Outcomes of Emergency Medical Patients Admitted to an Intermediate Care Unit With Detailed Admission Guidelines

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Background An important, but not well characterized, population receiving intermediate care is that of medical patients admitted directly from the emergency department.
Objective To characterize emergency medical patients and their outcomes when admitted to an intermediate care unit with clearly defined admission guidelines.
Methods Demographic data, admitting diagnoses, illness severity, comorbid conditions, lengths of stay, and hospital mortality were characterized for all emergency medical patients admitted directly to an intermediate care unit from July through December 2012.
Results A total of 317 unique patients were admitted (mean age, 54 [SD, 16] years). Most patients were admitted with respiratory (26.5%) or cardiac (17.0%) syndromes. The mean (SD) Acute Physiology and Chronic Health Evaluation score version II, Simplified Acute Physiology Score version II, and Charlson Comorbidity Index were 15.6 (6.5), 20.7 (11.8), and 2.7 (2.3), respectively. Severity of illness and length of stay were significantly different for patients who required intensive care within 24 hours of admission (n=16) or later (n=25), patients who continued with intermediate care for more than 24 hours (n=247), and patients who were downgraded or discharged in less than 24 hours (n=29). Overall hospital mortality was 4.4% (14 deaths).
Conclusions Emergency medical patients with moderate severity of illness and comorbidity can be admitted to an intermediate level of care with relatively infrequent transfer to intensive care and relatively low mortality.
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Intensive care resources are limited, but the number of patients needing intensive care is increasing.[1,2] Many patients admitted to intensive care units (ICUs) do not require intensive care and are admitted for close monitoring.[3-6] Intermediate care units (IMCUs), also known as high-dependency units, step-down units, or progressive care units, were created to accommodate patients who do not require intensive care but have needs that surpass the care and monitoring feasible in a general care area.[3,7-11] Patients may be transitioned to an IMCU after being stabilized in an ICU or after having their condition worsen in a general care area, or they may be directly admitted from the emergency department or postanesthesia care unit.

In the past 20 years, billing for intermediate care and the number of IMCUs have increased.[12-14] However, the optimal staffing structure, physical layout, and admission guidelines for these units are not well defined. The organization of IMCUs is complicated by regional needs, institutional missions, clinical expertise, and physical resources. The result is a marked heterogeneity in this level of care and the characteristics of the patients it serves.[15]

This heterogeneity makes the interpretation of IMCU patient outcomes and cost-effectiveness studies difficult.[15,16] Although professional societies and governmental groups have published IMCU admission guidelines,[8,17] they are broad and used in only a few studies.[18-22] Other studies[23-28] specify no guidelines or very limited admission guidelines. Further, most of the publications on IMCUs are old and are focused on the use of IMCUs as an alternative to postoperative ICU monitoring.[15] As a result, a contemporary "benchmark" of IMCU organizational structure paired with patients' characteristics and outcomes is lacking.[15,29,30] Thus, more focused assessments of intermediate care are needed.[15,28,31]

Optimal guidelines for intermediate care units are not well defined.

An important population considered for intermediate care is the population of medical patients admitted directly from the emergency department.[15,18,19,26,28,32] Importantly, patients from the emergency department admitted to IMCUs who require ICU transfer soon after admission have higher mortality rates than do similar patients admitted directly to ICUs.[33] Appropriate initial triage may therefore prevent irreversible deterioration in condition. The purposes of this report are to characterize the organizational structure of a well-established IMCU in a large urban academic medical center, and the diagnoses, severities of illness, and short-term outcomes of medical patients admitted directly from the emergency department in the context of detailed admission guidelines. This characterization may be helpful to institutions contemplating the development of an IMCU and to those interested in comparing their outcomes with outcomes at peer institutions.

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Methods

The study protocol was approved by the institutional review board of Johns Hopkins University (protocol number: NA_00083663).

Study Population

This is a retrospective study of patients admitted directly to the medical IMCU from the emergency department of Johns Hopkins Hospital, an urban academic medical center, between July 1, 2012, and December 31, 2012. All patients age 18 years or older admitted from the emergency department were included. Only data from each patient's first IMCU admission were included.

