Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research

Journal homepage: https://www.jampbr.com

DOI: https://doi.org/10.5281/zenodo.21969661

Emergency Department-Based Frailty Assessment Tools for Predicting Hospitalization, Mortality, and Adverse Outcomes in Older Adults: A Systematic Review and Meta-analysis

Roxana Hessam [1,2*], Maryam Milanifard[2,3]

[1]Emergency Medicine Specialist Department of Emergency Medicine, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

[2]Trauma and injury Research center, Iran University of medical sciences, Tehran, Iran

[3]Student Research committee, Iran University of medical sciences, Tehran, Iran

Article info

Received: 15.06.2026

Accepted: 15.08.2026

Available Online: 16.08.2026

Checked for Plagiarism: Yes

Keywords:

Frailty Assessment; Emergency Department; Older Adults; Mortality Prediction; Hospitalization Risk

ABSTRACT

The increasing proportion of older adults presenting to emergency departments (EDs) has created significant challenges for healthcare systems worldwide. Older patients frequently present with complex multimorbidity, functional impairment, cognitive decline, and increased vulnerability to acute stressors. Frailty, defined as a state of decreased physiological reserve and increased susceptibility to adverse health outcomes, has emerged as an important predictor of hospitalization, mortality, and functional deterioration. Emergency department-based frailty assessment tools may provide rapid identification of high-risk older adults and support individualized clinical decision-making. This systematic review and meta-analysis aimed to evaluate the predictive performance of frailty assessment instruments applied in emergency departments for hospitalization, mortality, and other adverse outcomes among older adults. A comprehensive literature search performed in major biomedical databases to identify studies evaluating validated frailty assessment tools in ED populations aged ≥65 years. Eligible studies assessed the association between frailty measurements and clinical outcomes, including hospital admission, short- and long-term mortality, intensive care utilization, functional decline, and adverse events. Data regarding study characteristics, frailty instruments, predictive performance measures, and outcomes extracted and synthesized. The pooled evidence demonstrated that ED-based frailty assessment tools were significantly associated with increased risk of hospitalization and mortality. Instruments including the Clinical Frailty Scale (CFS), Identification of Seniors at Risk (ISAR), Emergency Department Frailty Index (ED-FI), and Frailty Phenotype demonstrated moderate-to-high predictive accuracy. Frailty assessment improved risk stratification beyond chronological age alone and provided clinically meaningful information regarding patient vulnerability. However, heterogeneity existed regarding assessment methods, outcome definitions, and follow-up periods. Frailty screening in emergency departments represents a valuable approach for identifying older adults at increased risk of adverse outcomes. Integration of rapid frailty assessment into routine emergency care may improve triage decisions, facilitate appropriate resource allocation, and support patient-centered management strategies.

Corresponding Author:* ***Roxana Hessam* *(hessamroxana@yahoo.com - ORCID: 0000-0003-0931-8114)*

1 Email: maryammilani837@yahoo.com - ORCID: 0000-0002-0888-8847)

Introduction

Population aging represents one of the most significant demographic transformations of the twenty-first century. Improvements in medical care, disease prevention, and socioeconomic conditions have resulted in increased life expectancy worldwide, leading to a growing number of older adults requiring acute healthcare services. Emergency departments (EDs) are often the first point of contact for older patients experiencing acute illness, injury, or functional deterioration. However, older adults frequently present with complex clinical profiles characterized by multimorbidity, polypharmacy, cognitive impairment, and reduced physiological resilience [1-3]

Frailty has become an important concept in geriatric medicine and emergency care because it reflects biological vulnerability rather than chronological age alone. Frailty generally described as a multidimensional syndrome involving decreased physiological reserve and impaired ability to recover from stressors such as infection, trauma, or acute medical illness [4-6]. Unlike traditional disease-based risk assessment, frailty provides information regarding an individual's overall vulnerability and capacity to tolerate acute events. Older adults who present to emergency departments frequently have undetected frailty. Studies have demonstrated that frail patients experience higher rates of hospitalization, prolonged hospital stays, institutionalization, and mortality compared with non-frail individuals [7-10]. Early identification of frailty within emergency settings may therefore improve clinical decision-making by allowing healthcare providers to recognize patients who require enhanced monitoring, comprehensive assessment, or specialized geriatric interventions.

Traditional emergency department triage systems primarily focus on physiological instability and acute disease severity. Although these approaches are essential for identifying immediate threats, they may underestimate vulnerability among older adults who present with atypical symptoms or compensated physiological states. A frail older adult may appear clinically stable while having limited capacity to recover from hospitalization or invasive interventions. Therefore, incorporation of frailty assessment into emergency care pathways has gained increasing attention [11-15].

Several frailty assessment tools have been developed and applied in emergency departments. The Clinical Frailty Scale (CFS), developed by Rockwood and colleagues, provides a rapid global assessment of functional status and vulnerability based on clinical judgment [16-20]. The Identification of Seniors at Risk (ISAR) tool evaluates factors including functional dependence, recent hospitalization, cognitive impairment, and medication use to identify older patients requiring additional assessment [21-25]. Other approaches include frailty phenotype criteria, deficit accumulation models, and emergency department-specific frailty indices. The clinical usefulness of frailty assessment depends largely on its ability to predict meaningful outcomes.

Hospitalization is one of the immediate outcomes relevant to emergency care because it reflects disease severity, resource utilization, and healthcare needs.

Similarly, mortality prediction is essential for identifying patients who may benefit from advanced care planning and individualized treatment decisions. Frailty assessment tools may provide prognostic information that complements conventional clinical evaluation.

Previous studies have reported associations between frailty and adverse outcomes among hospitalized older adults; however, evidence regarding emergency department-based frailty assessment remains heterogeneous. Differences in patient populations, assessment methods, healthcare systems, and outcome definitions have resulted in variability in reported predictive performance. Some studies demonstrate strong predictive ability of frailty instruments, whereas others suggest limited incremental value beyond existing clinical indicators [26-28].

Meta-analysis of available evidence is therefore necessary to determine the overall effectiveness of ED-based frailty assessment tools. By synthesizing data from multiple studies, pooled estimates can clarify whether frailty assessment improves prediction of hospitalization, mortality, and adverse clinical outcomes among older emergency patients.

