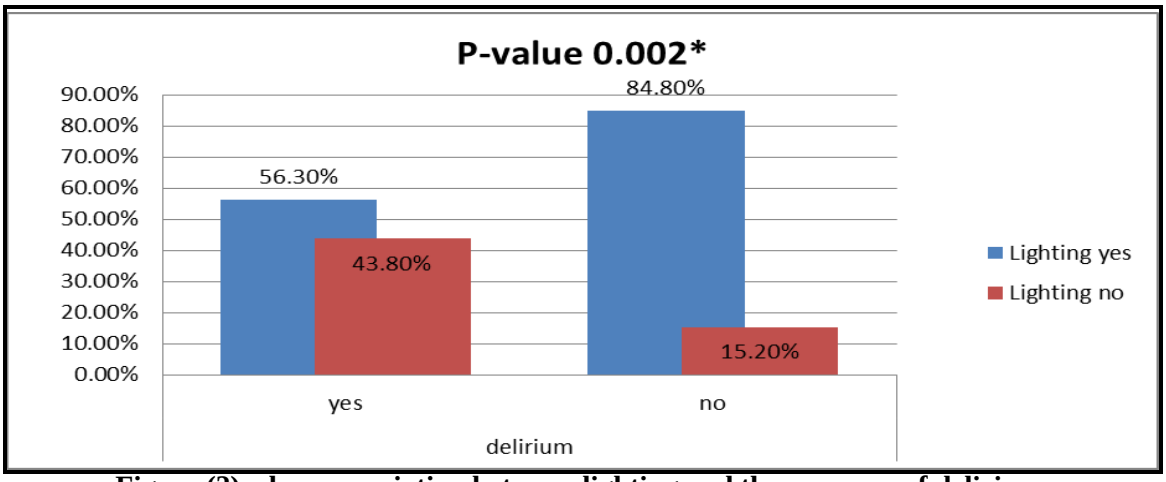

Figure (2): show association between lighting and the presence of delirium.

Table (4): The association between invasive procedures and the presence of delirium.

Variable			Delirium		P value
			Yes	No	
Invasive procedures	**yes**	Count	44	41	0.65
		% within delirium	91.7%	89.1%	
	no	Count	4	5	
		% within delirium	8.3%	10.9%	

Table (5): The association between mechanical ventilation and the presence of delirium.

Variable			Delirium		P value
			Yes	No	
Mechanical ventilation	**yes**	Count	29	4	0.001*
		% within delirium	60.4%	8.7%	
	no	Count	19	42	
		% within delirium	39.6%	91.3%	

Table (6): The association between the use of sedative drugs and the presence of delirium.

Variable			Delirium		P value
			Yes	No	
Sedative drugs	**yes**	Count	38	6	0.001*
		% within delirium	79.2%	13.0%	
	no	Count	10	40	
		% within delirium	20.8%	87.0%	

