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THE EFFECTIVENESS OF EARLY MOBILIZATION IN REDUCING THE LENGTH OF STAY FOR PATIENTS ON MECHANICAL VENTILATION: LITERATURE REVIEW

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ABSTRACT
Mechanical ventilation in critically ill patients is often associated with prolonged bed rest, which may lead to muscle weakness, delayed ventilator weaning, and extended length of stay in the ICU and hospital. One of the interventions widely recommended to reduce these adverse effects is early mobilization. To review the effectiveness of early mobilization in reducing the length of stay among patients receiving mechanical ventilation through a literature review. This study used a narrative literature review with a systematic approach based on PRISMA principles. Literature searching was conducted through Google Scholar and journals indexed in Scopus and Sinta for articles published between 2016 and 2025. From an initial identification of 146,361 records, a total of 14 articles met the final inclusion criteria after a rigorous screening process and were analyzed narratively. Most studies showed that early mobilization was associated with reduced ICU length of stay, shorter duration of mechanical ventilation, improved muscle strength, and better early physical function. Mobilization initiated within the first 48–72 hours tended to provide better outcomes than delayed mobilization. However, several studies reported that its effects on mortality and long-term outcomes remained inconsistent, and the success of the intervention was strongly influenced by patients' clinical stability, implementation protocols, and multidisciplinary team readiness. Early mobilization is sufficiently effective in supporting the recovery of mechanically ventilated patients, particularly in reducing ICU length of stay and duration of mechanical ventilation.

Keywords: early mobilization; ICU; length of stay; literature review; mechanical ventilation

INTRODUCTION
Mechanical ventilation is a primary supportive therapy for critically ill patients experiencing respiratory failure, impaired gas exchange, or a diminished ability to maintain spontaneous ventilation. Although this intervention plays a pivotal role in life-saving measures, its use is frequently followed by various complications during intensive care, particularly when patients undergo prolonged bed rest. Immobilization in the Intensive Care Unit (ICU) can accelerate the decline of muscle strength, hinder the recovery of respiratory function, delay the ventilator weaning process, and extend the length of stay (LOS) in both the ICU and the hospital. Furthermore, neuromuscular changes in critically ill patients can begin to occur within the first 48 hours of care; thus, delayed mobilization has the potential to worsen the patient's functional condition(Daum et al., 2024; Hiser et al., 2025)

One of the most common issues arising in critically ill patients is Intensive Care Unit-Acquired Weakness (ICU-AW), characterized by muscle weakness developing during intensive care that cannot be explained by other neurological diseases. Recent reviews indicate that approximately half of critically ill adult patients may experience ICU-AW, a condition associated with longer durations of mechanical ventilation, extended hospital stays, increased healthcare costs, and a decrease in post-discharge quality of life. This weakness affects not only the limb muscles but also the respiratory muscles, making it more difficult for patients to be liberated from the ventilator. Consequently, preventing the decline of muscle function from the early phases of treatment becomes crucial in the management of mechanically ventilated patients (Hiser et al., 2025; Vanhorebeek et al., 2020).

In recent years, early mobilization has been increasingly recommended as a component of early rehabilitation in the ICU. Generally, early mobilization is defined as mobilization efforts initiated as early as possible typically within the first 48–72 hours of ICU admission provided the patient's hemodynamic and respiratory conditions are stable. Interventions may include passive and active range-of-motion exercises, repositioning, sitting on the edge of the bed, standing, and gradual ambulation based on patient tolerance. Recent expert panel guidelines emphasize that early mobilization in critically ill patients aims to mitigate the adverse effects of immobilization, maintain muscle function, improve functional capacity, and support faster clinical recovery. In other words, early mobilization is no longer viewed merely as a supplementary action but as an integral part of modern critical care (Daum et al., 2024; Matsuoka et al., 2023).

A number of studies demonstrate that early mobilization has significant potential to improve the clinical outcomes of patients on mechanical ventilators. A meta-analysis by (Wang et al., 2023) on mechanically ventilated adult ICU patients reported that systematic early mobilization could reduce the ICU length of stay by approximately 2.18 days and the duration of mechanical ventilation by approximately 2.27 days. Similar findings were shown in a network meta-analysis by (Daum et al., 2024), which stated that mobilization within the first 72 hours was associated with shortened ICU and hospital stays, while also benefiting patient functional status. In a national context, research by (Munir et al., 2023) published in a Sinta-indexed Indonesian nursing journal demonstrated that early mobilization significantly increased the tidal volume of ventilated patients. This finding is critical, as improved respiratory function can support the weaning process and indirectly contribute to a shorter duration of care.