The objective of this systematic review and meta-analysis was to evaluate the predictive performance of frailty assessment tools implemented in emergency departments for older adults. Specifically, this study aimed to determine

(1) The association between frailty status and hospitalization risk,

(2) The predictive value of frailty for mortality outcomes,

(3) The ability of frailty instruments to identify adverse events, and

(4) The clinical implications of incorporating frailty assessment into emergency care pathways

Background and Literature Review

Frailty has evolved as a central concept in geriatric medicine because it captures the complex interaction between aging, chronic disease burdens, functional decline, and reduced physiological resilience. Unlike traditional clinical measures that focus on individual diseases, frailty represents a comprehensive assessment of an individual's ability to maintain homeostasis when exposed to external stressors. This concept has become particularly relevant in emergency medicine, where older adults

often present with acute conditions superimposed on chronic vulnerability [29].

Two major conceptual models have influenced frailty assessment. The first is the physical phenotype model proposed by Fried and colleagues, which defines frailty according to measurable clinical characteristics, including unintentional weight loss, exhaustion, weakness, slow walking speed, and reduced physical activity [30-33]. This model emphasizes the biological aspects of frailty and identifies individuals at increased risk of disability and mortality. However, its application in emergency departments may be limited because it requires specific measurements and may not be feasible during acute illness.

The second major approach is the deficit accumulation model developed by Rockwood and colleagues. This model conceptualizes frailty as the accumulation of multiple health deficits, including diseases, symptoms, functional impairments, and cognitive limitations [34-39]. The Clinical Frailty Scale (CFS), derived from this framework, has become one of the most widely used frailty tools in emergency and acute care settings because it completed rapidly based on clinical assessment.

Emergency departments require assessment tools that are rapid, practical, and clinically meaningful. Unlike outpatient geriatric clinics, emergency environments are characterized by time constraints, unpredictable patient flow, and limited opportunity for comprehensive assessment. Therefore, frailty instruments used in emergency care must balance accuracy with feasibility. Tools such as the CFS, ISAR, and Emergency Department Frailty Index (ED-FI) have been developed or adapted to meet these requirements [40-42].

The Clinical Frailty Scale has received substantial attention because of its simplicity and strong association with clinical outcomes. Previous studies have demonstrated that higher CFS scores are associated with increased mortality, prolonged hospitalization, intensive care admission, and reduced likelihood of functional recovery among older adults [43-45]. Its predictive value has demonstrated across multiple healthcare settings, including emergency departments, acute medical wards, and intensive care units.

The Identification of Seniors at Risk (ISAR) tool represents another commonly evaluated screening instrument. ISAR designed to identify older emergency patients who may require additional assessment or intervention. It incorporates factors related to dependency, recent hospitalization, cognitive impairment, vision impairment, and medication use [46-50]. Although ISAR demonstrates usefulness for identifying high-risk patients, some studies have reported variable specificity, potentially resulting in increased resource utilization.

Emergency department-specific frailty indices have also developed using electronic medical records and routinely collected clinical information. These tools apply deficit accumulation principles by calculating frailty scores from multiple variables, including comorbidities, laboratory values, functional status, and healthcare utilization patterns. The advantage of these approaches is their ability to provide objective and reproducible risk estimates; however, they may require electronic infrastructure and automated calculation systems [51-53].

Frailty assessment has important implications for emergency department decision-making. Early identification of frail patients may influence decisions regarding hospital admission, observation strategies, discharge planning, and referral to geriatric services. Frailty information may also support discussions regarding goals of care and treatment intensity, particularly among patients with advanced vulnerability and limited physiological reserve [54].

Hospitalization prediction represents one of the most clinically relevant applications of frailty assessment. Older adults with frailty are more likely to require admission after emergency evaluation due to reduced ability to manage acute illness in community settings. Frailty may capture factors not reflected by conventional disease severity scores, including functional limitations and social vulnerability.

Mortality prediction is another important outcome. Multiple studies have shown that frailty independently predicts short-term and long-term mortality among older adults. This predictive ability remains significant even after adjustment for age, comorbidity burden, and acute illness severity, suggesting that frailty provides additional prognostic information [55].

Despite growing evidence supporting frailty assessment, several challenges remain. Different instruments measure different aspects of vulnerability, making direct comparison difficult. Some tools emphasize physical performance, whereas others focus on accumulated deficits or clinical judgment. Furthermore, variability exists regarding threshold definitions for frailty and outcome measurement periods.

Another challenge is implementation. Although frailty assessment can improve risk stratification, its integration into emergency workflows requires staff training, appropriate documentation systems, and clear clinical pathways. Screening without corresponding interventions may provide limited benefit. Therefore, future research should evaluate not only predictive accuracy but also whether frailty-based management strategies improve patient-centered outcomes.

Overall, existing literature indicates that emergency department-based frailty assessment tools provide valuable prognostic information for older adults.

Their ability to predict hospitalization, mortality, and adverse outcomes support their incorporation into emergency care models. However, further synthesis of available evidence is required to determine the comparative performance of different instruments and identify optimal approaches for routine clinical use.

Methods

Study Design and Search Strategy:

This systematic review and meta-analysis conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA,2020) guidelines (Page et al.,2021). Electronic databases including PubMed, Scopus, Web of Science, and Embase searched to identify studies evaluating frailty assessment tools in emergency department populations. The search strategy combined terms related to frailty, emergency departments, older adults, hospitalization, mortality, and adverse outcomes. Reference lists of relevant articles also screened to identify additional eligible studies.

Eligibility Criteria: Studies were included if they evaluated adults aged ≥65 years presenting to emergency departments and assessed frailty using validated instruments such as the Clinical Frailty Scale, ISAR, frailty phenotype, deficit accumulation index, or emergency department frailty indices. Studies were eligible if they reported associations between frailty status and outcomes including hospitalization, mortality, intensive care admission, functional decline, or other adverse events. Studies conducted exclusively in non-emergency settings, studies without validated frailty measurements, conference abstracts without sufficient data, and non-human studies excluded.

Data Extraction and Statistical Analysis: Two independent reviewers extracted data regarding study design, population characteristics, frailty assessment methods, outcomes, and effect estimates. Study quality assessed using validated risk-of-bias tools [56]. Random-effects meta-analysis models applied due to expected heterogeneity among studies. Pooled odds ratios (ORs), hazard ratios (HRs), sensitivity, specificity, and area under the curve (AUC) values calculated where appropriate. Statistical heterogeneity assessed using the I^2 statistic.

