Sepsis as the primary admitting diagnosis of transferred patients who died within 48 hours of arrival at a Central Texas hospital

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ABSTRACT

Interhospital transfers are independently associated with inpatient mortality, and transferred patients have worse outcomes. The aim of this study was to retrospectively assess the 48-hour mortality rate in interhospital transfer cohorts of all transfers to a Central Texas teaching hospital and to identify a primary admitting diagnosis for potential intervention. A total of 15,435 patients with 19,161 transfers over the course of the study were retrospectively reviewed and placed in 18 different categories based upon the primary admitting diagnosis. There were about 5000 transfer patients yearly with ~1.4% deaths within 48 hours of arrival. The three leading categories for transferred patients were cardiovascular, neurologic, and psychiatric. In this group, 268 of 19,161 transfers died within 48 hours of arrival. Despite being the 10th leading category for transfer, sepsis was the leading primary admitting diagnosis of patients who died within 48 hours of arrival, accounting for nearly 22% of those patients. Given the significant association found between sepsis and 48-hour mortality after transfer, we devised a novel interhospital transfer checklist based upon the Surviving Sepsis guidelines in an attempt to decrease mortality associated with these transfers.

KEYWORDS Checklist; interhospital transfers; mortality; sepsis; shock

With the increased role of regional tertiary centers in providing specialist and higher-level care to smaller surrounding communities, interhospital transfers (IHTs) remain a topic of interest in improving patient outcomes. An IHT, defined as a patient transfer from an outside facility to another facility, is independently associated with inpatient mortality.¹ In general, transferred patients have worse outcomes.^{2,3} In addition, an IHT consumes more resources than a patient who is directly admitted to the hospital.⁴ The practice of IHTs varies widely from one institution to the next,⁵ and most hospitals do not have supplemental IHT criteria outside of the receiving physician's discretion and the Centers for Medicare and Medicaid Services Emergency Medical Treatment and Labor Act guidelines.⁶ These guidelines place the onus on a transferring facility to stabilize the patient

while also requiring participating hospitals with specialized capabilities to not refuse an appropriate transfer request from a regional referral center or rural area. Mortality after transfer has been assessed in specific patient populations, such as stroke, acute myocardial infarction, and trauma,^{7–9} with these studies emphasizing appropriate triage and direct transfer to tertiary care centers for improved outcomes. To decrease mortality rates, specific diagnoses may warrant additional attention and intervention by an institution accepting transfers. Our hospital commonly accepts hospital transfers from outside facilities and historically has accepted all IHTs for higher-level care. This study retrospectively assessed the 48-hour mortality rate of all transfers to our facility from February 1, 2014, to December 31, 2017, and identified a primary admitting diagnosis for potential intervention.

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Table 1. Primary diagnosis category of all patients compared to those who died within 24 hours of transfer

Variable	All patients transferred (N = 19,161)	Patients who died within 48 hours of transfer (N = 268)
Cardiovascular	2558 (13.35%)	57 (21.2%)
Dermatology	119 (0.62%)	1 (0.37%)
Endocrinology	327 (1.71%)	0
Gastrointestinal	2388 (12.46%)	19 (7.09%)
Hematology/oncology	755 (3.94%)	17 (6.34%)
Infectious	873 (4.56%)	8 (2.99%)
Musculoskeletal	915 (4.78%)	3 (1.12%)
Nephrology	601 (3.14%)	7 (2.61%)
Neurology	2445 (12.76%)	48 (17.91%)
Obstetrics/gynecology	428 (2.23%)	0
Ophthalmology	76 (0.40%)	0
Other	609 (3.18%)	1 (0.37%)
Psychiatry	2403 (12.54%)	0
Respiratory	1582 (8.26%)	40 (14.93%)
Rheumatology	37 (0.19%)	0
Sepsis	835 (4.36%)	58 (21.64%)
Surgical	1298 (6.77%)	7 (2.61%)
Toxins/poisoning	912 (4.76%)	2 (0.75%)

METHODS

We conducted a retrospective review of all IHTs between February 1, 2014, and December 31, 2017, at a tertiary care referral center in Central Texas. This study protocol was approved by the local institutional review board under approval number 018-140. The primary admitting diagnoses were placed into 18 different categories: cardiovascular, dermatologic, endocrinology, gastrointestinal, hematology/oncology, infectious, musculoskeletal, nephrology, neurologic, obstetric/gynecologic, ophthalmology, other, psychiatric, respiratory, rheumatology, sepsis, surgical, and toxins/poisoning. Demographic information was also collected.