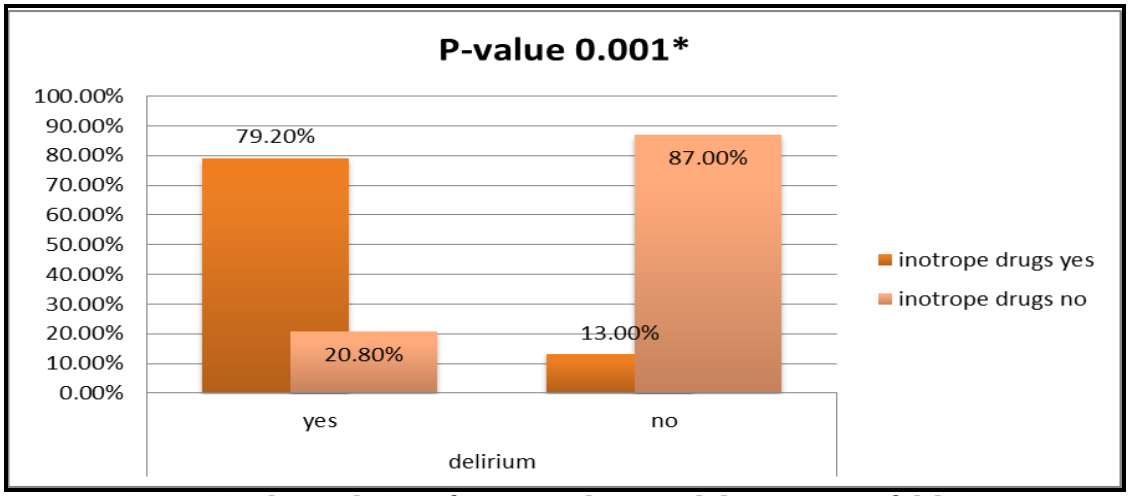

Figure (3): Show relation of inotrope drugs and the presence of delirium.

Table (1): Illustrates that the highest percentage of individuals (43.6%) being over 60 years old, the gender is relatively balanced, with a slight predominance of males (57.4%) compared to females (42.6%).

Figure (1): Illustrates that the diagnostic categories provided Renal diagnoses are the most frequent (43 cases), followed by Respiratory (39 cases), GIT (33 cases), and CNS (19 cases).

Table (2): Shows that larger proportion of patients without any respiratory history experienced delirium (68.8%) compared to those with specific respiratory conditions.

Table (3): Delicate that the substantial proportion of patients without any CNS history experienced delirium (64.6%) compared to those with a history of stroke (27.1%) or other CNS conditions (8.3%).

Figure (2): Illustrates that the bulk of the studied patients (84.8%) without delirium were exposed to lighting. Conversely, (15.2%) without delirium**.**

Table (4): Describes the indicate no statistically significant association between invasive procedures and delirium, with a p-value of 0.65. This suggests that there is no correlation between the presence of invasive procedures and the presence or absence of delirium.

Table (5): Shows that 29 out of 48 patients who developed delirium required mechanical ventilation, while only 4 out of 46 non-delirious patients required it. On the other hand, 19 delirious patients did not receive mechanical ventilation, compared to 42 non-delirious patients. These findings demonstrate a statistically significant association between the use of mechanical ventilation and the development of delirium, with a p-value of 0.001*.

Table (6): Indicates that 38 out of 48 patients with delirium (79.2%) were administered sedative drugs, compared to only 6 out of 46 patients without delirium (13.0%). In contrast, 10 delirious patients (20.8%) did not receive sedatives, while 40 non-delirious patients (87.0%) did not receive them. These findings reveal a statistically significant correlation between sedative drug use and the occurrence of delirium, with a p-value of 0.001*.

Figure (3): Show (79.2%) of patients with delirium received inotrope drugs, whereas (13.0%) without delirium received inotrope drugs. Conversely, (20.8%) of patients with delirium did not receive inotrope drugs, compared to (87.0%) without delirium.

Discussion

Delirium can lead to adverse outcomes such as extended periods of mechanical ventilation, increased lengths of stay in both the ICU and the hospital, higher mortality rates, long-term cognitive impairment, and elevated healthcare costs **(Mart et al., 2024).**

Incidence of delirium: The current findings show that slightly more than half of patients admitted to the ICU developed delirium (51%). This contrast with **Alzoubi et al. (2024),** who observed that only around one-quarter of ICU patients became delirious. Likewise, **Ali et al. (2021), Fiest et al. (2021), Mori et al. (2016),** and Tsuruta et al. (2014) indicated that the incidence of delirium among ICU patients varies from one-quarter to two-thirds. In contrast, **Al-Hoodar et al. (2022), Callahan et al. (2024), Torres-Contreras et al. (2019), & Bashar et al. (2021)** reported that the incidence of delirium among ICU patients is approximately one-quarter.

