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**Science Midwifery**

journal homepage:www.midwifery.iocspublisher.org

# Overview of patient responses to pain stimuli based on glasgow coma scale (GCS) scores

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**ARTICLE INFO**

***Article history:***

Received Oct 30, 2025
Revised Nov 2, 2025
Accepted Nov 10, 2025

***Keywords:***

Decreased Consciousness
Glasgow Coma Scale
Nail Bed Pressure
Pain Stimulation Technique

**ABSTRACT**

Decreased consciousness is a clinical condition that requires rapid and accurate assessment. One method used is the application of nail bed pressure pain stimulation to elicit a response from the patient. This study aims to determine the consistency of responses from patients with decreased consciousness when given pain stimulation based on the Glasgow Coma Scale (GCS) score in the emergency department of Dr. M. Djamil Hospital in Padang. This was a quantitative descriptive study with 70 respondents selected using purposive sampling. Consciousness levels were measured twice. Data were collected in July 2025 using the GCS assessment format, then analyzed descriptively and cross-tabulated using frequency distribution, percentages, means, standard deviations, and correlations. The nail bed pressure technique produced an average GCS score of 6.01 ± 0.625 on the first assessment and 6.04 ± 0.711 on the second assessment. Most scores were in the range of 6–7. The nail bed pressure technique provided an inconsistent picture of changes in GCS responses in patients with decreased consciousness.



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# INTRODUCTION

The International Classification of Diseases (2024) defines decreased consciousness as a state in which a person experiences varying degrees of impaired alertness, ranging from severe drowsiness and confusion to an inability to respond normally to external stimuli. According to Plum & Posner (1980) in Goldfarb et al., (2023), patients with decreased consciousness experience a decrease in alertness, reduced self-awareness, and impaired responses to external stimuli. This condition can be caused by damage to the ascending reticular activating system, cerebral hemispheres, or various factors such as toxins, metabolic disorders, or infections. In the Emergency Department, the main causes of decreased consciousness include trauma, cerebrovascular disease, seizures, poisoning, and infection (Zaith et al., 2023).

Patients with decreased consciousness have a higher risk of death compared to conscious patients. The mortality rate in unconscious or comatose patients can reach 54.7% within one year

after the incident, especially in cases of out-of-hospital cardiac arrest (Botker et al., 2017). Patients who are unresponsive to pain stimuli have an odds ratio (OR) of 31.0 (95% CI: 16.9–56.8) for death within one day, compared to conscious patients. According to Mamun et al., (2023), unconscious patients have a 9.56 times higher chance of death than conscious patients.

Cases of decreased consciousness in Indonesia, as recorded at Cipto Mangunkusumo Hospital (RSCM) in Jakarta, show that 12.7% of adult patients present with decreased consciousness as their main complaint. This complaint ranks third after shortness of breath (25.1%) and general weakness (16.2%) (Tantri et al., 2024). Then in West Sumatra Province, at one of the referral hospitals that serves as the main service center for various other hospitals, namely Dr. M. Djamil Padang General Hospital, particularly in the Emergency Room (ER), there were also quite a number of cases of decreased consciousness. Based on data from April 2025, the number of patients with emergency conditions treated reached 1,895, with 234 patients (12.3%) experiencing decreased consciousness (Dr. M. Djamil Padang General Hospital, 2025). The high number of cases of decreased consciousness indicates that Dr. M. Djamil Padang General Hospital handles emergency cases with high complexity.

Various methods have been developed to assess a patient's level of consciousness. Other methods such as ACDSC (Alert, Confused, Drowsy, Stupor, Coma) are more descriptive and subjective, and lack strong scientific validation. Meanwhile, the Japan Coma Scale (JCS) is a commonly used measurement tool in Japan with a 1–300 point system, but it is not well known internationally and is rarely used outside its country of origin (Poureskandari et al., 2023). The application of the Glasgow Coma Scale (GCS), using pain stimuli to elicit a pain response, is considered an important parameter in monitoring patients, especially those who cannot communicate. Pain stimuli are used not only for GCS assessment but also for neurological diagnosis and treatment planning. Pain stimulation is an important component in assessing neurological status and level of consciousness, especially using the Glasgow Coma Scale (GCS) (Nallaluthan et al., 2023).