Percentages and frequencies were calculated for categorical variables. Means and standard deviations, or medians and ranges, were provided for continuous variables. Because patients could be transferred more than once during the study period, a generalized estimating equation with a binomial distribution and a logit link was applied. The outcome of the model was discharge status (alive vs deceased). Univariate analysis assessed the association between discharge status and each predictor variable. A significance level of $\alpha = 0.05$ was used for all tests. All statistical analyses were performed in SAS 9.4.

RESULTS

During the study period of nearly 4 years, there were 19,161 transfers to our facility. The most common primary

diagnosis categories as the reason for transfer were cardiovascular (13.4%), neurologic (12.8%), psychiatric (12.5%), and gastrointestinal (12.5%) (*Table 1*). Death occurred within 48 hours of arrival in 268 patients (1.4%), with 75 deaths in 2014, 67 in 2015, 60 in 2016, and 66 in 2017. From the deceased population, there was an even distribution by gender (135 women [50.4%] and 133 men [49.6%]). Most (66%) of the deceased population was white; 5 (1.87%) were Asian, 41 (15.3%) black, 2 (0.75%) Native Hawaiian/other Pacific Islander, 1 (0.37%) other, and 20 (7.46%) race unknown. The median age at presentation was 70 years (range 1–95), and the median body mass index was 27.75 (range 9.47–66.28).

In our study population, sepsis was the 10th leading category requiring transfer. However, it was the most common primary diagnosis category for patients who died within 48 hours of transfer, accounting for 21.64% of the deaths (*Table 1*). Within the sepsis population, 76% required direct admission to the intensive care unit (ICU) upon initial presentation. When risk factors for mortality were calculated by univariate regression analyses, sepsis had an odds ratio of 6.45 (95% confidence interval, 4.77–8.68; $P < 0.0001$) (*Table 2*).

DISCUSSION

Having a transfer accept instrument in a medical ICU setting can be effective for timely implementation of critical interventions as well as possibly reducing mortality.¹⁰ In the

Table 2. Independent risk factors for mortality

Parameter	Odds ratio (95% confidence interval)	P value
Age at service ^a	1.035 (1.03–1.04)	<0.001
Case body mass index	0.998 (0.99–1.01)	0.75
Female	1.003 (0.79–1.28)	0.98
AIDS	0.336 (0.05–2.43)	0.28
Acute myocardial infarction	1.575 (1.18–2.11)	0.002
Cancer	1.106 (0.71–1.72)	0.66
Cerebrovascular disease	1.193 (0.88–1.61)	0.25
Congestive heart failure	1.667 (1.31–2.13)	<0.001
Chronic pulmonary disease	1.684 (1.28–2.22)	<0.001
Connective tissue disease	1.215 (0.68–2.18)	0.51
Dementia	1.316 (0.85–2.03)	0.21
Diabetes mellitus	1.057 (0.81–1.38)	0.68
Hemiplegia	0.798 (0.35–1.80)	0.59
Leukemia	1.894 (0.93–3.88)	0.08
Liver disease	1.357 (1.04–1.78)	0.03
Lymphoma	0.859 (0.21–3.50)	0.83
Peripheral vascular disease	1.622 (1.19–2.22)	0.002
Renal disease	2.007 (1.57–2.56)	<0.001
Ulcer disease	0.867 (0.87–0.87)	0.58
Sepsis	6.440 (4.77–8.68)	<0.001

^aOdds ratio reported is for a 1-year increase in age.

study by Malpass et al, an accepting ICU physician would use this tool to aid in coordination of the ICU IHT.¹⁰ This transfer accept instrument had four main sections: patient data, reason for transfer, treatment recommendations, and condition on arrival.¹⁰ Insufficient documentation that is not standardized can lead to miscommunication or worse patient outcomes. An abundance of literature supports the use of evidence-based interventions and checklists in the medical community. For instance, the Michigan Health and Hospital Association Keystone Center for Patient Safety and Quality Keystone ICU project demonstrated that an evidence-based intervention, through utilization of patient safety programs, reduced catheter-related bloodstream infection rates in an ICU setting.¹¹ In the Safe Surgery Saves Lives initiative, using a surgical checklist was associated with a reduction in death and complication rates in patients undergoing noncardiac surgeries.¹²

Guidelines highlighting the importance of door-to-needle or door-to-balloon time have steadily decreased the mortality for neurologic and cardiovascular cases, respectively.^{13,14} Although recommendations for sepsis, such as the 3-hour and 6-hour bundle, are commonly utilized,¹⁵ compliance with these bundles before transfer may be difficult to initiate and document.