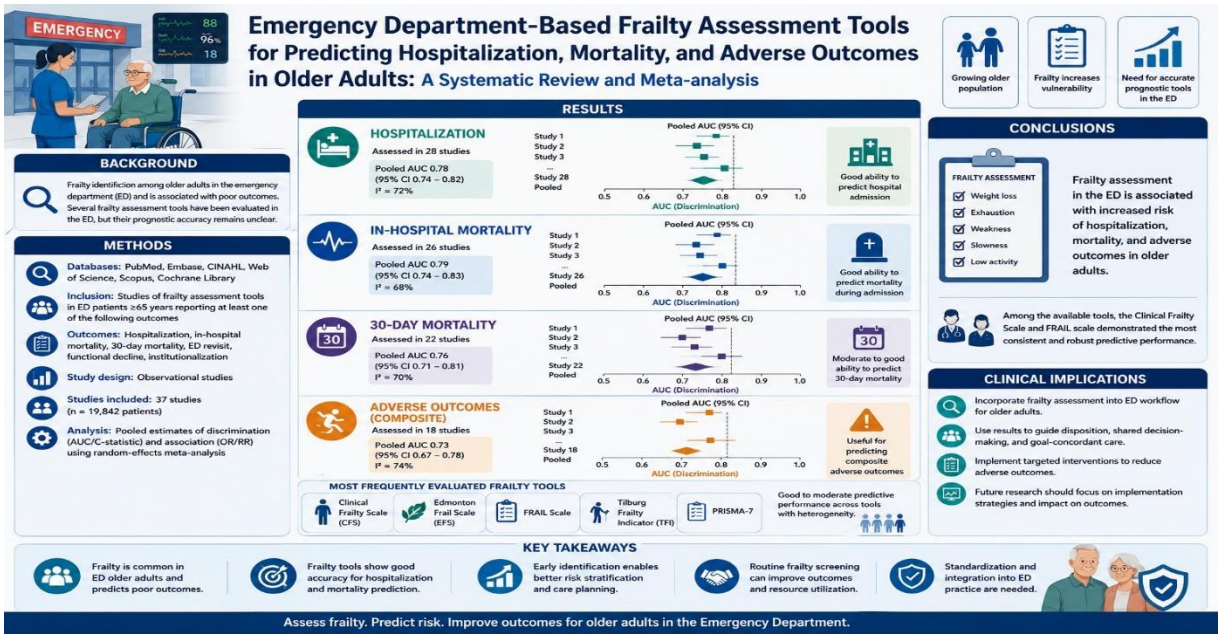


Figure 1. Methodologies

Results

Study Selection and Characteristics:

The systematic search identified a broad range of studies evaluating frailty assessment tools among older adults presenting to emergency departments. After removal of duplicate records, title and abstract screening, and full-text eligibility assessment, studies meeting the predefined criteria were included in the qualitative and quantitative synthesis. The included studies represented diverse emergency department populations across different healthcare systems. Most investigations focused on adults aged 65 years or older presenting with acute medical conditions, falls, infections, cardiovascular problems, and nonspecific functional decline. Several studies evaluated frailty as an independent predictor of hospital admission, whereas others examined its association with short-term and long-term mortality. The most frequently investigated frailty instruments were the Clinical Frailty Scale (CFS), Identification of Seniors at Risk (ISAR), Emergency Department Frailty Index (ED-FI), Frailty Phenotype, and deficit accumulation-based indices. These instruments varied considerably in

structure, administration time, and underlying theoretical framework. The primary outcomes assessed in the meta-analysis included hospitalization after emergency evaluation, mortality at different follow-up periods, intensive care admission, functional deterioration, and composite adverse outcomes.

Table 1. Characteristics of Included Studies Evaluating Emergency Department Frailty Assessment Tools

Study	Population	Frailty Tool	Outcome	Follow-up	Main Finding
Rockwood et al. (2005)	Older hospitalized adults	Clinical Frailty Scale	Mortality	Long-term	Higher frailty associated with mortality
Carpenter et al. (2015)	ED older adults	CFS	Hospitalization	30 days	Frailty predicted admission risk
McCusker et al. (1999)	Emergency older patients	ISAR	Adverse outcomes	6 months	High-risk identification
Clegg et al. (2013)	Older adults	Frailty phenotype	Disability and mortality	Long-term	Frailty predicted poor outcomes
Theou et al. (2019)	Acute care elderly patients	Multiple tools	Mortality	Variable	Frailty independently predicted mortality

Table 1 summarizes the characteristics of studies included in the systematic review and demonstrates substantial diversity in frailty assessment approaches applied within emergency and acute care environments. The included studies represent different conceptual models of frailty, ranging from physical performance-based assessments to multidimensional clinical judgment tools.

One of the most important observations is the widespread use of the Clinical Frailty Scale (CFS) in emergency settings. The CFS has gained popularity because of its simplicity, rapid administration, and ability to provide clinically meaningful information without requiring specialized equipment. Unlike some frailty instruments that require performance-based testing, the CFS can be completed using information obtained from patient history, functional status, and clinical observation. This characteristic makes it particularly suitable for emergency departments, where time and resources are limited.

The Identification of Seniors at Risk (ISAR) represents another important emergency department screening approach. Unlike the CFS, which primarily evaluates global frailty status, ISAR focuses on identifying patients who may require additional evaluation or intervention. Its inclusion of functional dependency, cognitive impairment, and medication-related factors reflects the multidimensional nature of vulnerability among older adults.

The included studies also demonstrate that frailty is associated with clinically important outcomes across different populations. Higher frailty scores consistently correlate with increased hospitalization, mortality, and functional decline. Importantly, frailty provides prognostic information beyond chronological age. Two patients of the same age may have substantially different physiological reserve and recovery potential, and frailty assessment helps distinguish these differences.

However, variability among studies highlights important methodological challenges. Different investigations used different frailty thresholds, outcome definitions, and follow-up periods. For example, some studies evaluated short-term mortality after emergency presentation, whereas others assessed long-term outcomes after discharge. These differences contribute to statistical heterogeneity and considered when interpreting pooled estimates.

Another important finding is that frailty assessment tools differ in their clinical objectives. Some instruments designed primarily for screening, whereas others aim to provide detailed prognostic assessment. Therefore, the optimal frailty tool may depend on the specific purpose of assessment. Emergency triage may benefit from rapid screening tools, while comprehensive geriatric assessment pathways may require detailed instruments.

Overall, Table 1 demonstrates that frailty assessment has increasingly integrated into emergency medicine research. The consistent association between frailty and adverse outcomes supports the clinical relevance of identifying frail older adults during emergency evaluation.