Nevertheless, research results regarding the effectiveness of early mobilization have not been entirely consistent. The large-scale TEAM randomized controlled trial, published in The New England Journal of Medicine, showed that increasing early active mobilization in ventilated adult patients did not result in a higher number of days alive and out of the hospital at 180 days compared to usual care; the intervention was also associated with more adverse events. These findings suggest that the benefits of early mobilization cannot be simplified as "the earlier, the better" for all patients. Its effectiveness is likely heavily influenced by the timing of intervention, exercise intensity, hemodynamic conditions, level of consciousness, respiratory stability, and the readiness of ICU team resources. Therefore, the interpretation of scientific evidence must be conducted carefully and in a balanced manner (Hiser et al., 2025).

Based on the aforementioned context, early mobilization is a promising intervention that still requires critical appraisal to assess how effectively it truly reduces the length of stay in mechanically ventilated patients. The variations in results across studies indicate that clinical decisions should not be based solely on assumed benefits but must refer to a synthesis of evidence that is current, relevant, and accountable. Conducting this review is highly important to bridge the gap between conflicting study outcomes, thereby helping clinicians optimize intensive care resources and prevent severe complications of prolonged immobility, such as ICU-acquired weakness. Therefore, the primary objective of this literature review is to examine the effectiveness of early mobilization in reducing the length of stay for patients on mechanical ventilators, and to identify how recent evidence can support critical care nursing practices that are safe, rational, and evidence-based (Daum et al., 2024; Schaller et al., 2016a; Wang et al., 2023).

METHOD

Study Design and Framework

This study adopts a systematic narrative literature review design. The process of searching, selecting, and reporting followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 (Page et al., 2021) statement to ensure transparency and structural integrity. The review was designed to evaluate the effectiveness of early mobilization in reducing the length of stay (LOS) for patients on mechanical ventilation.

Search Strategy

A comprehensive search was conducted across national and international electronic databases, including PubMed, ScienceDirect, Google Scholar, and journals indexed in Scopus and Sinta, for articles published between 2016 and 2025. The search strategy utilized Boolean operators (AND, OR) to link the following keywords: "early mobilization", "mechanical ventilation", "ICU", "length of stay", and "ventilator weaning". From an initial identification of 146,361 records across these databases, a total of 14 articles met the final eligibility criteria and were ultimately included in this review.

Eligibility Criteria and PICO Framework

The research question was formulated using the PICO (Population, Intervention, Comparison, and Outcome) framework to refine the search strategy and define eligibility criteria. The inclusion criteria were: (1) articles published in English or Indonesian; (2) available in full-text; (3) focused on early mobilization in adult ICU patients requiring mechanical ventilation; and (4) utilized primary research designs such as randomized controlled trials (RCTs), quasi-experimental studies, observational studies, cohort or cross-sectional studies, systematic reviews, meta-analyses, and relevant clinical guidelines. Exclusion criteria included editorials, commentaries, duplicate publications, and studies with insufficient or unclear outcome data. The specific PICO components are detailed in table 1.

Table 1.
PICO Framework

Component	Description
Population (P)	Adult patients admitted to the ICU requiring mechanical ventilation.
Intervention (I)	Early mobilization protocols initiated within the ICU setting.
Comparison (C)	Standard care, delayed mobilization, or no early mobilization intervention.
Outcome (O)	Reduction in ICU or hospital length of stay (LOS), duration of mechanical ventilation, and improvement in early physical function.

Quality Assessment

To ensure the robustness of the synthesis, the methodological quality of each included study was independently evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Tools. Assessment criteria included randomization, blinding, validity of measurement, and statistical integrity. Only studies categorized as high quality were synthesized in the final review.