IMCU Admission and Transfer Guidelines

Admission guidelines were developed from published guidelines with added detail (Table 1), including the intensity of monitoring and nursing

Table 1
Guidelines for intermediate care unit

Category	Admission guidelines	Trigger for intensive care unit consultation or transfer
Monitoring/general	Measure vital signs every 2 h or less often Collect samples for laboratory tests every 2 h (every 1 h for glucose) or less often Continuous pulse oximetry and cardiac monitoring Monitor arterial/venous pressure	Measure vital signs every hour needed for >4 h (one 4-h interval of vital signs measured every hour within 24 h acceptable)
Respiratory	$Pao_2 \geq 60$ mm Hg or $Spo_2 \geq 90\%$ Suctioning every 2 h or less often Nebulizer treatment every 2 h or less often Nasal cannula, hi-flow nasal cannula, oxygen via face mask Bilevel or continuous positive airway pressure (new or long term) Patient >24 h from tracheostomy Prostacyclin infusion for pulmonary hypertension	Fraction of inspired oxygen 1.0 for >24 h Respiratory rate >35/min, accessory muscle use Suctioning every hour or more often >8 h Continuous nebulizer treatment
Cardiovascular		
Hypertension	Hypertensive urgency Intravenous bolus of antihypertensive agent Labetalol, nicardipine, nitroglycerine infusion	Hypertensive emergency Frequent titration of infusions (more often than every 2 h)
Congestive heart failure, myocardial infarction, sepsis	Hemodynamically stable non-STEMI Dopamine ≤10 μg/kg per minute (≤3 titrations/day) Dobutamine ≤10 μg/kg per minute (<3 titrations/day)	STEMI Shock (systolic blood pressure <90 mm Hg or mean arterial pressure <60 mm Hg with end-organ dysfunction) Vasopressor for sepsis
Arrhythmia	Risk of life-threatening arrhythmia Intravenous bolus of adenosine, diltiazem, labetalol, metoprolol Diltiazem, labetalol, and amiodarone infusion	Need for temporary pacer (transcutaneous or transvenous) Bedside cardioversion Frequent titration of infusions (more often than every 2 h)
Gastrointestinal	Gastrointestinal bleeding with orthostasis but not shock ≤10-point decrease from baseline hematocrit Acute liver failure Hepatic encephalopathy ≤grade III Monitoring after uncomplicated TIPSS	Gastrointestinal bleeding with shock/need for venous sheath (Cordis) >10-point decrease from baseline hematocrit Grade IV encephalopathy, hepatic coma
Renal	Bedside intermittent hemodialysis Acute hemodialysis for drug intoxication Electrolyte abnormalities at risk for arrhythmias Electrolyte abnormalities requiring frequent laboratory tests	Hemodynamic intolerance of intermittent hemodialysis
Metabolic	Metabolic disorders requiring frequent laboratory tests (eg, diabetic ketoacidosis, nonketotic hyperglycemia)	
Hematologic	Thrombolytic infusion (no bolus) for stable patients	Bolus or infusion of thrombolytic agents for patients in unstable condition (eg, submassive pulmonary embolism)
Neurological	Neurological checks every 2 h or less often High aspiration risk due to impaired mental status Alcohol withdrawal (benzodiazepine infusions permitted) Opiate overdose (naloxone infusion permitted) Patient-controlled analgesia and epidural pumps for patient-controlled analgesia	Sustained score on Glasgow Coma Scale <9 Neurological checks more often than every 2 h for >8 h Uncontrolled alcohol withdrawal and frequent titration of benzodiazepine infusion
Miscellaneous	Endoscopy without sedation Venous sheaths permitted (nonhemorrhage patients) Arterial sheaths permitted for 4 h	1-to-1 nursing care >4 h
Prohibited	Temporary pacing, pulmonary artery catheters, lumbar drains, intrapleural bupivacaine, bladder pressure monitoring Nonemergent cardioversion, continuous nebulizer treatments, intermittent hemodialysis on vasopressors, continuous renal replacement therapy, procedural sedation	

Abbreviations: Spo_2, oxygen saturation shown by pulse oximetry; STEMI, ST-elevation myocardial infarction; TIPSS, transvenous intrahepatic portosystemic shunt.

care feasible on the unit.[8,34] Note, code status is not addressed by the guidelines. For patients admitted to the IMCU, "triggers" for critical care consultation and ICU transfer were delineated. To preserve continuity, admitted patients could receive short intervals of intense care on the IMCU (ie, hourly checks of vital signs and 1 to 1 nursing for up to 4 hours), although these needs would have precluded initial admission.

