Original Article/*Özgün Araştırma*

doi: 10.54875/jarss.2026.80388

Clinical Outcomes Following Direct Discharge Home From an Intensive Care Unit: A Single-Center Retrospective Observational Study

Yoğun Bakım Ünitesinden Doğrudan Eve Taburculuk Sonrası Klinik Sonuçlar: Tek Merkezli Retrospektif Gözlemsel Çalışma

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ABSTRACT

Objective: This study aimed to evaluate the association of the Modified Early Warning Score (MEWS) at intensive care unit (ICU) discharge and caregiver-related factors with clinical outcomes following direct discharge home (DDH).

Method: This retrospective observational study included 60 adult ICU patients who were discharged directly home after at least 24 hours of clinical stability. Demographic characteristics, ICU admission diagnosis, comorbidities, APACHE II and MEWS at discharge, ICU length of stay, transfer characteristics, 28-day mortality, and ICU readmission were evaluated. Caregiver training and post-discharge care conditions were also recorded.

Results: Sixty patients were included. Ward bed unavailability was recorded in 54 of the 60 patients (90.0%) during the direct discharge home process. The ICU readmission rate was 21.7% and the 28-day mortality rate was 16.7%. No significant associations were found between MEWS, ICU length of stay, or comorbidity burden and either mortality or ICU readmission (p>0.05).

Conclusion: This study describes outcomes following DDH in selected ICU patients. MEWS at discharge was not significantly associated with mortality or ICU readmission. Discharge assessment should incorporate clinical status and post-discharge support. Without a ward-transfer comparison group, these findings cannot establish the comparative safety of DDH.

Keywords: Intensive care units, patient discharge, early warning score, mortality, patient readmission

ÖZ

Amaç: Bu çalışma, yoğun bakım ünitesinden (YBÜ) eve doğrudan taburculuk sonrasında klinik sonuçlarla ilişkili olarak taburculuk sırasındaki Modifiye Erken Uyarı Skoru'nun (MEWS) ve bakım verenlerle ilişkili faktörlerin değerlendirilmesini amaçlamıştır.

Yöntem: Bu retrospektif gözlemsel çalışma, en az 24 saat klinik stabilite sonrasında YBÜ'den doğrudan eve taburcu edilen 60 yetişkin hastayı kapsamaktadır. Hasta demografik özellikleri, YBÜ yatış tanısı, komorbiditeler, APACHE II ve taburculuk sırasındaki MEWS değerleri, YBÜ yatış süresi, transfer özellikleri, 28 günlük mortalite ve YBÜ'ye yeniden yatış verileri incelendi. Bakım veren eğitimi ve bakım koşullarıyla ilgili veriler de kaydedildi.

Bulgular: Altmış hasta analize dahil edildi. Altmış hastanın 54'ünde (%90,0) doğrudan eve taburculuk sürecinde servis yatağı bulunamadığı kaydedildi. YBÜ'ye yeniden yatış oranı %21,7 ve 28 günlük mortalite oranı %16,7 idi. Modifiye Erken Uyarı Skoru, YBÜ'de kalış süresi veya komorbidite yükü ile mortalite ya da yeniden yatış arasında anlamlı ilişki saptanmadı (p>0,05).

Sonuç: Bu çalışma, seçilmiş YBÜ hastalarında doğrudan eve taburculuk sonrası sonuçları tanımlamaktadır. Taburculuk sırasındaki MEWS ile mortalite veya YBÜ'ye yeniden yatış arasında istatistiksel olarak anlamlı ilişki saptanmamıştır. Taburculuk değerlendirmesi klinik durumu ve taburculuk sonrası desteği kapsamalıdır. Servise nakledilen hastalardan oluşan bir karşılaştırma grubu bulunmadığından, bu bulgular doğrudan eve taburculuğun karşılaştırmalı güvenliliğini ortaya koyamaz.

Anahtar sözcükler: Yoğun bakım üniteleri, hasta taburculuğu, erken uyarı skoru, mortalite, hasta yeniden kabulü

Received/Geliş tarihi : 13.08.2026
Accepted/Kabul tarihi : 07.10.2026
Publication date : 28.10.2026

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Cite as: Kocabeyoglu GM, Yıldız D, Akan B, Ozkocak Turan I. Clinical outcomes following direct discharge home from an intensive care unit: A single-center retrospective observational study. JARSS 2026;34(4):292-297.