The administration of pain stimulation techniques is a crucial component in assessing a patient's level of consciousness using the Glasgow Coma Scale (GCS). However, several studies have shown significant variations in the selection and application of these techniques among healthcare professionals. Research conducted by Reith et al., (2016) discussed five main pain stimulation techniques used in clinical practice (nail pressure, supraorbital pressure, trapezius muscle pinch, sternal rub, and ear lobe stimulation).

The use of nail bed pressure is an integral part of clinical practice, particularly for assessing a patient's level of consciousness based on the Glasgow Coma Scale (GCS). This method is widely used in emergency department (ED) settings due to its simplicity, speed, and effectiveness in eliciting motor responses that can be interpreted objectively (Bonin et al., 2023).

To date, there are no standardized Standard Operating Procedures (SOPs) regarding the use of pain stimulation techniques in the ED of Dr. M. Djamil Padang General Hospital, leading to variations in practice and potential inconsistencies in GCS assessment. In addition, the lack of previous research on pain stimulation techniques is another finding that indicates the need for further research to objectively compare the effectiveness of the two techniques.

Based on the background and phenomena above, the researcher was interested in conducting research to determine the consistency of patients' responses to pain stimulation based on the Glasgow Coma Scale (GCS) score in the emergency room of Dr. M. Djamil Padang General Hospital.

# RESEARCH METHOD

This study is a quantitative descriptive study conducted at the Emergency Room of Dr. M. Djamil General Hospital in Padang in July 2025. The study population consisted of all patients with decreased consciousness, and a sample of 70 respondents was selected using purposive sampling.

The inclusion criteria were patients with decreased consciousness who were unresponsive to alert and verbal stimuli, aged 18–60 years, and obtained family consent, while the exclusion criteria included patients under the influence of sedative drugs, patients with a history of extremity disorders, and patients with lucid interval conditions. The study was conducted from July 2024 to August 2025, with data collection taking place in July 2025. The research instrument was a GCS assessment observation sheet.

The research procedure was carried out by obtaining family consent through informed consent, then administering pain stimulation using the nail bed pressure technique according to the order of the envelope draw. Each respondent received four stimulations lasting 10–15 minutes, and the results of the consciousness assessment were recorded directly on the GCS observation sheet. Measurements were taken twice. In this study, consistency meant that the GCS scores from two measurements using the same pain stimulation technique showed the same value, while inconsistency meant that the GCS scores from two measurements using the same technique showed different values.

The statistical analysis used in this study included descriptive analysis in the form of frequency distribution, percentages, means, and standard deviations, as well as inferential analysis using correlation analysis (cross-sectional study) to determine the difference in GCS scores between the two pain stimulation techniques. This study has also received ethical approval from the Health Research Ethics Committee of the Ministry of Health, Directorate General of Advanced Health, Dr. M. Djamil Hospital, Padang, with letter number DP.04.03/D.XVI.2.3/967/2025.

# RESULTS AND DISCUSSIONS

The results of the study include respondent characteristics and the average response of patients with decreased consciousness based on the Glasgow Coma Scale (GCS) score when given pain stimulation using the nail bed pressure technique.

**Tabel 1.** Respondent characteristics

| Characteristic | f | % |
|---|---|---|
| Consistent | 18 | 25.7 |
| Inconsistent | 52 | 74.3 |
| Total | 70 | 100 |

Based on the distribution of consistent GCS responses to nail bed pressure stimuli in 70 respondents, it was found that 18 people (25.7%) showed inconsistent responses. Although the majority of respondents (74.3%) were still consistent, the proportion of a quarter of respondents with unstable results indicates the limitations of this method.

The results of the study indicate that nail bed pressure does not always elicit a stable neurological response in all individuals. Inconsistent responses may be due to physiological or technical factors. Physiologically, although nail bed pressure provides rapid and easily accessible local pain stimulation, the distal area of the finger is prone to variations in sensitivity due to trauma, tissue damage, or circulatory disorders that can reduce the reliability of the response (Cook et al., 2025).

Additionally, this inconsistency may also be associated with the limitations of localized mechanical stimuli, such that in some patients with impaired consciousness, the activation of pain receptors may not be sufficient to produce stable motor or verbal response patterns. Research by Zhang et al., (2025) shows that although nail bed pressure can trigger brain activation in many patients, there are variations in responsiveness that affect the consistency of results.