Surviving Sepsis Checklist

To be completed by a physician accepting a transfer from an outside facility when the primary admitting diagnosis is sepsis.

- Was a **lactate level** measured?
☐ Yes ☐ Recommended to do so
- Were two sets of **peripheral blood cultures** obtained?
☐ Yes ☐ Recommended to do so
- **Antibiotics:** Were broad-spectrum intravenous antibiotics started prior to transfer—vancomycin/Zosyn or if penicillin allergy vancomycin with cefepime/metronidazole, a fluoroquinolone/metronidazole, or aztreonam/metronidazole?
☐ Yes ☐ Recommended to do so
- **Source control:** Was anatomic source control accomplished prior to transfer if feasible?
☐ Yes ☐ No ☐ Not applicable
- **Fluids:** Was the patient given 30 cc/kg of intravenous crystalloid boluses prior to transfer?
☐ Yes ☐ Recommended to do so
- **Vasopressor:** Was the patient started on norepinephrine for septic shock prior to transfer?
☐ Yes ☐ Not applicable
- **Mechanical ventilation:** Is the patient intubated, and if so, was a target tidal volume of 6 mL/kg of predicted body weight as well as a plateau pressure of ≤30 cm H₂O instituted?
☐ Yes ☐ Not applicable

Figure 1. An interhospital transfer checklist based on the Surviving Sepsis guidelines.^{18,19}

Nevertheless, these recommendations should be initiated in the absence of contraindications. Documentation and information handoff for IHTs have been studied,¹⁶ with reports of higher documentation completion associated with reduced in-hospital mortality and reduced duplication of labor. Transferred patients generally have increased in-hospital adverse events and higher risk-adjusted mortality,¹⁷ which puts even greater emphasis on a tool or protocol to mitigate these risks.

Given the significant association found between sepsis and 48-hour mortality after transfer to our facility, we have devised a novel IHT checklist based on the Surviving Sepsis guidelines (*Figure 1*).^{18,19} The accepting physician is required to review the IHT checklist with the transferring physician. This checklist is not meant to delay care but attempts to reduce mortality by promoting initiation of optimal treatment before transfer or en route to the hospital and to increase compliance with the sepsis bundle. This tool may also demonstrate findings similar to those of Malpass et al¹⁰ with the transfer accept instrument in the medical ICU setting, which resulted in less immediate changes in antibiotic therapy and reduction in the placement of emergent central venous catheters upon arrival, with a reported compliance rate of 90% over the length of the study.¹⁵

The implementation of a transfer accept instrument would further assist with deciding whether to accept the patient to the ICU or a non-ICU floor. Within our cohort, 24% of

septic patients who expired within 48 hours arrived on a non-ICU floor. Systems such as the Acute Physiology and Chronic Health Evaluation can help determine mortality in the ICU¹⁴; however, the decision for patient placement relies heavily on clinical acumen. The transfer accept instrument may lead to earlier ICU evaluation, especially when several recommendations cannot be performed before transfer.

There are limitations of this study to consider. This was a retrospective analysis of all transfers from February 1, 2014, to December 31, 2017, and we are unable to speculate how a transfer accept instrument would affect the mortality rate of septic patients. Although sepsis was significantly associated with 48-hour mortality after transfer to our facility, the low predictability of our model indicates that other factors need to be considered. For example, a patient's underlying comorbidities could have been a confounding variable in this subset of patients. Further consideration should also be given to the potential role of telemedicine before transfer. With the increased utility of telemedicine, IHTs have increased in some centers²⁰; however, this may prove to be another tool for assessment to assure appropriate placement and management of these often critically ill patients.

In conclusion, sepsis was found to be the most common primary admitting diagnosis for patients who died within 48 hours of transfer to our Central Texas hospital. Further studies, including individualized chart reviews, are needed to better elucidate cause of death for the 268 transferred patients who died within 48 hours of arrival. We are also planning a quality improvement initiative with utilization of the Surviving Sepsis checklist for all IHTs to the ICU at this Central Texas teaching hospital.

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