Triage to the IMCU

Within the limits of the admission guidelines, triage to the IMCU was determined by the attending physician in the emergency department in conjunction with the admitting medical resident and/or ICU resident as needed. This arrangement allowed clinicians to admit patients who objectively met criteria for IMCU admission to the ICU when there was concern for impending clinical deterioration. Patients with care needs exceeding IMCU standards remained in the emergency department until an ICU bed could be obtained or their condition improved. For patients triaged to intermediate care, the IMCU charge nurse reviewed emergency department data and the inpatient care plan to ensure compliance with admission guidelines.

IMCU Setting

The IMCU is an "open" unit, limited to medical patients.[15] It is near the general medical care areas. All patients receive continuous pulse oximetry and cardiac monitoring (12-lead). During the first 3 months of data collection, the IMCU was a 15-bed unit and admitted a mean of 119 (SD, 7.5) patients per month. During the second 3 months of the study, the IMCU moved to an 18-bed unit and admitted a mean of 136 (SD, 12) patients per month. The mean daily census was 12.5 before the move and 14.9 after the move. During the study period, the hospital staffed 980 beds, of which 230 were controlled by the Department of Medicine. Within the Department of Medicine is a 12-bed cardiac ICU, a 12-bed cardiac IMCU, an 18-bed medical ICU, and the 15- to 18-bed medical IMCU that is the focus of this report. The remaining 170 beds provided routine general care with vital sign assessment every 4 hours and the option of telemetry. Of note, the IMCU and ICUs are located in different buildings and have different nursing and physician staff.

Most patients were admitted with respiratory or cardiac-related syndromes.

IMCU Unit Staffing

Nursing shifts were staffed by a charge nurse without primary patient care responsibilities, 1 or 2 support associates, and a unit clerk, with a nurse to patient ratio of 1 to 3. Nursing shifts were 12 hours with staff changes at 7 AM and 7 PM. An additional 8-hour rotation (7 AM-3 PM, 3 PM-11 PM, 11 PM-7 AM) was staffed by a nurse who supported those on the 12-hour rotations and covered any unexpected absences. Coverage of all shifts was achieved with 29 full-time nurse positions during the first 3 months and 34.5 positions during the second 3 months of the study. To work independently, each nurse completed an 11-week IMCU orientation program of classroom teaching, self-education, supervised bedside learning, and examinations covering unit-specific pharmacology, arrhythmia detection, and general knowledge. A critical care nursing credential was not required. Unit operations were further overseen by a physician medical director, a full-time nurse manager, a clinical nurse specialist (0.2 full-time equivalents [FTEs]), and a unit safety officer (0.2 FTEs).

Ancillary Services

The unit was supported with a unit-dedicated respiratory therapist 24 hours per day. A full-time inventory management clerk maintained stock of all supplies typically used on the unit (1 FTE). Physical, occupational, and speech therapy, wound care services, and nutrition staff were available from a hospital-wide pool. Social workers staffing the IMCU also staffed the medical ICU. Patient transport was supervised by an inpatient critical care transport service so that IMCU nurses were infrequently removed from bedside care.

Physician Providers

Patients admitted to the IMCU were managed by 1 of 8 physician teams. Five teams were general medicine teams, each with 5 intern house staff supervised by 2 resident house staff and 1 attending physician. The other 3 teams were subspecialty teams. One was dedicated to patients living with HIV, and the other 2 cared for patients with other subspecialty problems (ie, pulmonary, gastrointestinal, renal, rheumatologic, cardiomyopathy). Subspecialty fellows and attending physicians supervised the house staff caring for their patients on these services. Patients were assigned to an intern or resident from one of these teams at the time of hospital admission or transfer from an ICU. This physician and team (daytime) and on-call team members (overnight coverage) cared for their patients in the IMCU or

the general care area (after transfer) until hospital discharge. This care included daily bedside assessments and clinical decision-making by the assigned physician and team (rounds). For patients transferred to the ICU, all care responsibilities were assumed by the ICU physician and nursing teams.