Thus, it can be concluded that although nail bed pressure is often used due to its simplicity and non-invasive nature, the finding of inconsistency of 25.7% confirms that this method is not entirely reliable. Therefore, examiners should consider other clinical factors and, if necessary, use

alternative pain stimuli (e.g., supraorbital pressure or trapezius squeeze) to improve the accuracy of patient consciousness assessment.

**Table 2.** Average GCS 1 and 2 measurements with nail bed pressure

| Nail Bed Pressure | Average |
|---|---|
| GCS 1 | 6.01 |
| GCS 2 | 6.02 |

Based on the average response of patients with decreased consciousness based on the Glasgow Coma Scale (GCS) score when given pain stimulation using the nail bed pressure technique, the results of the study showed that there was no significant difference between the GCS scores on the first and second examinations. However, the very small difference in scores—GCS 1 (6.01) and GCS 2 (6.02)—indicates potential instability because the patients' responses were not entirely consistent in each examination.

Although the average GCS score was 6, indicating moderate to severe consciousness (GCS < 8), the almost identical average values in the two examinations did not automatically reflect high reliability. Even the slightest change in patients with decreased consciousness can indicate variations in neurological responses, so nail bed pressure may not necessarily provide truly consistent results. This is in line with the opinion of Rahman et al., (2021) that although nail bed pressure is often used because it is easy to apply, this peripheral stimulus still has limitations because it is influenced by local factors such as distal tissue damage, nerve sensitivity, and circulatory disorders.

From a nursing perspective, the inconsistency of these results is important to note because it can cause bias in monitoring the patient's neurological status. If the examiner relies solely on nail bed pressure, there is a possibility that small changes in the GCS score will be overlooked or considered consistent, when in fact they may indicate a worsening condition. Therefore, monitoring patients with decreased consciousness should not rely solely on nail bed pressure stimulation, but should also involve other alternative stimuli and comprehensive clinical evaluation to ensure the accuracy of the assessment.

**Table 3.** Consistency of GCS measurement results based on age group

| Age | GCS consistency | | | | Number | | *P-value* |
|---|---|---|---|---|---|---|---|
| | Consistent | | Inconsistent | | | | |
| | f | % | f | % | f | % | |
| Young | 4 | 30.8 | 9 | 69.2 | 13 | 100 | 0,026 |
| Adult | 12 | 38.7 | 19 | 61.3 | 31 | 100 | |
| Elderly | 2 | 7.7 | 24 | 92.3 | 26 | 100 | |
| Total | 18 | 25.7 | 52 | 74.3 | 70 | 100 | |

In the young age group (20–35 years), 4 people (30.8%) showed consistent results, while 9 people (69.2%) showed inconsistent results. In the adult age group (36–50 years), 12 people (38.7%) showed consistent results and 19 people (61.3%) showed inconsistent results. Meanwhile, in the elderly age group (51–59 years), only 2 people (7.7%) showed consistent results, while the majority, namely 24 people (92.3%), showed inconsistent results. Overall, of the 70 respondents studied, 18 people (25.7%) had consistent results and 52 people (74.3%) had inconsistent results to the nail bed pressure stimulus.

The Chi-Square test results showed a significant relationship between age and the consistency of the Glasgow Coma Scale (GCS) scores through the nail bed pressure stimulus (p = 0.026). This means that age can affect the consistency of patients' responses to the pain stimulus given.

The results showed a significant relationship between age and GCS score consistency using nail bed pressure stimulus (p=0.026). The distribution of results shows that in the young age group

(20–35 years), 69.2% of respondents were inconsistent, in the adult group (36–50 years) 61.3%, and in the elderly group (51–59 years) it increased sharply to 92.3%. This indicates that the older the respondents, especially in the elderly category, the greater the tendency for respondents to show inconsistency in GCS assessment.

Physiologically, this finding can be understood through the degenerative mechanism in the nervous system that occurs with age. In the elderly group, there is a decrease in pain sensitivity due to changes in the peripheral and central nerve fibers, so that the response to pain stimuli becomes duller and less sensitive than in younger people (Cook et al., 2019). In contrast, younger or adult individuals have higher nerve sensitivity, so responses to pain stimuli are often more varied and unstable (Hohenschurz-Schmidt et al., 2025; Schogl et al., 2025).