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INTRODUCTION

Advances in critical care have improved survival among critically ill patients; however, the transition from intensive care to lower levels of care remains a vulnerable period associated with deterioration and mortality (1, 2). Although intensive care unit (ICU) admission criteria are relatively standardized, discharge practices vary across institutions.

Direct discharge home (DDH) from the ICU has emerged as a pragmatic strategy in healthcare systems facing bed shortages or high patient turnover (3). Potential advantages include reduced hospital length of stay and decreased exposure to hospital-acquired complications (4). However, concerns remain regarding patient selection, post-discharge monitoring, and safety (5).

Early warning scores such as the Modified Early Warning Score (MEWS) quantify physiological instability and may support discharge decisions (6). Nevertheless, recovery after critical illness is multidimensional and is influenced by frailty, functional impairment, cognitive status, and social support (7, 8). Caregiver preparedness may also affect post-discharge care and healthcare utilization (9, 10).

Despite increasing interest in DDH, standardized selection criteria and validated prediction models remain limited. This study aimed to evaluate clinical outcomes after DDH and to assess whether MEWS at ICU discharge and selected patient- and caregiver-related factors were associated with 28-day mortality and ICU readmission. The MEWS was selected because of its simplicity, routine availability, and use in discharge decision-making at our institution.

MATERIALS and METHODS

This retrospective observational study was conducted in the ICU of Ankara Numune Training and Research Hospital. The study was approved by the Ankara Numune Training and Research Hospital Ethics Committee (10.04.2018, approval number E-18-2247).

During the study period, from November 1, 2018 to March 1, 2020, 920 patients were monitored in the ICU. Patients considered clinically stable for at least 24 hours were evaluated for potential discharge. Clinical stability was assessed by the physician primarily responsible for the patient's care, based on oxygen requirements, respiratory status, circulatory status, and neurological condition. No predefined numerical thresholds were used; eligibility for DDH was determined through an overall clinical assessment. Patients considered for DDH were selected according to clinical judgment, physiological stability, and system-related factors, including ward bed availability. Seventy patients were discharged directly home and initially included. Ten patients were subsequently excluded because of missing clinical data or inability to contact caregivers, leaving 60 patients for analysis. Twenty patients were considered for DDH but were not ultimately discharged directly home. The reasons for not proceeding with DDH were not documented in the available records; therefore, a breakdown by reason could not be provided. This selection process may introduce selection bias (Figure 1).

Data were retrospectively collected from patient records, medical charts, and structured telephone interviews with caregivers conducted within a few months after discharge. Most caregivers were family members or close relatives. Variables included demographic characteristics, ICU admission diagnosis, comorbidities, APACHE II score, MEWS at ICU discharge, ICU length of stay, transfer characteristics, 28-day mortality, and ICU readmission. Caregiver-related variables included training received and desire to receive training.

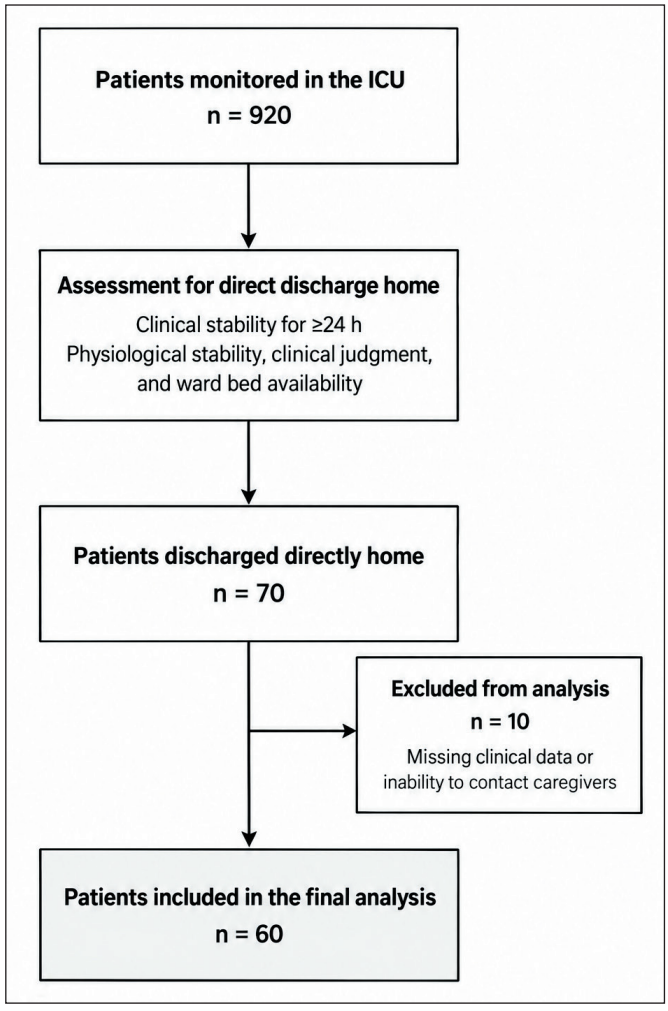


Figure 1. Flowchart of patient selection and study enrollment.
ICU: Intensive care unit.