Patient Characteristics: In this study, the sample shows a bimodal distribution of males and females, with most individuals being over 60 years of age and fewer in the 30–40 age range or under 18 years old. The most prevalent diagnoses were renal conditions, followed by respiratory, gastrointestinal, and central nervous system (CNS) disorders. These results align with **Abazid et al. (2021),** who found that the average age was over 55 years, with more than one-quarter of participants being women. **Alzoubi et al. (2024)** similarly found that ICU patients were generally older, with an average age exceeding 65 years, and there was a nearly equal distribution between males and females. The most common admission diagnoses included gastrointestinal, cardiovascular, respiratory, neurological, renal, and musculoskeletal conditions, as well as other illnesses such as tumors. **Melvin et al. (2017)** also identified a strong positive link between advanced age and delirium, emphasizing older age as a significant risk factor. Likewise, **Pandharipande et al. (2006)** noted a sharp increase in the likelihood of developing delirium after the age of 65.

In contrast, findings from **Al-Hoodar et al. (2022),** showed that nearly 75% of participants were male and just over 25% were female, with a lower mean age of 53 years (SD 19.6). Most participants had existing medical conditions and comorbidities, and the majority were non-smokers. **Maldonado (2018),** along with **Stubljar et al. (2019), Tate et al. (2013), & Al-Hoodar et al. (2022),** found no significant association between age and the onset of delirium. In the authors' view, age-related changes in cerebral function, including altered stress-regulating neurotransmitters, reduced cerebral blood flow, neuronal damage, and altered intracellular signaling, may all contribute to delirium risk.

Comorbidities and delirium: With respect to respiratory conditions, more than two-quarter of patients who lacked any respiratory history still developed delirium, underscoring that factors aside

from respiratory diseases might drive delirium development in this population. This is in line with **Abazid et al. (2021),** who found no correlation between respiratory disorders and delirium in the ICU.

Delirium and CNS Conditions: A notable finding was that over half of patients without a CNS history became delirious, whereas those with prior stroke or other CNS conditions appeared less affected. In addition, slightly more than half of those with a history of diabetes mellitus exhibited delirium in comparison to individuals lacking endocrine diseases. **Abazid et al. (2021)** similarly noted that only two patients with a history of stroke experienced delirium, while 12 stroke survivors did not, and they observed no substantial link between delirium and diabetes ($p = 0.38$).

Light Exposure:

A statistically significant association was found between lighting and the occurrence of delirium ($p < 0.05$). Patients who were not delirious were typically exposed to more light, while those who developed delirium were more often in dimly lit environments. These findings are consistent with **Spies et al. (2024),** who observed that approximately 75% of patients in standard ICU rooms developed delirium, compared to less than 25% in modified, better-lit rooms ($p = 0.017$). Similarly, **Lee et al. (2021)** reported lower delirium rates in patients assigned to rooms with windows. However, contrasting evidence from **Sangari et al. (2021)** indicated that lighting conditions in the ICU did not have a statistically significant effect on delirium. Likewise, **Sonneville et al. (2020)** found no difference in delirium incidence between patients in single rooms with or without natural light access.

Invasive procedures: In this study, invasive procedures demonstrated no statistically significant association with delirium ($p = 0.65$), mirroring the findings of **Abazid et al., (2021).** However, **Callahan et al., (2024)** reported that almost half of delirious patients received a nasogastric tube, whereas only about 9% of non-delirious patients did, and one-quarter of delirious patients required at least one red blood cell transfusion compared to fewer than one-quarter of non-delirious patients.

Mechanical ventilation: A statistically significant link emerged between mechanical ventilation and delirium ($p = 0.001$). These results are consistent with **Abazid et al. (2021), Al-Hoodar et al. (2022), Rasheed et al. (2019), Bashar et al. (2021), & Tilouche et al. (2018),** who identified sedation, frequently necessary for mechanical ventilation, as a contributing factor to delirium.

Sedative and Inotrope use: The study demonstrated a statistically significant association between the administration of sedative medications and the occurrence of delirium ($p = 0.001$). This finding is consistent with **Al-Hoodar et al. (2022),** who also reported a strong positive link between sedative use and delirium. Similarly, **Torres-Contreras et al. (2019)** identified several contributing factors to delirium, including sedative use, infections, metabolic acidosis, mechanical ventilation, age over 60, and APACHE II scores greater than 14.