In addition to neurological factors, psychological aspects also contribute. Younger patients are more susceptible to emotional conditions such as anxiety or fatigue, resulting in more pronounced variations in pain responses (Aboushaar & Serrano, 2024; Landmark et al., 2024). Conversely, in the elderly, decreased nerve function makes pain processing simpler, so response patterns tend to be more consistent. This is in line with the study by Zhang et al., (2025), which reported a strong relationship between age and brain activation patterns in response to pain stimuli, with the elderly showing more homogeneous responses than younger age groups.

Thus, age has been proven to be an important factor influencing the interpretation of GCS examination results. The elderly tend to show more uniform responses due to decreased nerve sensitivity, while younger and adult patients are likely to show greater response variation.

**Table 4.** Consistency of GCS measurement results based on gender

| Gender | GCS consistency | | | | Number | | *P-value* |
|---|---|---|---|---|---|---|---|
| | Consistent | | Inconsistent | | | | |
| | f | % | f | % | f | % | |
| Male | 8 | 26.7 | 22 | 73.3 | 30 | 100 | 0,875 |
| Female | 10 | 25.0 | 30 | 75.0 | 40 | 100 | |
| Total | 18 | 25.7 | 52 | 74.3 | 70 | 100 | |

The table shows that in the male group (30 respondents), 8 people (26.7%) showed consistent results and 22 people (73.3%) showed inconsistent results. In the female group (40 respondents), there were 10 people (25.0%) with consistent results and 30 people (75.0%) with inconsistent results.

Overall, of the 70 respondents studied, 18 (25.7%) had consistent results and 52 (74.3%) had inconsistent results. The proportion of inconsistent results in both groups was relatively similar, namely 73.3% in males and 75.0% in females.

The Chi-Square statistical test showed a p-value of 0.875 (> 0.05), indicating no significant relationship between gender and GCS nail bed pressure consistency. In other words, both male and female respondents had an equal chance of showing consistency or inconsistency in their response to nail bed pressure stimuli.

The results showed that there was no significant relationship between gender and GCS score consistency using nail bed pressure stimulus (p = 0.875). The proportion of inconsistency in male respondents was 73.3% and in female respondents was 75.0%, with a very small difference. This indicates that gender does not significantly affect the consistency of patient responses to pain stimuli. Physiologically, both males and females have central and peripheral nervous systems that play the same role in mediating responses to pain stimuli (Failla et al., 2024; Verma et al., 2025). Any differences that may exist, such as pain sensitivity or pain tolerance threshold, do not necessarily affect the consistency of GCS assessment results because the indicators assessed focus more on motor, verbal, and eye-opening responses than on the subjectivity of pain (Smith et al., 2025). Thus, the small variability between men and women does not result in a significant difference in the results of this study.

Several previous studies also support these findings. For example, Zhang et al., (2025) reported that gender did not significantly affect the consistency of consciousness assessment using the GCS, but was more influenced by the patient's neurological condition and age. In line with this, in clinical practice, differences in GCS responses are more determined by factors such as brain injury, hemodynamic status, and the patient's neurological stability than by biological factors like gender (Kwon et al., 2024; Omar et al., 2024).

Thus, the results of this study confirm that gender is not a significant factor affecting the consistency of GCS scores with nail bed pressure stimuli. This is important for healthcare practitioners, as GCS examination interpretation can be performed objectively without considering gender differences, but rather focusing on the patient's clinical aspects.

**Table 5.** Consistency of GCS measurement results based on education

| Education | GCS consistency | | | | Number | | *P-value* |
|---|---|---|---|---|---|---|---|
| | Consistent | | Inconsistent | | | | |
| | f | % | f | % | f | % | |
| Elementary School | 0 | 0 | 5 | 100 | 5 | 100 | 0,571 |
| Junior High School | 4 | 30.8 | 9 | 69.2 | 13 | 100 | |
| High School | 11 | 26.2 | 31 | 73.8 | 42 | 100 | |
| College | 3 | 30.0 | 7 | 70.0 | 10 | 100 | |
| Total | 18 | 25.7 | 52 | 74.3 | 70 | 100 | |

In the junior high school group (13 respondents), there were 4 people (30.8%) with consistent results and 9 people (69.2%) with inconsistent results. Furthermore, in the high school group (42 respondents), 11 people (26.2%) showed consistent results and 31 people (73.8%) showed inconsistent results. Meanwhile, in the university group (10 respondents), there were 3 people (30.0%) with consistent results and 7 people (70.0%) with inconsistent results.