RESULT

Based on the literature search, 14 articles met the inclusion criteria and were included in this narrative analysis. These articles utilized various research designs, including systematic reviews, meta-analyses, randomized controlled trials (RCTs), quasi-experimental studies, cohort studies, observational studies, surveys, and clinical guidelines. Generally, the synthesis of these findings indicates that early mobilization is associated with a reduction in ICU length of stay (LOS), decreased duration of mechanical ventilation, improved early physical function, and enhanced muscle strength. However, several studies also suggest that benefits regarding mortality rates and long-term outcomes remain inconsistent.

Study Selection and Quality

The systematic search and screening process resulted in 14 articles that met all eligibility criteria. The selection flow is documented in the PRISMA Flow Diagram **(Figure 1)**. The quality assessment results using the JBI tools are summarized in **Table 2**. All included studies (n=14) demonstrated high methodological quality, providing a reliable foundation for the narrative synthesis.

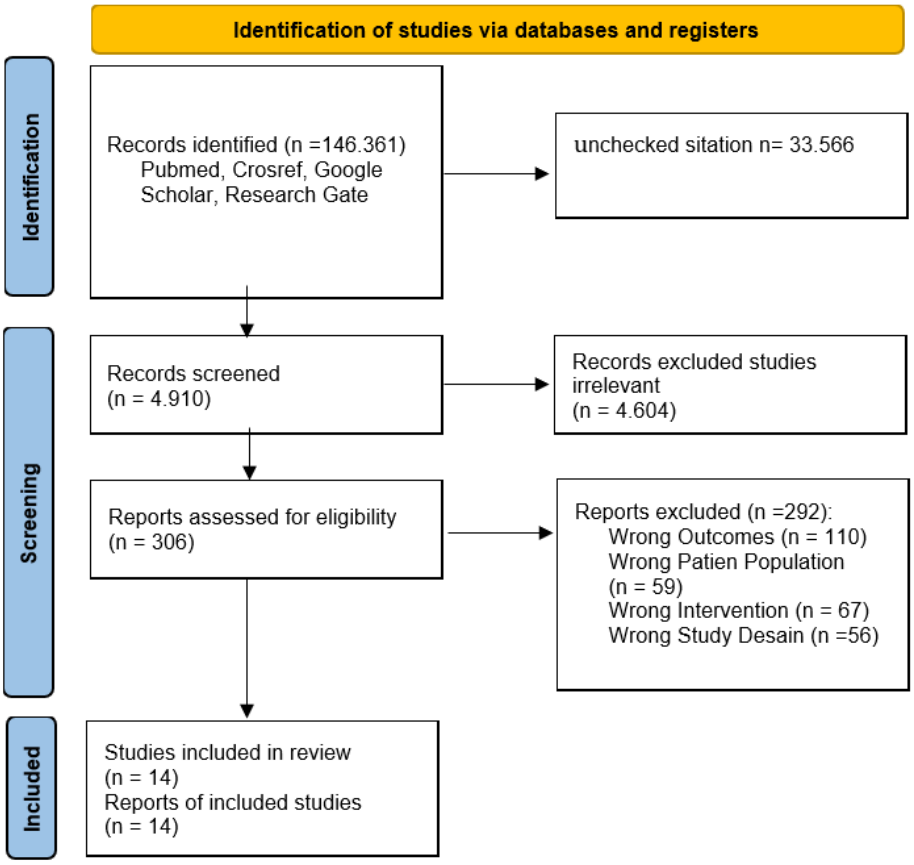

Figure 1. PRISMA Flow Diagram

Table 2.
Quality Assessment Summary (JBI Tools)

No	Author (Year)	Study Design	JBI Criteria (Summary)	Result (Predominant "Yes")	Quality
1	Hodgson et al. (2016)	RCT	Randomization, control, follow-up, analysis	Yes	High
2	Schaller et al. (2016)	RCT	Randomization, blinding, valid outcomes	Yes	High
3	Dong et al. (2016)	RCT	Randomization, clear intervention, analysis	Yes	High
4	McWilliams et al. (2018)	RCT	Clear design, measurable outcomes, analysis	Yes	High
5	Sarfati et al. (2018)	RCT	Randomization, control, measurement validity	Yes	High
6	Das et al. (2021)	Quasi-experimental	Comparison group, valid outcomes	Yes	High
7	Dong et al. (2021)	RCT	Randomization, clear intervention, analysis	Yes	High
8	TEAM Study (2022)	RCT	Multicenter, randomization, robust analysis	Yes	High
9	Kinoshita et al. (2022)	Cohort	Clear sampling, follow-up, bias control	Yes	High
10	Patel et al. (2023)	RCT	Randomization, valid cognitive outcomes	Yes	High
11	Munir et al. (2023)	Quasi-experimental	Pre-post, control, statistical analysis	Yes	High
12	Kho et al. (2024)	RCT	Multicenter, control, analysis	Yes	High
13	Watanabe et al. (2025)	Cohort	Prospective, clear variables, analysis	Yes	High
14	Shiota et al. (2025)	Observational	Clear sampling, intervention, and outcomes	Yes	High