Transfer delay was defined as the time elapsed from the determination of the transfer destination and timing to the patient's actual departure from the ICU.

The primary outcome was 28-day mortality following DDH. Intensive care unit readmission was defined as readmission to an ICU within 28 days after DDH; hospital admissions without ICU admission were not included in this outcome. Other exploratory outcomes included associations between MEWS and clinical outcomes, transfer delay, and caregiver-related factors. Causes of death were obtained from telephone interviews with caregivers and should therefore be interpreted as caregiver-reported causes.

The DDH decisions were supported by MEWS as part of the overall clinical assessment. A MEWS value of ≥2 was considered to indicate higher physiological risk; however, no absolute cutoff was strictly enforced, and discharge decisions were based on the overall clinical condition, clinical trajectory, and system-related factors.

Statistical Analysis

Statistical analyses were performed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Distributional characteristics were assessed using the Kolmogorov-Smirnov test and homogeneity of variance using the Levene test. Categorical variables were presented as number and percentage. Continuous variables were presented as mean ± standard deviation or median (interquartile range), as appropriate. Categorical variables were compared using the chi-square or Fisher's Exact test. Continuous variables were compared using the Student t-test for normally distributed data and the Mann–Whitney U test for non-normally distributed data. A two-sided p value <0.05 was considered statistically significant.

RESULTS

Among 920 patients monitored during the study period, 70 were discharged directly home and 10 were excluded, resulting in 60 patients for analysis. The mean age was 69.38 ± 18.57 years (range, 18–95 years), the mean APACHE II score was 16.92 ± 7.87 (range, 1–33), and the mean ICU length of stay was 13.42 ± 11.49 days (range, 1–68 days). Thirty-one patients (51.7%) were female and 29 (48.3%) were male. There were no significant differences between female and male patients in age, APACHE II, MEWS, ICU length of stay, or mortality (Table I).

The most common ICU admission diagnosis was respiratory insufficiency (45.0%), followed by cerebrovascular events (16.7%). Other admission diagnoses are presented in Table II.

Ten patients died within the study outcome period, corresponding to a 28-day mortality rate of 16.7%. Caregiver-reported causes of death were respiratory failure in four patients, myocardial infarction in four, and newly developed cerebrovascular events in two. Patients who died had higher comorbidity burden and longer ICU length of stay, but these differences were not statistically significant.

Thirteen of 60 patients (21.7%) were readmitted to the ICU. The most common reasons for readmission were lung infection and newly developed cerebrovascular events (four patients each, 30.8%). Congestive heart failure and sepsis accounted for two cases each (15.4%), and traumatic injury for one case (7.7%). Patients who were readmitted had higher comorbidity burden and longer ICU length of stay, but the differences were not statistically significant.

Table I. Comparison of Demographic and Clinical Characteristics Between Female and Male Patients

	Female (n=31)	Male (n=29)	p
Age (years)	72.65 ± 16.11 76 (21)	65.90 ± 20.59 69 (26)	0.219
APACHE II	17.19 ± 7.81	16.62 ± 8.06	0.781
MEWS	1.58 ± 1.34 1(1)	1.90 ± 1.61 2 (2.5)	0.474
ICU LOS (days)	14.06 ± 13.70 10 (9)	12.72 ± 8.72 10 (11.5)	0.795
Mortality, n (%)	4 (12.9)	6 (20.7)	0.500

Continuous variables are presented as mean ± standard deviation and, where shown, median (interquartile range). Mortality is presented as n (%), with percentages calculated within each sex group. Age, MEWS, and ICU length of stay were compared using two-sided Mann–Whitney U tests with correction for ties and without continuity correction. APACHE II scores were compared using an independent-samples Student's t-test. Mortality was compared using a two-sided Fisher's exact test.
APACHE II: Acute Physiology and Chronic Health Evaluation II, **MEWS:** Modified Early Warning Score, **ICU:** Intensive care unit, **LOS:** Length of stay.