Overall, out of 70 respondents, 18 people (25.7%) had consistent results and 52 people (74.3%) had inconsistent results. Although there were variations between educational groups, the results showed that the majority of respondents at all educational levels showed more inconsistency than consistency.

The Chi-Square test results showed a p-value of 0.571 (> 0.05), indicating no significant relationship between the highest level of education and consistency in GCS nail bed pressure. Thus, the respondents' educational level did not significantly affect the consistency of their responses to pain stimuli.

The results showed that there was no significant relationship between the highest level of education and the consistency of GCS scores using the nail bed pressure stimulus ($p = 0.571$). In all education categories, including elementary school, junior high school, high school, and college, the majority of respondents showed high consistency to the stimulus. Even among respondents with an elementary school education, all (100%) showed consistent results. This shows that formal education does not have a significant effect on the variation in GCS score consistency.

Theoretically, consistency in GCS responses is determined more by physiological and neurological aspects than by the respondent's education level. GCS assessment involves motor, verbal, and eye-opening responses to pain stimuli, so the results depend on the patient's central and peripheral nervous system conditions, not on their educational background (Omar et al., 2024). Educational level may influence aspects of health information understanding or adherence to therapy, but it is not directly related to the neurological reflex responses that form the basis of GCS assessment.

In line with these findings, Zhang et al., (2025) study also showed that demographic variables such as education and gender were not significantly related to the consistency of neurological examination results. The factors that had a more dominant influence on consistency were age and the patient's clinical condition, especially those related to neurological function and the presence of impaired consciousness Riduansyah et al., (2021).

Thus, the results of this study confirm that the highest level of education is not a significant factor affecting the consistency of GCS scores with the nail bed pressure stimulus. This reinforces the understanding that neurological examinations such as the GCS are objective and not influenced by cognitive factors or social background, but are more determined by the patient's physiological condition.

**Table 6.** Consistency of GCS measurement results based on occupation

| Occupation | GCS consistency | | | | Number | | *P-value* |
|---|---|---|---|---|---|---|---|
| | Consistent | | Inconsistent | | | | |
| | f | % | f | % | f | % | |
| Unemployed/Housewife | 1 | 7.1 | 13 | 92.9 | 14 | 100 | 0,448 |
| Laborer | 0 | 0 | 1 | 100 | 1 | 100 | |
| Private Sector | 2 | 33.3 | 4 | 66.7 | 6 | 100 | |
| Self-employed | 13 | 30.2 | 30 | 69.8 | 43 | 100 | |
| Civil servant | 2 | 33.3 | 4 | 66.7 | 6 | 100 | |
| Total | 18 | 25.7 | 52 | 74.3 | 70 | 100 | |

Based on Table 6, it was found that in the group of respondents who were unemployed/housewives (14 people), 1 person (7.1%) showed consistent results and 13 people (92.9%) showed inconsistent results. In the group of laborers (1 respondent), all (100.0%) showed inconsistent results.

Among respondents with private sector jobs (6 people), 2 people (33.3%) showed consistent results and 4 people (66.7%) showed inconsistent results. Furthermore, in the self-employed group (43 people), which was the largest group, 13 people (30.2%) showed consistent results and 30 people (69.8%) showed inconsistent results. In the civil servant group (6 people), 2 people (33.3%) had consistent results and 4 people (66.7%) had inconsistent results.

Overall, out of a total of 70 respondents, 18 people (25.7%) showed consistent results and 52 people (74.3%) showed inconsistent results. This shows that in all job categories, the majority of respondents showed inconsistent GCS scores in response to nail bed pressure stimuli.

The Chi-Square test results showed a p-value of 0.448 (> 0.05), which means that there is no significant relationship between occupation and GCS nail bed pressure consistency. Thus, occupational background does not significantly affect the pattern of consistency responses to pain stimuli.