Data Collection

Patients admitted from the emergency department to the IMCU were identified from unit admission logs. Data were recorded in duplicate by trained physician abstractors working independently. Inconsistencies were arbitrated by a third independent review. The Acute Physiology and Chronic Health Evaluation (APACHE) II score, Simplified Acute Physiology Score (SAPS) II, and Charlson Comorbidity Index (CCI) were calculated from patient data obtained in the first 24 hours of hospitalization.[35-37] Missing data were assumed normal.

Outcomes

Study outcomes included the proportion of patients for whom an ICU consultation was obtained in the emergency department, severity of illness, comorbidity, lengths of stay (LOS), and hospital mortality. Patients were further characterized by location 24 hours after admission.

Statistical Analysis

Clinical and administrative data were characterized with descriptive statistics. Severity of illness, comorbidity, and LOS among survivors were compared by using the Wilcoxon rank sum test. The Fisher exact test was used for comparisons of hospital mortality. Data are described as means (SD) or medians (interquartile range), as appropriate.

Results

Patients' Characteristics

During the study, 649 different patients were admitted to the IMCU. Of these, 317 (49%) were admitted from the emergency department. The demographic and admitting characteristics are detailed in Table 2. More than half were considered for ICU admission. The mean (SD) for APACHE II score, SAPS II, and CCI was 15.6 (6.5), 20.7 (11.8), and 2.7 (2.3), respectively. Data components for the calculation of APACHE II scores and SAPS II were missing in 2.5% and 6% of patients, respectively. When diagnoses are assigned by organ system, most patients were admitted with respiratory (26.5%) or cardiac-related syndromes (17.0%).

Table 2
Characteristics of 317 patients in the intermediate care unit

Unique admissions	Value
Age, mean (SD), y	54 (16.4)
Female sex, % of patients	51
Race, % of patients	
African American	64
White	31
Asian	1
Other	4
Consultation with intensive care unit while in emergency department, % of patients	55
Days in intermediate care unit, median (IQR)	4 (3-8)
Hospital mortality, % of patients	4.4
Disease severity/comorbidity, mean (SD)	
APACHE II	15.6 (6.5)
SAPS II	20.7 (11.8)
Charlson Comorbidity Index	2.7 (2.3)
Primary diagnostic category, % of patients	
Respiratory[a]	26.5
Cardiac	17.0
Sepsis[a]	13.6
Gastrointestinal	13.6
Endocrine (diabetic ketoacidosis)	12.0
Neurological	10.7
Metabolic/renal	6.6

Abbreviations: APACHE, Acute Physiology and Chronic Health Evaluation; IQR, interquartile range; SAPS, Simplified Acute Physiology Score.
[a] Most often transferred to an intensive care unit within 24 hours of admission to intermediate care unit.

However, when considering specific diagnoses, the most common were sepsis (13.6%) and diabetic ketoacidosis (12.0%).

Characteristics by Need for ICU

After admission, patients followed 1 of 4 pathways. Within 24 hours of admission, 16 (5%) were transferred to the ICU and 29 (9%) were downgraded to a general care area or discharged (Table 3). The 25 patients (8%) transferred to an ICU after 24 hours had a median IMCU length of stay of 2.7 days (IQR, 1.7-3.8 days) before transfer. The remaining 247 patients either died on the IMCU (5 patients) or were downgraded or discharged. Patients transferred to the ICU at any time had higher APACHE II scores ($P<.001$) and SAPS II ($P\leq.06$) scores than did patients who remained on the IMCU at 24 hours and never required ICU transfer. Patients who were downgraded or who were discharged within 24 hours of admission had significantly lower APACHE II ($P=.003$) and SAPS II ($P=.004$) scores than any other group. Comorbidity did not differ. Of the patients transferred to the ICU in the 24 hours following admission,

Table 3
Severity of illness, comorbidity, and mortality by ICU admission status and location at 24 hours