Furthermore, the data also revealed a significant relationship between the use of inotrope medications and the development of delirium ($p = 0.001$). These results are in line with **Callahan et al. (2024),** who found that nearly 50% of patients who developed delirium had received steroids, compared to approximately 25% of those who did not develop delirium.

Conclusion

Based on the present study, 51% of critically ill patients in the ICU at Al-Eman General Hospital in Assiut experienced delirium. A pronounced association occurs between ICU admission and the risk of delirium.

Recommendations

1. Establish a standardized schedule for routine delirium assessments in ICUs.
2. Collect nationwide data on the incidence of delirium among critically ill patients in Egypt.
3. Conduct daily (every 24 hours) delirium evaluations using an appropriate screening tool.
4. Implement a care bundle approach to manage delirium.
5. Replicate this study with a larger sample size to validate and expand upon these findings.

Reference

Abazid, R., Al-Harbi, S., Allihimy, A., Aldrewesh, D., Alkuraydis, S., Alhammad, I., & Abohamr, S. (2021): Incidence of delirium in the critical care unit and risk factors in the Central Region, Saudi Arabia. Saudi Medical Journal, 42(4), 445.

Al-Hoodar, R., Lazarus, E., Al Omari, O., & Al Zaabi, O. (2022): Incidence, associated factors, and outcome of delirium among patients admitted to ICUs in Oman. Critical Care Research and Practice, 2022(1), 4692483.

Ali, M., Hashmi, M., Ahmed, W., Raza, S., Khan, M., & Salim, B. (2021): Incidence and risk factors of delirium in surgical intensive care unit. Trauma Surgery & Acute Care Open, 6(1), e000564.

Alzoubi, E., Shaheen, F., & Yousef, K. (2024): Delirium incidence, predictors and outcomes in theintensive care unit: A prospective cohort study.

InternationalJournal of Nursing Practice, 30(1), e13154

Arockiam, C. (2023): Identifying Delirium in Hospitalized Patients Using Nursing Delirium Screening Scale (Doctoral dissertation, Grand Canyon University).

Barr J, Fraser GL, & Puntillo K, (2013): American College of Critical Care Medicine: Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med; 41:263-306.

Bashar, A., Heal, R., Hasan, N., & Haque, M. (2021): Effect of COVID-19 on shrimp aquaculture in Bangladesh. Available at SSRN 3867896.

Bhattacharyya, A., Sheikhalishahi, S., Torbic, H., Yeung, W., Wang, T., Birst, J., & Osmani, V. (2022): Delirium prediction in the ICU: designing a screening tool for preventive interventions. JAMIA open, 5(2), ooac048.

Callahan, K., Chesnut, S., & Lasiter, S. (2024): Prevalence of Clinical Factors Experienced by Patients who Developed Delirium in Intensive Care Units: A Descriptive Study Involving 20,000 Patients. Delirium Communications.

Creswell, J. (2014): A concise introduction to mixed methods research. SAGE publications

Ekong, M., Monga, T., Daher, J., Sashank, M., Soltani, S., Nwangene, N., & Rai, M. (2024): From the Intensive Care Unit to Recovery: Managing Post-intensive Care Syndrome in Critically Ill Patients. Cureus, 16(5), e61443.

Fiest, K., Soo, A., Hee Lee, C., Niven, D., Ely, E., Doig, C., & Stelfox, H. (2021): Long-term outcomes in ICU patients with delirium: A population-based cohort study. American Journal of Respiratory and Critical Care Medicine, 204(4), 412–420

Grover S, & Kate N. (2019): Assessment and management of delirium in medical practice. In: Hemanshu Prabhakar, ed. Neurointensive Care. New Delhi, India: Oxford University Press India.