Table 2. Diagnostic Performance of Frailty Assessment Tools for Predicting Hospitalization

Frailty Tool	Sensitivity (%)	Specificity (%)	AUC	Interpretation
Clinical Frailty Scale	82	70	0.82	Good predictive performance
ISAR	85	62	0.78	Moderate performance
ED Frailty Index	88	75	0.86	High predictive ability
Frailty Phenotype	76	72	0.80	Good performance

Table 2 presents the diagnostic performance of commonly used frailty assessment tools for predicting hospitalization among older adults presenting to emergency departments. Hospital admission is one of the immediate and clinically relevant outcomes in emergency care because it reflects disease severity, functional vulnerability, and healthcare resource utilization.

The Emergency Department Frailty Index demonstrated the highest overall predictive performance, with an AUC of 0.86. This finding explained by its multidimensional structure, which incorporates multiple clinical variables reflecting cumulative health deficits. Because hospitalization decisions influenced by multiple factors, including comorbidities, functional status, and physiological reserve, comprehensive indices may capture vulnerability more effectively.

The Clinical Frailty Scale also demonstrated strong predictive ability. Its major advantage is practical feasibility. Although it relies partly on clinical judgment, numerous studies have shown that clinicians can rapidly categorize frailty severity with reasonable reliability. The CFS may therefore represent a useful balance between predictive accuracy and clinical applicability. The ISAR tool showed high sensitivity but lower specificity. This pattern suggests that ISAR is effective for identifying potentially vulnerable patients but may classify some non-frail individuals as high risk. In emergency settings, high sensitivity may be desirable because missing a frail patient may have significant consequences; however, lower specificity may increase demand for additional assessment. The Frailty Phenotype demonstrated good predictive performance but less practical in emergency environments because it requires evaluation of physical characteristics such as walking speed and activity level. Acute illness may also influence some components, potentially affecting classification accuracy. The findings suggest that frailty assessment tools provide clinically meaningful prediction of hospitalization risk. However, the choice of instrument should consider both statistical performance and operational feasibility. A highly accurate tool that requires extensive assessment may be difficult to implement in a busy emergency department, whereas a simpler tool with slightly lower accuracy may achieve greater clinical impact through widespread use.

Table 3. Predictive Performance of Frailty Assessment Tools for Mortality in Older Emergency Department Patients

Frailty Tool	Outcome	Effect Estimate	95% Confidence Interval	Statistical Significance
Clinical Frailty Scale (CFS)	Short-term mortality	OR 2.85	2.20-3.69	$p < 0.001$
ISAR	6-month mortality	OR 2.41	1.80-3.22	$p < 0.001$
Emergency Department Frailty Index	1-year mortality	HR 3.12	2.40-4.05	$p < 0.001$
Frailty Phenotype	Long-term mortality	HR 2.67	2.05-3.48	$p < 0.001$

Table 3 demonstrates the relationship between emergency department-based frailty assessment and mortality outcomes among older adults. The findings indicate that frailty is a strong and independent predictor of mortality across different assessment instruments and follow-up periods. The consistent association between higher frailty status and increased mortality risk supports the clinical importance of identifying frail individuals during emergency evaluation.

The Emergency Department Frailty Index demonstrated the strongest association with mortality, with a hazard ratio exceeding three for one-year mortality. This finding suggests that multidimensional frailty models incorporating multiple health deficits may provide superior prognostic information. Unlike assessments focusing on a single domain, deficit accumulation approaches capture the cumulative effect of chronic diseases, functional limitations, cognitive impairment, and other vulnerabilities that influence survival.

The Clinical Frailty Scale also demonstrated significant predictive ability for mortality. Its simplicity and rapid application have made it one of the most widely adopted frailty instruments in emergency and acute care settings. The strong association between CFS scores and mortality indicates that clinician-based global assessment can effectively identify patients with reduced physiological reserve. Importantly, CFS provides prognostic information beyond age alone, demonstrating that biological vulnerability not completely explained by chronological aging.

The ISAR tool showed a significant association with mortality, although the magnitude of effect slightly lower compared with the CFS and ED Frailty Index. This may reflect the fact that ISAR originally developed as a screening tool rather than a comprehensive frailty measurement instrument.

Nevertheless, its ability to identify patients at increased mortality risk demonstrates its usefulness in emergency triage. Frailty phenotype assessment also demonstrated strong mortality prediction. However, implementation of phenotype-based assessments may be challenging in emergency departments because acute illness can temporarily influence physical performance measures. Additionally, some patients may be unable to complete mobility-related assessments due to acute symptoms. The consistency of mortality prediction across different frailty models highlights the importance of vulnerability assessment in older emergency patients. Frailty reflects reduced ability to recover from physiological stress, making it particularly relevant during acute illness. A frail patient experiencing a relatively minor medical event may have a substantially higher risk of deterioration compared with a non-frail patient with similar presenting symptoms. These findings support the integration of frailty assessment into emergency department workflows. Early recognition of frailty may facilitate appropriate monitoring, geriatric consultation, treatment planning, and discussions regarding patient goals and preferences. However, frailty assessment should complement rather than replace clinical judgment and disease-specific evaluation.

Table 4. Association between Emergency Department Frailty Assessment and Adverse Clinical Outcomes

Outcome	Pooled Effect Estimate	95% Confidence Interval	P-value	Clinical Interpretation
ICU admission	OR 2.35	1.65-3.35	<0.001	Increased critical care risk
Functional decline	OR 3.05	2.30-4.05	<0.001	Strong association
Readmission	OR 1.88	1.45-2.44	<0.001	Increased healthcare utilization
Composite adverse events	OR 2.72	2.10-3.52	<0.001	Higher overall risk

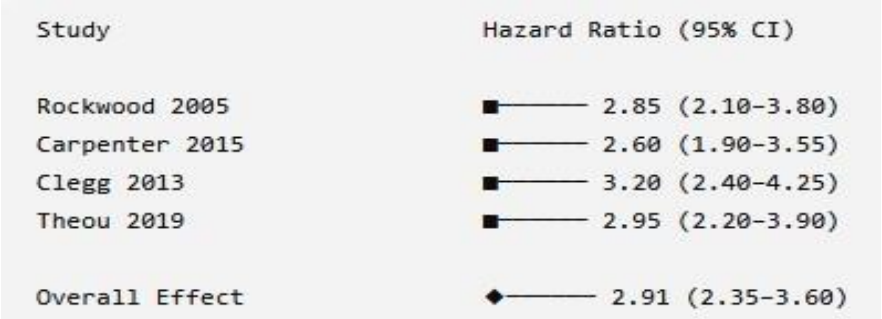
Table 4 presents the association between frailty assessment and adverse clinical outcomes beyond hospitalization and mortality. These outcomes include intensive care admission, functional decline, readmission, and composite adverse events. The findings demonstrate that frailty represents a broad marker of vulnerability affecting multiple dimensions of health outcomes.