Literature Synthesis

The synthesis of the 14 included studies is presented in table 3. The data extraction focused on the effectiveness of early mobilization (EM) regarding ICU length of stay and mechanical ventilation duration.

Table 3.
Synthesis of Reviewed Literature

No.	Author, Year, Country	Title	Methods (Design, Sample, Variables, Intervention, Analysis)	Key Findings
1	(Hodgson et al., 2016), Binational/ Multicenter	A binational multicenter pilot feasibility randomized controlled trial of early goal-directed mobilization in the ICU	D: Pilot multicenter RCT; S: ICU patients V: Early goal-directed mobilization I: Early mobilization vs. standard care A: Comparative	The intervention was proven feasible and significantly increased maximal activity levels compared to standard care.
2	(Schaller et al., 2016b), USA/ Germany	Early, goal-directed mobilisation in the surgical intensive care unit: A randomised controlled trial	D: RCT S: Surgical ICU patients; V: Goal-directed early mobilization I: Early mobilization program A: Comparative	Early mobilization improved mobility at surgical ICU discharge and significantly shortened the surgical ICU length of stay (LOS).
3	(Dong et al., 2021), China	Early rehabilitation therapy is beneficial for patients with prolonged mechanical ventilation after coronary artery bypass surgery	D: RCT S: Post-CABG patients with prolonged mechanical ventilation V: Early rehabilitation I: Early rehabilitation program A: Comparative	Early rehabilitation shortened mechanical ventilation duration, accelerated recovery, and reduced the length of hospital stay.
4	(McWilliams et al., 2018), UK	Earlier and enhanced rehabilitation of mechanically ventilated patients in critical care: A feasibility randomised controlled trial	D: Feasibility RCT S: Mechanically ventilated patients V: Earlier and enhanced rehabilitation I: Rehabilitation intervention A: Comparative	Patients in the intervention group were mobilized earlier and achieved higher mobility levels at ICU discharge.
5	(Sarfati et al., 2018), France	Efficacy of early passive tilting in minimizing ICU-acquired weakness: A randomized controlled trial	D: RCT S: ICU patients V: Early passive tilting I: Early passive tilting intervention A: Comparative	The intervention helped minimize ICU-acquired weakness and supported gradual mobilization in critically ill patients.
6	(Das et al., 2021), India	Effect of graded early mobilization on psychomotor status and length of intensive care unit stay in mechanically ventilated patients	D: Quasi-experimental S: Mechanically ventilated patients V: Graded early mobilization I: Graded mobilization program A: Comparative	Demonstrated improvements in motor and psychological status and a reduction in ICU LOS for mechanically ventilated patients.
7	(Dong et al., 2021), China	Early rehabilitation relieves diaphragm dysfunction induced by prolonged mechanical ventilation: A randomised control study	D: RCT S: Patients with prolonged mechanical ventilation V: Early rehabilitation and diaphragm function I: Early rehabilitation program A: Comparative	The rehabilitation group showed better diaphragm function and shorter ventilation duration; however, ICU LOS did not differ significantly.
8	(The TEAM Study Investigators, 2022), Multicenter	Early active mobilization during mechanical ventilation in the ICU	D: Multicenter RCT S: Adult patients with mechanical ventilation V: Early active mobilization I: Intervention vs. usual care A: Comparative	Did not increase the number of days alive and out of the hospital at 180 days and was associated with an increase in adverse events.