Huang, C., Wu, B., Chen, H., Tao, H., Wei, Z., Su, L., & Wang, L. (2024): Delirium in psychiatric settings: risk factors and assessment tools in patients with psychiatric illness: a scoping review. BMC nursing, 23(1), 464.

Johansson, L., Bergbom, I., Waye, K., Ryherd, E., & Lindahl, B. (2012): The sound environment in an ICU patient room-a content analysis of sound levels and patient experiences. Intensive and Critical Care Nursing, 28(5), 269-279.

Lee, H., Bae, E., Lee, H., Lee, S., & Lee, J. (2021): Association of natural light exposure and delirium according to the presence or absence of windows in the intensive care unit. Acute and Critical Care, 36(4), 332.

Maldonado, J. (2018): Delirium pathophysiology: An updated hypothesis of the etiology of acute brain failure. International Journal of Geriatric Psychiatry, 33, 1428–1457.

Mart, M., Boehm, L., Kiehl, A., Gong, M., Malhotra, A., Owens, R. & Girard, T. (2024): Long-term outcomes after treatment of delirium during critical illness with antipsychotics (MIND-USA): a randomised, placebo-controlled, phase 3 trial. The Lancet Respiratory Medicine.

Matteucci M., Ferrarese, S., Cantore, C., Cappabianca, G., Massimi, G., Mantovani, V., & Beghi, C. (2020): Hyperlactatemia during cardiopulmonary bypass: risk factors and impact on surgical results with a focus on the long-term outcome. Perfusion, 35(8), 756-762.

Melvin, V., Meagher, D., Mc Carthy, G., & Adamis, D. (2017): A longitudinal Study of delirium motor subtypes in elderly medical inpatients. International Journal of Integrated Care, 17(5), 507.

Mori, S., Takeda, J., Carrara, F., Cohrs, C., Zanei, S., & Whitaker, I. (2016): Incidence and factors related to delirium in an intensive care unit. Revista da Escola de Enfermagem da U.S.P.,50(4), 587–593.

Mukherjee, U., Sehar, U., Brownell, M., & Reddy, P. (2024): Mechanisms, consequences and role of interventions for sleep deprivation: Focus on mild cognitive impairment and Alzheimer's disease in elderly. Ageing Research Reviews, 100, 102457.

Naved, S., Siddiqui, S., & Khan, F. (2011): APACHE-II score correlation with mortality and length of stay in an intensive care unit. Journal of the College of Physicians and Surgeons Pakistan, 21(1),4.

Neziraj M, Sarac K, & Samuelson K, (2011): The intensive care delirium screening checklist: translation and reliability testing in a Swedish ICU, Acta Anaesthesiology Scandinavica, 55(7):819-26.

Park SY, & Lee HB. (2019): Prevention and management of delirium in critically ill adult patients in the intensive care unit: a review based on the 2018 PADIS guidelines. Acute Crit Care. May;34(2):117-125.

Prandharipande, P., Shintani, A., & Peterson, J. (2006): Lorazepam is an independent risk factor for transitioning to delirium in intensive care patients. Anesthesiology, 104, 21-26.

Rafiee, S., Safari, Z., & Shokri-Mashhadi, N. (2020): Current Nutritional Statuses and Gastrointestinal Complications in Critically Ill Patients Admitted to ICUs in Iran: A Cross-

Sectional Study. Nutrition and Food Sciences Research, 7(3), 9–14.

Rasheed, T., Bilal, M., Nabeel, F., Adeel, M., & Iqbal, H. (2019): Environmentally-related contaminants of high concern: potential sources and analytical modalities for detection, quantification, and treatment. Environment international, 122, 52-66.

Salluh JI, Wang H, Schneider EB, Nagaraja N, Yenokyan G, Damluji A, Serafim RB, & Stevens RD. (2015): Outcome of delirium in critically ill patients: systematic review and meta-analysis. BMJ. 03;350: h2538.