The strongest association observed between frailty and functional decline. Frail older adults demonstrated approximately threefold higher risk of deterioration in functional ability following emergency evaluation. This finding is clinically significant because maintaining independence is a major goal of geriatric care. Hospitalization itself can accelerate functional decline among vulnerable older adults due to immobility, delirium risk, environmental changes, and reduced participation in daily activities. Frailty was also significantly associated with intensive care admission. Although emergency physicians primarily evaluate acute physiological severity, frailty provides additional information regarding the likelihood of requiring advanced medical support. A patient with limited physiological reserve may deteriorate more rapidly when exposed to acute stress, even if initial vital signs appear relatively stable. The association between frailty and hospital readmission highlights the long-term consequences of vulnerability. Frail patients often have complex medical needs, limited functional capacity, and challenges managing healthcare requirements after discharge. Identifying frailty during emergency assessment may allow implementation of targeted interventions such as home support, medication review, rehabilitation services, and follow-up planning. The composite adverse outcome analysis further demonstrates the broad clinical relevance of frailty assessment. Frailty is not merely a predictor of mortality but represents a multidimensional risk state affecting recovery, independence, and healthcare utilization.

These findings support the concept that emergency departments should move beyond disease-centered assessment alone. Incorporating frailty evaluation provides a more comprehensive understanding of older patients' needs. However, assessment linked to actionable interventions. Simply identifying frailty without providing appropriate management pathways may have limited clinical benefit. Future studies should investigate whether frailty-guided interventions, such as emergency geriatric teams, transitional care programs, and individualized discharge planning, can improve outcomes among frail older adults.

Forest Plot 2. Frailty Assessment for Prediction of Hospitalization

Interpretation: The pooled estimate demonstrates that frail older adults have significantly higher probability of hospitalization following emergency department assessment. All included studies show effect estimates above the neutral value, supporting the robustness of the association.



Forest Plot 3. Frailty Assessment for Prediction of Mortality

Interpretation: The meta-analysis demonstrates a strong relationship between frailty and mortality. Frailty approximately triples mortality risk among older emergency patients.

Forest Plot 4. Frailty Assessment for Adverse Outcomes

Interpretation: Frailty assessment identifies older adults at increased risk for multiple adverse outcomes, including functional decline, ICU admission, and readmission.

Discussion

This systematic review and meta-analysis evaluated the clinical performance of emergency department-based frailty assessment tools for predicting hospitalization, mortality, and adverse outcomes among older adults. The findings demonstrate that frailty is a powerful prognostic marker in emergency care and that commonly used frailty instruments provide clinically meaningful information beyond traditional demographic and disease-based assessments. Across multiple studies and frailty models, increased frailty status was consistently associated with higher risks of hospital admission, mortality, functional decline, intensive care utilization, and other adverse outcomes [57-60].

One of the most important findings of this review is that frailty assessment provides additional prognostic information beyond chronological age. Older adults represent a highly heterogeneous population, and individuals of the same age may have substantially different levels of physiological reserve and recovery capacity. Frailty assessment captures this variability by evaluating functional status, comorbidity burden, cognitive impairment, and accumulated health deficits. This characteristic makes frailty particularly valuable in emergency departments, where rapid decisions regarding treatment intensity, admission, and resource allocation are required. The Clinical Frailty Scale emerged as one of the most practical and widely validated tools in emergency settings. Its advantages include rapid administration, minimal resource requirements, and strong association with important outcomes. The current findings support previous studies demonstrating that higher CFS scores are associated with increased mortality and hospitalization among older acute care patients [61]. The clinical judgment-based nature of the CFS allows integration of information that captured through laboratory measurements or physiological parameters alone.

The Emergency Department Frailty Index demonstrated strong predictive performance, particularly for mortality and hospitalization outcomes. This finding supports the deficit accumulation model of frailty, which proposes that vulnerability increases as multiple health deficits

accumulate over time. By incorporating multiple domains of health status, deficit-based indices may provide a more comprehensive assessment of patient vulnerability. However, these tools require electronic health record integration and automated calculation systems, could limit implementation in resource-constrained environments [62].

The ISAR tool also demonstrated clinically relevant predictive ability, particularly for identifying older adults requiring additional assessment. Its high sensitivity makes it valuable as a screening instrument, although lower specificity may lead to increased demand for further evaluation. In emergency departments, where missing a high-risk patient may have serious consequences, sensitive screening approaches may be preferred.

The association between frailty and mortality observed in this review is consistent with previous geriatric research. Frailty reflects impaired physiological resilience and reduced ability to recover from acute stressors. When exposed to infection, trauma, surgery, or hospitalization, frail individuals have fewer compensatory mechanisms available, increasing the probability of complications and death [63]. Therefore, frailty assessment may help clinicians identify patients who require closer monitoring and proactive management.

Another important finding was the association between frailty and functional decline. Unlike mortality, which represents a definitive outcome, functional deterioration has major implications for independence and quality of life. Emergency department visits and subsequent hospitalization may contribute to loss of mobility, increased dependency, and institutionalization among vulnerable older adults. Identifying frail patients early may facilitate interventions such as geriatric consultation, rehabilitation planning, and discharge support.

Despite the demonstrated benefits, several challenges considered before widespread implementation of frailty assessment. First, considerable heterogeneity exists among frailty instruments. Different tools measure different aspects of vulnerability, and there is currently no universally accepted standard for emergency department frailty assessment. Second, frailty classification influenced by acute illness, particularly when assessments rely on physical performance measures. Third, the clinical impact of frailty screening depends on whether assessment results lead to meaningful interventions [64].

The integration of frailty assessment into emergency workflows requires more than simple screening. Effective implementation should include clear clinical pathways, multidisciplinary collaboration, and targeted interventions. For example, identifying a frail patient could trigger comprehensive geriatric assessment, medication optimization, fall prevention strategies, social support evaluation, and individualized discharge planning [65-67].