No.	Author, Year, Country	Title	Methods (Design, Sample, Variables, Intervention, Analysis)	Key Findings
9	(Kinoshita et al., 2022), Japan	The effects of early rehabilitation in the intensive care unit for patients with severe COVID-19 pneumonia: A retrospective cohort study	D: Retrospective cohort S: Severe COVID-19 patients in ICU V: Early rehabilitation I: Retrospective cohort analysis A: Comparative	Showed improved daily function in survivors without serious adverse events, with relatively favorable extubation rates and ICU LOS.
10	(Patel et al., 2023), USA	Effect of early mobilisation on long-term cognitive impairment in critical illness in the USA: A randomised controlled trial	D: RCT S: Critically ill patients V: Early mobilization and long-term cognitive impairment I: Early mobilization intervention A: Comparative	Suggested potential improvements in long-term cognition post-ventilation, though adverse events in the intervention group require attention.
11	(Munir et al., 2023), Indonesia	Effectiveness of early mobilization on tidal volume in patients with ventilators	D: Quasi-experimental S: Ventilated patients V: Early mobilization and tidal volume I: Early mobilization intervention A: Comparative test	Showed a significant increase in tidal volume post-intervention and significant differences between groups.
12	(Kho et al., 2024), Multicenter	Early in-bed cycle ergometry in mechanically ventilated patients	D: Multicenter RCT S: Mechanically ventilated patients V: Early in-bed cycle ergometry I: Cycling + routine physiotherapy vs. standard A: Comparative	Adding cycling to routine physiotherapy was safe but did not improve physical function three days after ICU discharge.
13	(Watanabe et al., 2025), Multicenter	Investigating dose level and duration of rehabilitation of mechanically ventilated patients in the ICU	D: Prospective multicenter cohort; S: Mechanically ventilated ICU patients; V: Rehabilitation dose and duration; I: Prospective cohort; A: Association analysis	Rehabilitation dose during ICU stay was a better predictor of walking independence than single measures of intensity or duration.
14	(Shiota et al., 2025), Japan	Enhancing early mobilization in critically ill patients through multidisciplinary rounds: A process-focused observational study	D: Observational quality-improvement S: Critically ill/ventilated patients V: Multidisciplinary rounds and early mobilization I: Quality improvement study A: Descriptive/ Comparative	Multidisciplinary rounds improved early mobilization practices, particularly in ventilated patients, and accelerated the initiation of physiotherapy.

DISCUSSION

The analysis of 14 selected articles indicates that early mobilization (EM) is generally effective in improving short-term outcomes for critically ill patients on mechanical ventilators. The following sections provide a detailed discussion based on the seven identified themes.

Theme 1: Effectiveness of Early Mobilization on Length of Stay (LOS)

Most articles demonstrate that EM is effective in reducing the length of stay in the ICU, with several studies also reporting a shortening of the overall hospital stay. This evidence is observed in both primary research and high-level evidence syntheses. A meta-analysis by (Wang et al., 2023) showed that EM in adult ICU patients on mechanical ventilation could reduce ICU LOS by approximately 2.18 days. These findings are supported by a network meta-analysis by (Daum et al., 2024) which identified that mobilization initiated within the first 72 hours is significantly associated with reduced ICU and hospital LOS. The reduction in LOS can indeed be attributed to the prevention or elimination of complications associated with immobility, such as deep vein thrombosis (DVT), pulmonary embolism, pressure ulcers, and muscle atrophy (de Brito et al., 2018; Floyd et al., 2016). By mitigating these morbidities, EM effectively prevents the prolongation of hospitalization and the

associated increase in healthcare costs (Adogwa et al., 2017). However, as noted by (Monsees et al., 2023) study heterogeneity remains high, suggesting that the effect size may vary across different clinical settings and patient populations.

Theme 2: Impact on Mechanical Ventilation Duration and Weaning

In addition to LOS, EM helps shorten the duration of mechanical ventilation and supports the weaning process. Dong et al. (2016) reported that early rehabilitation in patients with prolonged mechanical ventilation accelerated recovery. Similar results by (Dong et al., 2021) showed that early rehabilitation improves diaphragm function and shortens ventilation duration. Crucially, early mobilization serves to reduce the risk of respiratory-related immobility complications, specifically nosocomial pneumonia (Floyd et al., 2016). For instance, systematic early mobilization has been associated with reduced ventilator days and enhanced physical recovery (Bassett et al., 2012). On a national level, Munir et al. (2023) demonstrated that EM significantly increases tidal volume in ventilated patients. This finding is critical as it suggests a biological mechanism; improvements in respiratory mechanics facilitate earlier liberation from the ventilator and discharge from the ICU.