Table II. Diagnoses at ICU Admission

Diagnosis	n	%
Respiratory Insufficiency	27	45.0
Gastrointestinal Hemorrhage	4	6.7
Intoxication	3	5.0
Drug Abuse	2	3.3
Postoperative Illness	1	1.7
Acute Kidney Injury	5	8.3
Sepsis	4	6.7
Cerebrovascular Event	10	16.7
Trauma	4	6.7

Data are presented as n (%). Percentages are calculated using the total study population (n=60).
ICU: Intensive care unit.

Table III. Association between MEWS at ICU Discharge and 28-day ICU Readmission and Mortality

MEWS	ICU readmission within 28 days				p
	No		Yes		
	n	%	n	%	
<2	24	51.1	8	61.5	0.547
≥ 2	23	48.9	5	38.5	
MEWS	**28-day mortality after DDH**				**p**
	Deceased		Living		
	n	%	n	%	
<2	5	50	27	54.0	0.999
≥ 2	5	50	23	46.0	

Data are presented as n (%). Percentages are calculated within each outcome column.
MEWS: Modified Early Warning Score, **ICU:** Intensive care unit, **DDH:** Direct discharge home.

Table IV. Transport Characteristics and Transfer Delay During DDH

	n	%
Mode of transport		
Ambulance	34	56.7
Private vehicle	26	43.3
Transfer Delay Duration		
None	37	61.7
1 hour	2	3.3
2 hours	4	6.7
3 hours	1	1.7
4 hours	3	5.0
5 hours	3	5.0
6 hours	2	3.3
10 hours	1	1.7
1 day	3	5.0
2 days	2	3.3
4 days	2	3.3
Reason for delay (n = 23)		
Family Reasons	1	4.3
Ambulance delay	14	60.9
Carrier service delay	2	8.7
Medical reasons	4	17.4
Late companion arrival	2	8.7

Data are presented as n (%). Percentages for mode of transport and transfer delay duration are based on the total study population (n=60). Percentages for reasons for delay are based on patients with a transfer delay (n=23).
DDH: Direct discharge home.

No statistically significant differences in 28-day ICU readmission or mortality were observed between patients with MEWS <2 and those with MEWS ≥2 at ICU discharge (Table III).

Thirty-four patients (56.7%) were transported by ambulance, and 37 (61.7%) had no recorded transfer delay. Among the 23 patients with a transfer delay, ambulance delay was the most common reason (14 patients, 60.9%) (Table IV). Transfer delay was not significantly associated with 28-day ICU readmission or mortality (Table V).

Twenty-four patients (40.0%) were discharged home without documented consultant approval, either because approval was considered unnecessary or because it was obtained too late. Ward bed unavailability was reported during 54 DDH episodes. Twenty-seven of the 60 caregivers (45.0%) received training for post-discharge care, and 16 (26.7%) expressed a desire to receive training. No significant association was found between caregiver training and mortality (p=0.097). Forty-seven patients (78.3%) did not have access to home-care services after DDH.

DISCUSSION

In this retrospective study of 60 patients discharged directly home from the ICU, the 28-day mortality rate was 16.7% and ICU readmission occurred in 21.7%. The principal finding was that MEWS at discharge was not significantly associated with either outcome. These findings suggest that a single physiological score may be insufficient for post-ICU risk stratification.

The observed mortality and readmission rates indicate that patients discharged directly home remain clinically vulnera-

Table V. Association between Transfer Delay and 28-day ICU Readmission and Mortality

Transfer delay	ICU readmission within 28 days				p
	No		Yes		
	n	%	n	%	
Yes	18	38.3	5	38.5	0.999
No	29	61.7	8	61.5	
Transfer delay	**28-day mortality after DDH**				**p**
	Deceased		Living		
	n	%	n	%	
Yes	4	40.0	19	38.0	0.999
No	6	60.0	31	62.0	

Data are presented as n (%). Percentages are calculated within each outcome column.
ICU: Intensive care unit, **DDH:** Direct discharge home.

ble during the early post-ICU period. Previous studies have shown that ICU readmission and post-ICU mortality may reflect persistent physiological impairment and incomplete recovery rather than discharge timing alone (1, 11, 12).