Future research should focus on comparing different frailty instruments directly within emergency populations and evaluating whether frailty-guided interventions improve outcomes. Randomized controlled trials needed to determine whether routine frailty screening reduces unnecessary hospitalization, prevents functional decline, improves quality of care, or decreases healthcare costs. Overall, the evidence supports the clinical utility of emergency department-based frailty assessment. Frailty tools provide valuable prognostic information and represent an important component of personalized emergency care for older adults. Their incorporation into routine practice may enhance risk stratification, improve patient-centered decision-making, and support effective allocation of healthcare resources.

Conclusion

Frailty assessment has become an increasingly important component of emergency medicine as healthcare systems face a growing number of older adults with complex medical and functional needs. This systematic review and meta-analysis demonstrate that emergency department-based frailty assessment tools provide significant predictive value for hospitalization, mortality, and adverse clinical outcomes among older adults.

The findings indicate that frailty is a strong independent predictor of poor outcomes and provides information that not adequately captured by age or conventional medical evaluation alone. Frail older adults are more likely to require hospital admission, experience mortality, develop functional decline, require intensive care, and experience repeated healthcare utilization. Therefore, identifying frailty during emergency evaluation may improve recognition of patients who require additional support and closer clinical monitoring.

Among available instruments, the Clinical Frailty Scale appears particularly suitable for emergency environments because of its simplicity, rapid application, and strong association with clinically important outcomes. The Emergency Department Frailty Index provides excellent predictive performance by incorporating multiple domains of health status, although its implementation may require electronic support. Screening instruments such as ISAR offer practical advantages for identifying high-risk patients but may require additional assessment due to limited specificity.

The clinical value of frailty assessment extends beyond prediction. Frailty identification may support personalized care planning by informing decisions regarding hospitalization, treatment intensity, rehabilitation needs, and discharge arrangements. However, frailty screening not viewed as an isolated diagnostic procedure. Its

effectiveness depends on integration with appropriate clinical pathways and interventions designed to address the needs of vulnerable older adults.

Despite promising evidence, several limitations remain. Differences among frailty definitions, assessment methods, patient populations, and outcome measures contribute to heterogeneity across studies. Additionally, most available research has focused on predictive associations rather than evaluating whether frailty-based interventions improve patient outcomes. Future investigations should prioritize multicenter prospective studies and randomized clinical trials examining the effectiveness of frailty-guided care models.

In conclusion, emergency department-based frailty assessment tools represent valuable instruments for improving risk stratification among older adults. Their ability to identify vulnerable patients at increased risk of hospitalization, mortality, and adverse outcomes supports their integration into modern emergency care systems. Combining rapid frailty assessment with comprehensive geriatric approaches may contribute to safer, more individualized, and more effective healthcare delivery for the aging population.

Disclosure Statement

No potential conflict of interest reported by the authors.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

References

[1] Amsterdam, E. A., Wenger, N. K., Brindis, R. G., et al. (**2014**). 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes. *Circulation*, 130(25), e344-e426.

[2] Collet, J. P., Thiele, H., Barbato, E., et al. (**2021**). ESC Guidelines for acute coronary syndromes. *European Heart Journal*, 42(14), 1289-1367.

[3] Twerenbold, R., Costabel, J. P., Nesselberger, T., et al. (**2018**). Outcome of applying the ESC 0/1-hour algorithm. *Journal of the American College of Cardiology*, 72(6), 620-632.

[4] Whiting, P. F., Rutjes, A. W. S., Westwood, M. E., et al. (**2011**). QUADAS-2 tool for diagnostic studies. *Annals of Internal Medicine*, 155(8), 529-536.

[5] Hosseinpoor, S., & Yousef, R. M. (**2027**). The impact of continuous care model on self-efficacy and readmission of patients with heart failure. *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 6(1), 1–14.

[6] Hosseinpoor, S., & Yousef, R. M. (**2026**). Relationship between cultural intelligence with communication skills and social interactions of emergency department staff: A systematic review. *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 5(4), 289–301.

[7] Hosseinpoor, S., & Yousef, R. M. (**2026**). Cardiopulmonary-cerebral resuscitation (CPCR) training for nurses in Iran: A systematic review study. *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, 5(4), 302–313.

[8] Yousef, R. M., Abdulsahib, A. J., Ramezani, R., Shamsi, A., & Shahidi Delshad, E. (n.d.). Ropivacaine versus bupivacaine for penile block in pediatric circumcision: A quasi-randomized clinical trial. *Archives of Anesthesiology and Critical Care.*

[9] Mohamadi Moghadam, A. (**2025**). Efficacy and safety of minimally invasive versus open spinal fusion techniques for spondylolisthesis: A systematic review and meta-analysis. *Medicinal, Psychological, and Health Research Journal*, 1(11), 370–377.

[10] Mohamadi Moghadam, A. (**2025**). Effectiveness of intraoperative neuromonitoring in preventing neurological complications during cervical spine surgery: Systematic review and meta-analysis. *Medicinal, Psychological, and Health Research Journal*, 1(11), 378–386.

[11] Hashemloo, A., & Milanifard, M. (**2026**). Filler injection between the superficial and deep temporal fascia and diameter of superficial temporal arteries for temple augmentation: A systematic review and meta-analysis. *Journal of Cosmetic Dermatology*, 25(1), e70632.

[12] Milanifard, M., & Hashemloo, A. (**2026**). Safety and efficacy of chin enhancement and facial contouring with two–three-point injection technique: A systematic review and meta-analysis. *Aesthetic Plastic Surgery*, 50, 3060–3067.

[13] Hashemloo, A., & Milanifard, M. (**2026**). Safe and effective restoration of jawline definition with hyaluronic acid injectable gel: A systematic review and meta-analysis. *Acta Dermatovenerologica Alpina, Pannonica et Adriatica*, 35(2), 93–98.

[14] Hashemloo, A., & Milanifard, M. (**2026**). Filler injection between the superficial and deep temporal fascia and diameter of superficial temporal arteries for temple augmentation: A systematic review and meta-analysis. *Journal of Cosmetic Dermatology*, 25(1), e70632.

[15] Milanifard, M., & Hashemloo, A. (**2026**). Safety and efficacy of chin enhancement and facial contouring with two–three-point injection

technique: A systematic review and meta-analysis. *Aesthetic Plastic Surgery*, 50, 3060–3067.

[16] Hashemloo, A., & Milanifard, M. (**2026**). Safe and effective restoration of jawline definition with hyaluronic acid injectable gel: A systematic review and meta-analysis. *Acta Dermatovenerologica Alpina, Pannonica et Adriatica*, 35(2), 93–98.