The results of the study show that there is no significant relationship between occupation and GCS score consistency using nail bed pressure stimulus ($p = 0.448$). In all occupational categories, whether unemployed/housewives, laborers, private sector employees, entrepreneurs, or civil servants, the majority of respondents showed inconsistency. Even in the unemployed/housewife group, almost all (92.9%) showed inconsistent results, and in the laborer group, all respondents (100%) showed inconsistency. This indicates that occupational background does not significantly affect GCS response patterns.

Theoretically, the consistency of GCS assessment is more determined by neurological factors and the patient's physiological condition than by socioeconomic factors or type of occupation (Bodolo et al., 2023). Occupation may be related to physical activity levels, socioeconomic status, or exposure to stress, but this does not necessarily have a direct effect on the motor, verbal, or eye-opening responses assessed in the GCS (Omar et al., 2024). Responses to pain stimuli reflect brain and central nervous system function rather than external factors such as occupation.

The study by Zhang et al., (2025) also confirms that social demographic factors such as occupation have no significant relationship with the consistency of neurological responses. Conversely, age, health status, and the presence of neurological disorders are more dominant factors influencing GCS examination results. Thus, the results of this study are consistent with previous findings that GCS is objective and independent of social factors, including occupation.

Therefore, it can be concluded that occupation does not significantly affect the consistency of GCS scores with nail bed pressure stimuli. These results reinforce the understanding that the GCS examination should be viewed as an objective measure of a patient's neurological condition, which is more influenced by physiological factors and age than by the respondent's occupational background.

# CONCLUSION

Provide a statement that what is expected, as stated in the "Introduction" chapter can ultimately result in "Results and Discussion" chapter, so there is compatibility. Moreover, it can also be added the prospect of the development of research results and application prospects of further studies into the next (based on result and discussion).

Based on the results of the study, it can be concluded that the nail bed pressure technique is not yet fully effective in overcoming variations in consciousness assessment in the emergency department because it produces motor responses that tend to be inconsistent compared to other techniques. This inconsistency indicates that nail bed pressure can actually reduce the objectivity of the Glasgow Coma Scale (GCS) in assessing the neurological status of patients with decreased consciousness. In addition, the examination results are also influenced by patient characteristics such as age, gender, and clinical condition, thereby further limiting the reliability of nail bed pressure.

Therefore, this technique should be used with caution and should not be the sole method of pain stimulation in GCS assessment. Hospitals need to develop more comprehensive Standard Operating Procedures (SOP) that consider other more stable stimulus alternatives. Furthermore, training for healthcare personnel is crucial to ensure examinations are conducted accurately and ethically, while also encouraging further research to evaluate the factors influencing patient inconsistency in response to nail bed pressure during GCS examinations.

Comparative studies comparing various pain stimulation methods, such as supraorbital pressure, trapezius squeeze, and sternal rub, are recommended to assess the consistency of GCS results across different levels of impaired consciousness. This method could provide stronger scientific evidence regarding the safest and most ethical methods for clinical practice. Furthermore, this approach could aid in the development of standardized guidelines for the neurological assessment of patients with impaired consciousness.

This study's contribution to strengthening evidence-based policy services lies in the principles of objectivity, accuracy, and patient safety in assessing the level of consciousness. The results indicate that the nail bed pressure technique is not yet fully reliable for assessing pain response in patients with decreased consciousness, so more standardized and evidence-based clinical guidelines are needed. These findings provide an important basis for nurses in improving the quality of care in the emergency room through the use of valid, ethical, and consistent examination techniques. Furthermore, the results of this study can strengthen nurse competency training policies in neurology assessment, the development of standardized GCS examination SOPs, and the application of evidence-based nursing practices in clinical decision-making, thereby supporting professional, safe, and patient-centered surgical practices.

# ACKNOWLEDGEMENTS

The researchers would like to express their deepest gratitude and appreciation to all parties who have provided support in the preparation of this article. Special thanks are extended to the supervising lecturer for his guidance, direction, and valuable corrections during the research and writing process. Thanks are also extended to the management and medical staff at the Emergency Department of Dr. M. Djamil Padang General Hospital for their permission and assistance in data

collection, as well as to all respondents who were willing to participate in this research. May all the assistance and support provided be a good deed and receive a fitting reward.

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