Sangari, A., Emhardt, E., Salas, B., Avery, A., Freundlich, R., Fabbri, D., & Schlesinger, J. (2021): Delirium variability is influenced by the sound environment (DEVISE study): how changes in the intensive care unit soundscape affect delirium incidence. Journal of medical systems, 45(8), 76.

Sessler, C., Gosnell, M., Grap, M., Brophy, G., O'Neal, P., Keane, K. & Elswick, R. (2002): The Richmond Agitation–Sedation Scale: validity and reliability in adult intensive care unit patients. American journal of respiratory and critical care medicine, 166(10), 1338-1344.

Sonneville, R., Smonig, R., Dupuis, C., Bouadma, L., de Montmollin, E., & Timsit, J. (2020): Natural light exposure and delirium in ICU: does the dark side cloud everything?. Annals of Intensive Care, 10(1), 25.

Spies, C., Piazena, H., Deja, M., Wernecke, K., Willemeit, T., Luetz, A., & ICU Design Working Group. (2024): Modification in ICU design may affect delirium and circadian melatonin: a proof of concept pilot study. Critical Care Medicine, 52(4), e182-e192.

Stewart, T. (2024): Schizophrenia, Psychosis, and Delusions. In Psychiatric-Mental Health Nurse Practitioner Program Companion and Board Certification Exam Review Workbook (pp. 261-292). Cham: Springer Nature Switzerland.

Stubljar, D., Stefin, M., Tacar, M., Cerovic, O., & Grosek, S. (2019): Prolonged hospitalization is a risk factor for delirium onset: One-day prevalence study in Slovenian intensive care units. Acta Clinica Croatica, 58(2), 265–273.

Tate, J., Sereika, S., Divirgilio, D., Nilsen, M., Demerci, J., Campbell, G., & Happ, M. (2013): Symptom communication during critical illness: The impact of age, delirium, and delirium presentation. Journal of Gerontological Nursing, 39(8), 28–38

Tilouche, N., Hassen, M., Ali, H., Jaoued, O., Gharbi, R., & El Atrous, S. (2018): Delirium in the intensive care unit: incidence, risk factors, and impact on outcome. Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine, 22(3), 144.

Tomczyk, K., Jurasz, K., Chojnacka, N., Klarycki, J., Podgórska, D., Cymer, R., & Sanecki, M. (2024): Hospital Hallucinosis-where to look for the cause of the delirious syndrome in a geriatric patient and what management to implement. Journal of Education, Health and Sport, 53, 102-125.

Torres-Contreras, C., Páez-Esteban, A., del Castillo, A., Rincón-Romero, M., Amaris-Vega, A., & Martínez-Patiño, J. (2019): Factores asociados con el delírium en pacientes críticos de una institución de salud de Bucaramanga, Colombia. Enfermería Intensiva, 30(1), 13-20.

Tsuruta, R., Oda, Y., Shintani, A., Nunomiya, S., Hashimoto, S., Nakagawa, T., Oida, Y., Miyazaki, D., & Yabe, S. (2014): Delirium andcoma evaluated in mechanically ventilated patients in the intensive care unit in Japan: A multi-institutional prospective observational study. Journal of Critical Care, 29(3), 472.e1–472.e5

Wattis, J., & Curran, S. (2024): Practical psychiatry of old age. CRC Press.

Weatherhead, J., Niedner, M., Dahmer, M., Malas, N., Owens, T., & Kawai, Y. (2022): Patterns of delirium in a pediatric intensive care unit and associations with noise pollution. Journal of Intensive Care Medicine, 37(7), 946-953.

Zaal IJ, Devlin JW, & Peelen LM, (2015): A systematic review of risk factors for delirium in the ICU. Crit Care Med ; 43:40-47

Zaher-Sánchez, S., Satústegui-Dordá, P., Ramón-Arbués, E., Santos-Sánchez, J., Aguilón-Leiva, J., Pérez-Calahorra, S., & Echániz-Serrano, E. (2024): The Management and Prevention of Delirium in Elderly Patients Hospitalised in Intensive Care Units: A Systematic Review. Nursing Reports, 14(4), 3007.