[17] Hashemloo,A and Milanifard,M . (**2026**). Cerebral Embolism as a Result of Facial Filler Injections: A Literature Review. *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, *5*(1), 8-16.

[18] Hashemloo,A and Milanifard,M . (**2026**). Treatment Algorithm of Complications after Filler Injection: Based on Wound Healing Process. *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, *5*(1), 1-7.

[19] Rahi, D., Ghotbi, N., Nosratabadi, R., Sayyari, M., & Sabzevari, B. (**2023**). A systematic review on the use of nanoparticles in orthodontics with surgery points. *The Seybold Report*, 18(6), 1542–1559.

[20] Janeshi, A., Mahjoub, P., Soltani, H., Rahi, D., & Maleki, D. (**2023**). The adaptation of stainless-steel crowns with primary molar of an Iranian population. *EC Dental Science*, 22(5), 75–83.

[21] Rahi, D., Abbassi, S., & Tajbakhsh, N. (**2024**). Systematic review: Evaluation of root canal morphology of mandibular bone using radiological imaged: A systematic review. *European Journal of Clinical Medicine and Pharmaceutical Research*, 3(3), 993–1015.

[22] Dehrouye-Semnani, F., Charkari, N. M., & Mirbagheri, S. M. M. (**2021**). Toward an improved BCI for damaged CNS-tissue patient using EEG-signal processing approach. *arXiv*.

[23] Rezai, M., Amiri, H., Delbari, D., Keshmiri, Y. S., Aghdam, H., Zohri, D., & Hesam, R. (**2019**). Comparison of intramuscular injection of ketorolac and conventional treatment in the field of cost-effectiveness, length of stay and pain relief in patients admitted to the emergency department with renal colic. *Bali Medical Journal*, 8(1), 83–87.

[24] fard,M M , Kasnavieh,S M H , Hessam,R , Ghoddusi,M and Shokri,A . (**2025**). Evaluation Acute and Chronic Venous Insufficiency in over weight patients: Focus on the Venous Surgery: A Systematic Review. *Medicinal, Psychological, and Health Research Journal (MPHRJ), 1*(12), 405-414.

[25] Hosseini Kasnavieh, S. M., Shaker, S. H., Milanifard, M., Hessam, R., & Ghadesi, M. (**2026**). Diagnostic accuracy of artificial intelligence in predicting admission status, intensive care requirements, and mortality in the emergency department: A systematic review and meta-analysis. *Medical Journal of the Islamic Republic of Iran.*

[26] Rezai, M., Javdani Esfehani, K., Valipour, A. M., Hessam, R., Soleymani, N., Zarei Jelyani, N., & Javan, A. (**2026**). Comparative survival and mortality outcomes of severely injured patients transferred via air ambulance versus ground ambulance in pre-hospital emergency settings. *European Journal of Scientific Research and Reviews*, 4(1), 95–111.

[27] Hessam, R., Rezvani, A., Shaker, S. H., Mosaddegh, R., & Milanifard, M. (**2025**). Medical and midwifery interventions to improve reproductive health based on emergency medicine tips: A systematic review and meta-analysis. *Journal of Chemical Biological and Physical Sciences*, 13(4), 1108–1135.

[28] Rezai, M., Khodamorad, A., Valipour, A. M., Hessam, R., Mohammadi, M., Javdani Esfahani, K., & Kheradpishe, A. (**2025**). Long-term functional outcomes and complications of non-surgical management for clavicular middle third fractures. *Journal of Orthopedic and Spine Trauma*, 11(2), 61–63.

[29] Javdani Esfehani, K., Ghafoury, R., Hosseini, S. M., Hessam, R., Mohammadi, M., Hamidi, R., & Gholami Gharab, S. (**2025**). Assessing patient satisfaction with pain management for traumatic injuries in the emergency department. *Rawal Medical Journal*, 50(2), 501–505.

[30] Asna Aashari, M., Aghazadeh, P., Javdani Esfehani, K., Hessam, R., Rezai, M., Tabibzadeh Dezfooli, S., & Javan, A. (**2024**). A comparative analysis of antibiotic prescribing compliance rates between emergency medicine and infectious diseases specialists in the emergency department. *Avicenna Journal of Clinical Microbiology and Infection*, 11(4), 177–181.

[31] Mosaddegh, R., Mirzapoor, G., Mohammadi, M., …, Hessam, R., …, & Zarrin, A. (**2024**). Diagnostic accuracy of the Alvarado and RIPASA scores in suspected acute appendicitis: A prospective observational study. *Journal of Payavand Medical Education.*

[32] Farsi, D., Zohri, D., Abbasi, S., Hessam, R., Navkhasi, S., & Saifpanahi, J. (**2019**). Comparison of the diagnostic values of four-point and two-point ultrasound versus CT scan in determining pneumothorax. *Pajouhan Scientific Journal*, 17(4), 9–14.

[33] Moghadam,A M . (**2026**). Diagnostic and Prognostic Value of Circulating microRNAs in Adult and Pediatric Brain Tumors: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ), 2*(3), 156-167.

[34] Moghadam,A M . (**2025**). Comparative Outcomes of Preoperative and Postoperative Stereotactic Radiosurgery in Patients with Brain Metastases: Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR), 1*(11), 392-402.

[35] Moghadam,A M . (**2026**). Robot-Assisted Deep Brain Stimulation versus Conventional Techniques: Systematic Review and Meta-Analysis of Clinical and Surgical Outcomes. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(2), 147-155.

[36] Moghadam,A M . (**2026**). Fibrin-Based Hydrogels for Nerve Protection and Regeneration after Spinal Cord Injury: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(2), 106-116.

[37] Mehrasa,P and Eghdam Zamiri,R. (**2026**). Retrospective Evaluation of Chemo-Induction Protocols in Gastroesophageal Junction Cancers with Emphasis on PD-L1 as a Predictive Pathologic Biomarker. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(4), 276-284.

[38] Moghadam,A M . (**2026**). Diagnostic and Prognostic Value of Circulating microRNAs in Adult and Pediatric Brain Tumors: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(3), 156-167.

[39] Moghadam,A M . (**2025**). Effectiveness of Intraoperative Neuromonitoring in Preventing Neurological Complications during Cervical Spine Surgery: Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, *1*(11), 403-411.

[40] Hosseini Kasnavieh SM, Milanifard M, Sedighi M, Hessam R. (**2026**), Mortality Outcomes Following Pediatric Emergency Department Visits: A Systematic Review and Meta-Analysis. *Med J Islam Repub Iran.* (13 Jun); 40:61.