Variable	ICU admission		No ICU admission	
	Before 24 h (n = 16)	After 24 h (n = 25)	IMCU > 24 h (n = 247)	IMCU ≤ 24 h (n = 29)
APACHE II score,[a] median (IQR)	21.5 (18-28.5)[b]	19 (16-22)[b]	15 (10-19)	12 (7-15)[c]
SAPS II score,[a] median (IQR)	26 (12.5-43)[d,e]	26 (22-40)[b]	18 (12-26)	12 (7-20)[f]
CCI,[a] median (IQR)	2 (2-3.5)	3 (1-6)	2 (1-4)	2 (1-3)
No. (%) who died	2 (12.5)[d]	7 (28)[b,g]	5 (2)	0 (0)

Abbreviations: APACHE, Acute Physiology and Chronic Health Evaluation; CCI, Charlson Comorbidity Index; ICU, intensive care unit; IMCU, intermediate care unit; SAPS, Simplified Acute Physiology Score.
[a] Severity of illness and comorbidity calculated from data obtained during the first 24 hours of hospital admission.
[b] $P < .001$ vs No ICU admission groups.
[c] $P = .003$ vs No ICU admission and IMCU > 24 h.
[d] $P = .06$ vs No ICU admission and IMCU > 24 h.
[e] $P = .004$ vs No ICU admission and IMCU ≤ 24 h.
[f] $P = .004$ vs No ICU admission and IMCU > 24 h.
[g] $P = .44$ vs ICU admission before 24 h.

all but 1 received interventions available only in an ICU (Table 4).

Median hospital LOS for survivors was 4 days (IQR, 3-8 days). Among patients who required ICU transfer at any time, hospital LOS was longer (median, 12.5 days; IQR, 8.5-22 days) than for patients who never required ICU transfer (4 days; IQR, 2-7 days; $P < .001$). Hospital LOS was shorter (1 day; IQR, 1-3 days) for patients downgraded within 24 hours compared with all other survivors ($P < .001$). The majority of patients admitted remained on the IMCU at least 24 hours and never required ICU transfer (n = 242). Their median IMCU LOS of 2.4 days (IQR, 1.7-3.7 days).

Respiratory, cardiac, and sepsis syndromes were prevalent diagnoses among patients who experience unplanned ICU transfer.

Mortality

Hospital mortality was 4.4% overall (14 deaths) and was highest among patients transferred to the ICU more than 24 hours after IMCU admission (Table 3), two of whom had limitations in care (do not intubate/resuscitate). Although 5 patients died without ICU transfer, each was pursuing palliative, end-of-life care. No patients downgraded from the IMCU within 24 hours died or required ICU admission.

Discussion

We have characterized medical patients admitted directly from the emergency department to the IMCU of an urban academic medical center. The spectrum of diagnoses admitted, presented with severity-of-illness measures and LOS data, staffing and triage structure detail, and well-defined admission guidelines provide a point of reference that fills a gap in the literature.

Most prior studies of intermediate care have been focused on postoperative patients.[20,25,38-48] Only a few studies[18,19,21,23,24,27,28] report outcomes of predominantly medical patients, but they provide little characterization of patients admitted from the emergency department. Further, descriptions of admission guidelines, triage, and staffing structure are limited in these studies. For example, Franklin et al[27] described a 12-bed IMCU that provided "cardiorespiratory monitoring" and a nurse to patient ratio of 1 to 4. Patient source, severity of illness, and physician staffing models were not detailed. Auriant et al[24] described a 4-bed IMCU within an emergency department. Admission to and discharge from the unit were at the discretion of an intensivist. With the exception of excluding patients in need of mechanical ventilation, hemodialysis, and invasive hemodynamic monitoring, admission guidelines were not detailed, nor was the nurse to patient ratio.

More recently, Torres et al[23] characterized 412 patients admitted to a 20-bed IMCU capable of electrocardiographic monitoring, noninvasive ventilation, invasive hemodynamic monitoring, and use of inotropic agents. Physician staffing and nurse to patient ratio were not reported. Last, Lucena et al[19] described a "closed" IMCU with up to 9 beds staffed by a single physician team composed of residents supervised by a hospitalist. Nurse to patient ratio was 1 to 3 and admission guidelines were those of the Society of Critical Care Medicine, which are nonspecific.[8] Although each study has improved our understanding of intermediate care, a more

Table 4
Description of patients requiring transfer to ICU within 24 hours of admission to IMCU