Theme 3: Physical Function, Muscle Strength, and Prevention of ICU-AW

A frequently recurring theme is the impact of EM on preserving muscle strength and preventing Intensive Care Unit-Acquired Weakness (ICU-AW). Zhang et al. (2019) indicated that EM is associated with a lower incidence of ICU-AW and improved functional capacity. Anekwe et al. (2020) also reported that early rehabilitation reduces the likelihood of neuromuscular decline. While Matsuoka et al. (2023) found that mobilization within 72 hours benefits physical function, they also noted that these gains do not always persist in the long term, highlighting the need for continuous post-ICU rehabilitation.

Theme 4: Optimal Timing of Implementation

The synthesis suggests that the timing of intervention is a decisive factor. Articles consistently assert that mobilization initiated within the first 48–72 hours produced better outcomes than delayed intervention. Ding et al. (2019) indicated that this window is the most optimal for reducing ICU-AW. This is aligned with the expert panel guidelines by Schaller et al. (2024), which establish that EM should ideally begin within the first 72 hours, provided the patient has passed safety screenings. This reinforces that precision in timing is as vital as the exercise itself.

Theme 5: Safety and Clinical Stability

Safety is a paramount concern for mechanically ventilated patients. While Taito et al. (2016) and Nydahl et al. (2017) showed that adverse events are relatively rare, the TEAM Study Investigators (2022) revealed that early active mobilization does not always provide universal benefits and was associated with an increase in adverse events in certain groups. Therefore, EM must remain selective and gradual, carefully considering the patient's hemodynamic and respiratory status. It should not be viewed as a standalone intervention but as a clinical decision-making process.

Theme 6: Barriers and Implementation Factors

The success of EM depends heavily on field implementation. (Dubb et al., 2016) identified various barriers, including patient factors, service structures, and ICU culture. (Goddard et al., 2018) emphasized that team communication and clinician beliefs significantly influence outcomes. Furthermore, surveys by (Alqahtani et al., 2022) showed that implementation is affected by knowledge, staffing, and sedation levels. Thus, EM must be conceptualized as a structured multidisciplinary program rather than a mere physical repositioning of the patient.

Theme 7: Inconsistency in Mortality and Long-Term Outcomes

A significant finding in this review is the discrepancy between short-term gains and long-term outcomes. While EM improves muscle strength and reduces LOS, its impact on mortality and 180-day survival remains inconclusive. The TEAM Study (2022) demonstrated that early active mobilization did not increase the number of days alive and out of the hospital at 180 days.

Consequently, while EM is a promising intervention, its benefits must be interpreted with caution regarding long-term survival, suggesting that future research should focus on post-ICU recovery phases.

Limitations of the Study

This literature review has several limitations that should be considered when interpreting the findings. First, the search was restricted to five primary databases (Google Scholar, PubMed, ScienceDirect, Scopus, and Sinta), which may have led to the omission of relevant studies published in other specialized medical databases or grey literature. Second, there is significant heterogeneity among the included studies regarding research designs, patient demographics, the specific protocols of early mobilization (EM) used, and the timing of intervention. Such variations make it challenging to establish a single, universal "dosage" for mobilization. Third, not all reviewed articles provided comprehensive data on long-term outcomes, such as 180-day survival or post-discharge quality of life, which limits the depth of the longitudinal analysis. Finally, potential language bias may exist as the review primarily focused on studies published in English and Indonesian.

CONCLUSSION

The synthesis of 14 articles confirms that early mobilization (EM) is an effective intervention for reducing ICU length of stay, shortening mechanical ventilation duration, and improving early physical function in critically ill patients. These benefits are primarily driven by the prevention of immobility-related complications and neuromuscular decline. To achieve optimal results, EM should be initiated within a 48–72 hour window through a structured, multidisciplinary approach, ensuring patient safety and clinical stability. While EM significantly enhances short-term recovery, its impact on long-term mortality remains inconsistent, necessitating further research into post-ICU rehabilitation.

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