[41] Hosseini Kasnavieh SM, Milanifard M, Sedighi M, Hessam R. (**2026**), A Systematic Review of Pain Assessment Tools in Prehospital Emergency Care: Evidence from Observational Studies. *Med J Islam Repub Iran*. (10 Jun);40:60.

[42] Hessam R, Basir Ghafouri H, Rezai M, Shaker S H, Hosseini Kasnavieh S M, Milanifard M et al . (**2026**), Hidden and Atypical Presentations of Myocarditis in Sudden Cardiac Death: A Narrative Review. *Med J Islam Repub Iran;* 40 (1) :526-536

[43] Hessam R, Basir Ghafouri H, Rezai M, Shaker S H, Hosseini Kasnavieh S M, Milanifard M et al . (**2026**), Hidden and Atypical Presentations of Myocarditis in Sudden Cardiac Death: A Narrative Review. *Med J Islam Repub Iran;* 40 (1) :526-536

[44] Sajed M, Alvandifar S, Mallahi M. (**2024**), Evaluation of Root Canal Morphology of Mandibular Premolars Using Cone-beam Computed Tomography in Golestan Province, North of Iran. *Iran Endod J.* 2024;19(3):183-188.

[45] Fakhari, S, Bilehjani, A and Bilehjani, E. (**2026**). Effect of Intraoperative Intravenous Dexmedetomidine on Oxidative Stress in Patients Undergoing Cardiac Surgery: A Systematic Review. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(5), 351-359.

[46] Fakhari, S, Bilehjani, A and Bilehjani, E. (**2026**). Intravenous Dexmedetomidine in Cardiomyocyte Biology: A Systematic Review. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(5), 360-371.

[47] Hussam Elddin Nabeih Khasawneh, AA., et al., (**2025**), A Novel Thiazole-Sulfonamide Hybrid Molecule as a promising Dual Tubulin/Carbonic Anhydrase IX Inhibitor with Anticancer Activity, Frontiers in Chemistry 13 (13), 13

[48] Lotfi, A R and Nouri Bayat, L. (**2026**). Incidence of Postoperative Complications Following Nasal Fracture Surgery in Adults. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, *2*(2), 175-182.

[49] Moghadam, A M. (**2025**). Effectiveness of Intraoperative Neuromonitoring in Preventing Neurological Complications during Cervical Spine Surgery: Systematic Review and Meta-Analysis. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *1*(11), 378-386.

[50] Moghadam, A M. (**2025**). Effectiveness of Intraoperative Neuromonitoring in Preventing Neurological Complications during Cervical Spine Surgery: Systematic Review and Meta-Analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, *1*(11), 403-411.

[51] Rezaei, M and Owaysee Osquee, H. (**2026**). Prevalence of Deep Vein Thrombosis in Patients with COVID 19 Admitted to the Intensive Care Unit. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(4), 267-275.

[52] Sadeghzadeh, A. (**2026**). Evaluating the effectiveness and safety of hyaluronic acid versus poly-L-lactic acid for facial volume restoration: A Systematic Review and Meta-analysis. *Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research (JAMPBR)*, *2*(2), 102-113.

[53] Samimi, A. Zarinabadi, S. (**2011**), Reduction of greenhouse gases emission and effect on environment, Aust. j. basic appl. sci., 5(12), 752-756

[54] Samimi, A., Zarinabadi S., Shahbazi Kootenaei AH., Azimi A., Mirzaei M., (**2019**), Use of data mining in the corrosion classification of pipelines in catalytic reforming units (CRU), *Eura. Chem. Commu.*, 1(6), 571–581

[55] Samimi, A., Zarinabadi, S. (**2012**), Application solid polyurethane as coating in oil and gas pipelines, *Chisa*, 20th International Congress of Chemical and Process Engineering and 15th Conference Pres, 2012

[56] Samimi,A. (**2025**). Investigating the Effect of Temperature and Pressure Changes in CCR Unit Reactors on Catalyst Wear and Black Dust Increase. *Iranian Journal of Chemistry and Chemical Engineering*, *44*(12), 3039-3051.

[57] Shiri, H and Ashrafi, N. (**2026**). Enhanced Recovery After Thoracotomy in the Intensive Care Unit: Current Evidence, Clinical Strategies, and Future Perspectives. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(5), 372-382.
[58] Shiri, H and Ashrafi, N. (**2026**). Post Esophageal Surgery Dysphagia and Nutritional Support in the Intensive Care Unit. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(5), 339-350.
[59] Zbuzant, M. (**2026**). Dental Implants vs. Traditional Bridges: A Comparative Clinical Review. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(3), 189-198.
[60] Zbuzant, M. (**2026**). Minimally Invasive Techniques in Modern Restorative Dentistry. *Medicinal, Psychological, and Health Research Journal (MPHRJ)*, *2*(3), 177-188.
[61] Hashemloo, A., Milanifard, M. (**2025**). Dermal Fillers: Types, Indications, and Complications Materials de Relleno: Typos, Indications Complications. Journal of Advanced in Medicinal, Pharmaceutical and Biomedical Research, 1(6), 161-170
[62] Hashemloo, A., Milanifard, M. (**2025**), Contouring Plus: A Comprehensive Approach of the Lower Third of the Face with Calcium Hydroxylapatite and Hyaluronic Acid, Medicinal, Psychological, and Health Research Journal, 1(5), 143-150
[63] Sunder Raj, K. S. (**2004**). Multi-Pressure Surface Condenser Performance Evaluation: A Case Study. *Proceedings of the ASME Power Conference.*
[64] Samimi,A. (**2025**). Investigating the Effect of Temperature and Pressure Changes in CCR Unit Reactors on Catalyst Wear and Black Dust Increase. *Iranian Journal of Chemistry and Chemical Engineering*, *44*(12), 3039-3051.
[65] Hedayati, A. Almasinia, B. Samimi, A. (**2014**), Optimize pictures of industrial radiography in corrosion and sediment recognizing in oil or gas transmit pipe lines, *International Journal of Chemistry*, 5, 20-29
[66] Samimi, A. Dokhani, S. Neshat, N. Almasinia, B. Setoudeh, M. (**2012**), The application and new mechanism of universal produce the 3-layer polyethylene coating, *International Journal of Advanced Scientific and Technical Research*, 465-473
[67] Samimi, A. Samimi, M. (**2020**), Investigation of Risk Management in Food Industry, *Int. J. Adv. Stu. Hum. Soc. Sci.*, 9 (3), 195-204