Patient No.	IMCU admitting diagnosis	Additional clinical picture	Trigger for ICU transfer	ICU care
1	Sepsis	Bacteremia, hypoxic respiratory insufficiency with ALI vs CHF	High nursing needs, worsening hypoxemia	Intubated
2	Alcohol withdrawal	Hypoxemia, mental status change	High nursing needs, worsening hypoxemia, not handling secretions	Intubated
3	Hypertensive urgency	Hypertensive urgency	Intraparenchymal hemorrhage reclassified patient as hypertensive emergency	Frequent titration of intravenous antihypertensive agents
4	COPD exacerbation	Trial of BiPAP	High nursing needs, progressive hypercapnia	Intubated
5	Pneumonia	Progressive hypoxemia	Frequent nursing needs, high oxygen requirement, and high respiratory rate; aggressive fluid resuscitation; frequent nebulized bronchodilators	Intubated
6	COPD exacerbation	Persistent respiratory insufficiency and hypotension	Frequent nursing needs; high oxygen requirement, respiratory rate, aggressive fluid resuscitation; frequent nebulized bronchodilators	Hourly nebulized bronchodilators
7	Hypercapnia	Femur fracture, narcotic therapy for pain; trial of BiPAP	Frequent nursing needs, failed extubation after fixation of femur	Intubated
8	Diabetic ketoacidosis, hypertensive urgency	Hypertensive urgency	Labile blood pressure; acute left iliac artery dissection reclassified patient as hypertensive emergency	Frequent titration of intravenous antihypertensives
9	Pneumonia	Volume overload, left ventricular ejection fraction 15%, tachycardia, progressive hypoxemia	Frequent nursing needs, progressive hypoxemia, initiation of intravenous antihypertensive agents; BiPAP	Diuresis, frequent titration of intravenous antihypertensive agents
10	Alcohol withdrawal	Escalation of intravenous benzodiazepines	Frequent nursing needs and benzodiazepine titration, delirium tremens	Deep sedation and intubation
11	COPD exacerbation	Trial of BiPAP	Frequent nursing needs; progressive hypercapnic respiratory failure	Intubated, treated with vasopressors
12	COPD exacerbation	Trial of BiPAP	Low respiratory rate, progressive hypercapnia; mental status change	Cardiac arrest peri-intubation
13	Sepsis	Progressive hypotension and acidosis despite fluid resuscitation and antibiotics; trial of BiPAP	Frequent nursing needs, mental status change, progressive respiratory failure, and pH 7.10	Intubation, vasopressors, inotropic agents
14	Sepsis	Progressive hypotension, ejection fraction 15%	Frequent nursing needs, hypotension unresponsive to fluid	Vasopressors
15	Sepsis	Progressive hypotension and acidosis despite fluid resuscitation and antibiotics	Frequent nursing needs, progressed to septic shock despite aggressive fluid resuscitation and antibiotics; PEA arrest	Intubated, vasopressors
16	NSTEMI	Dyspnea	Troponin > 30 ng/mL	None

Abbreviations: ALI, acute lung injury; BiPAP, bilevel positive airway pressure; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ICU, intensive care unit; IMCU, intermediate care unit; NSTEMI, non-ST-elevation myocardial infarction; PEA, pulseless electrical activity.

standardized definition and consistent admission guidelines would improve the interpretability of future research.

When considering admission guidelines for intermediate care, special attention should be given to the clinical course of patients who are more likely to deteriorate and require an ICU. In our study, 5% of patients required ICU transfer within 24 hours. These events may suggest undertriage and occurred most often in patients admitted with respiratory syndromes (eg, exacerbation of chronic obstructive pulmonary disease, pneumonia) or sepsis. Two other studies[26,32] have addressed this concept. In one, patients admitted to mixed medical-surgical IMCUs were defined as undertriaged if they required "active life support therapy" during the first day of admission.[3,26] Undertriage occurred in 8.3% of 8971 patients, of whom 38% were admitted from an emergency department. Among nonsurgical patients, undertriage occurred most often in patients with pneumonia, sepsis, cardiac dysrhythmias, and gastrointestinal bleeding. The other study[32] was composed of predominantly nonsurgical emergency department admissions to a general care area or IMCU in 13 hospitals. Again, the most common diagnoses among patients transferred to an ICU within 24 hours of admission included respiratory, cardiac, and sepsis syndromes. Patients with these syndromes may therefore represent easily identifiable subpopulations that may benefit from further study to identify features that would trigger earlier ICU admission.