The lack of association between MEWS and outcomes is clinically relevant. Early warning scores are designed primarily to identify physiological deterioration and may not capture frailty, functional impairment, cognitive status, or social support (13, 14). In our cohort, patients with MEWS values of ≥2 were not necessarily at higher risk of mortality or readmission. This may reflect the limited ability of a single time-point score to represent the overall clinical trajectory. Chronic or stable physiological abnormalities may also influence MEWS without necessarily indicating imminent deterioration.

Other approaches, including the National Early Warning Score 2, Sequential Organ Failure Assessment, and frailty-based tools such as the Clinical Frailty Scale, have been proposed for risk stratification (15, 16). However, these approaches also have limitations when used alone. Functional status and vulnerability may add prognostic information beyond physiological parameters (17). Our findings therefore support a multidimensional approach that combines physiological stability with clinical trajectory, functional status, comorbidity, and social or caregiver support.

System-related factors were prominent in our cohort, with ward bed unavailability recorded in 54 of 60 DDH episodes (90.0%). This finding suggests that DDH decisions were frequently made in the context of limited ward capacity and may have been influenced by organizational constraints alongside clinical assessment. Previous studies have identified organizational factors as important determinants of ICU discharge practices (3, 5). However, ward bed unavailability does not establish that capacity constraints were the decisive reason for DDH in each case. Without a comparison group transferred to a ward, this study cannot determine whether bed shortages influenced post-discharge mortality or ICU readmission. These findings should therefore be interpreted within the institutional context, and their generalizability to settings with greater ward bed availability may be limited. When system pressures influence discharge decisions, structured assessment may be particularly important. Future prospective studies should document how bed availability influences discharge decisions and distinguish clinical readiness for home discharge from organizational pressures.

Caregiver preparedness was another relevant component. Fewer than half of caregivers received training for post-discharge care, and 16 of the 60 caregivers (26.7%) expressed a desire to receive training. No statistically significant association between caregiver training and mortality was found. Most patients did not have access to formal home-care services. These findings highlight the potential importance of transitional care and caregiver support after DDH (9, 10, 18).

The findings should be interpreted in light of the study limitations. The retrospective design introduces the possibility of selection bias and residual confounding. The sample was small, limiting statistical power, and frailty was not systematically assessed. In addition, the outcome analysis included only selected patients who were discharged directly home, and no comparison group of patients transferred to a ward was available. Selection based on clinical judgment and system-related factors may have influenced the observed outcomes. Therefore, the reported mortality and ICU readmission rates are descriptive and cannot establish whether DDH is equivalent to, safer than, or non-inferior to conventional ward transfer. Evaluation of comparative safety requires an appropriate comparison group and adjustment for differences in baseline characteristics and illness severity. The single-center nature of the study may limit the generalizability of our findings to other institutions and patient populations. Finally, caregiver-related data were obtained retrospectively by telephone and were not collected using a validated caregiver burden or satisfaction instrument. Causes of death were reported by caregivers during telephone interviews, which may introduce recall bias and misclassification of the cause of death.

A post-hoc power calculation using G*Power version 3.1.9.7 estimated approximately 42% power for a medium effect size under a two-sided alpha of 0.05 and the observed 16.7% mortality rate. This supports interpreting the negative associations, particularly those involving MEWS, as exploratory rather than definitive.

CONCLUSION

This retrospective observational study describes outcomes following DDH from the ICU in selected patients. Within this small cohort, MEWS at discharge was not significantly associated with 28-day mortality or ICU readmission. These descriptive findings should not be interpreted as evidence that DDH is equivalent to, safer than, or non-inferior to conventional ward transfer. Discharge assessment should consider physiological stability, clinical trajectory, functional status, comorbidities, caregiver preparedness, and available post-discharge support. Comparative studies with adjustment for baseline characteristics and illness severity are needed to evaluate the relative safety and outcomes of these discharge pathways.

Ethics Approval: The study was approved by the Ankara Numune Training and Research Hospital Ethics Committee (10.04.2018, approval number E-18-2247).

Conflict of Interest: This is a statement confirming that all authors have read and affirm that this manuscript is an honest, accurate and transparent account of the study; no important aspects have been omitted; and any discrepancies from the study as planned have been explained. We confirm that there is no conflict of interest.

Funding: The authors did not receive any funding for this study.

AUTHOR CONTRIBUTIONS

Conception or design of the work: IOT, BA

Data collection: GMK, DY

Data analysis and interpretation: GMK, BA

Drafting the article: GMK, DY

Critical revision of the article: GMK

Other (study supervision, fundings, materials, etc): -

The authors (GMK, DY, BA, IOT) reviewed the results and approved the final version of the manuscript.

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