Intermediate care has an established role in managing moderately ill emergency medical patients.

We have presented data on severity of illness, comorbidity, mortality, and LOS. Because IMCU structure and admission criteria of prior studies have varied, and because of our focus on medical patients admitted from the emergency department, it is not appropriate to compare our results with results previously published. However, severity of illness and hospital LOS differed significantly between patients who were transferred to the ICU, patients who remained on the IMCU at 24 hours and never required ICU care, and patients who were downgraded or discharged within 24 hours of hospital admission. These findings are consistent with the presence of distinct subpopulations admitted from the emergency department to our IMCU. Importantly, median IMCU LOS for patients remaining in the IMCU at 24 hours who never required ICU transfer (76% of all patients) was 2.4 days. These observations, and the fact that 55% of our patients were assessed by the ICU team before admission, suggest that intermediate care has an established role in our management of moderately ill emergency medical patients.

This study has important limitations. First, our findings reflect the experience of a single center and are limited to medical IMCU patients admitted directly from the emergency department. The extent to which our guidelines would be acceptable and our results reproducible in other centers is not clear. However, because we have provided a detailed description of our unit staffing model (ie, nurses, physicians, managers, others) and detailed admission guidelines, our results build upon recent multicenter epidemiologic studies.[14,21,26,28,32] Although larger studies provide valuable insight into trends that may be present in many health care systems, researchers in those studies did not report the organizational detail we have provided. Such detail may be helpful to institutions contemplating the development of an IMCU and to staff at those institutions interested in comparing their outcomes with outcomes of peer institutions.

Second, it has been well demonstrated that the presence of guidelines does not translate directly to adherence to those guidelines.[49,50] Based on chart review, we have confidence that all but 1 patient transferred to an ICU within 24 hours truly progressed to require intensive care (Table 4). However, it is likely that some patients received intensive care in the IMCU without ICU transfer. Indeed, to preserve continuity of care, short-term intense care may be preferred to ICU transfer in some patients. Our unit guidelines address this situation by allowing a time-limited period of intense care (ie, hourly checks of vital signs for up to 4 hours and hourly suctioning for up to 8 hours), even though these needs would preclude initial admission.

Third, we assumed that any missing data components in our calculation of APACHE II and SAPS II scores were normal. Although this assumption was made in only 2.5% of APACHE II and 6% of SAPS II calculations, our scores could underestimate the true severity of illness in some patients. We chose APACHE II and SAPS II scores because they have previously performed well in the IMCU setting, and because they are well understood by the critical care community thanks to their frequent use.[19,22,24] Only recently was an IMCU-specific severity of illness and mortality prediction model developed (IMCU Severity Score).[22] This new score was not available at the time of our data collection and should undergo external validation before broad use.

Last, although mortality was higher among patients admitted to the ICU, the study was not designed to assess the cause of this higher mortality. However, it is reasonable to consider that deaths of patients transferred to the ICU within 24 hours of admission may represent undertriage. Although deaths among those transferred to the ICU after 24 hours could reflect undertriage too, they may also suggest failure of therapy or limitations in ICU bed availability.

In conclusion, using detailed admission guidelines with triggers for ICU consultation and transfer, we have shown that emergency medical patients with moderate severities of illness and comorbidity, many of whom were considered for ICU admission in the emergency department, can be admitted to an IMCU with relatively infrequent ICU transfer and relatively low mortality. A more standardized definition of intermediate care and IMCU admission guidelines will improve the interpretability of the results of future research in this area.

FINANCIAL DISCLOSURES
None reported.

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CE 1.0 Hour Category C

Notice to CE enrollees:

This article has been designated for CE contact hour(s). The evaluation tests your knowledge of the following objectives:

1. Characterize the organizational structure of an established medical intermediate care unit.
2. Describe admission guidelines for a medical intermediate care unit and triggers for critical care consultation and transfer.
3. Delineate the established role of intermediate care in the management of emergency medical patients.

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