Factors Associated With the **Rate of Sepsis After Surgery**

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BACKGROUND Sepsis is a critical illness that requires early detection and intervention to prevent disability and/or death.
OBJECTIVE To analyze the association between various hospital-related factors and rates of sepsis after surgery in Massachusetts hospitals.
METHODS The sample consisted of 53 hospitals with intensive or critical care units and 25 hospitals with step-down units. Hospital characteristics, staffing levels, and health care–acquired conditions were examined using publicly available data. Analysis of variance and linear regression were performed to explore the relationship between nurse and physician staffing levels and sepsis rates.
RESULTS Sepsis rates were significantly lower when nurses cared for fewer patients ($P < .001$) and when intensivist hours were greater ($P = .03$). Linear regression for nurse staffing revealed that higher rates of catheter-associated urinary tract infection ($P = .001$) and higher numbers of step-down patients cared for by nurses ($P = .001$) were associated with a significantly higher rate of sepsis ($P < .001$). Linear regression for physician staffing revealed that higher rates of catheter-associated urinary tract infection ($P < .001$) and wound dehiscence after surgery ($P < .001$), greater hospitalist hours ($P = .001$), and greater physician hours ($P = .05$) were associated with a significantly higher sepsis rate, while greater intensivist hours were associated with a lower sepsis rate ($P = .002$).
CONCLUSION In this study, greater nurse staffing and intensivist hours were associated with significantly lower rates of sepsis, whereas greater physician staffing and hospitalist hours were associated with significantly higher rates. Further research is needed to understand the roles of the various types of providers and the reasons for their differing effects on sepsis rates. (*Critical Care Nurse*. 2020;40[5]:e1-e9)

Nearly every 20 seconds in the United States alone, someone is diagnosed with sepsis. The number of sepsis cases per year is increasing and currently totals 1.7 million. Sepsis, a medical emergency, is a critical illness resulting from a toxic reaction to an infection, with often dire consequences that may include death.[1] Globally, 30 million people die of sepsis each year,[2] while in the United States sepsis accounts for approximately 270 000 deaths per year.[3] Although 87% of cases are community acquired,[3] sepsis is the leading cause of death in US hospitals.[4]

As a result of awareness campaigns, increasing attention is being given to early recognition and prompt treatment of sepsis. Given the large number of sepsis cases worldwide, it is critical to understand factors that may contribute to increased rates of sepsis. Although it is well known that sepsis has many contributing factors including the presence of open wounds, urinary tract infections, age, and overall medical condition, to date no studies have addressed the impact of hospital characteristics and staffing levels on

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rates of sepsis. Therefore, the aim of this study was to examine hospital characteristics and staffing levels and how these factors may affect health care–acquired conditions that are associated with rates of sepsis.

Background

Sepsis Awareness

Consensus guidelines have been developed in the United States, England, and Germany that define the term *sepsis* and describe the latest evidence-based practice standards for treatment. Previously, however, a wide array of terms was used to describe sepsis. The use of variable diagnostic codes in large databases has contributed to the confusion about the condition. Because of the lack of a clear definition, sepsis has been challenging to track in epidemiological studies. In fact, it was not until 1990 that the Centers for Disease Control and Prevention (CDC) issued the first epidemiological report on sepsis.[5]

Consistent with governmental agencies of other countries, the CDC defines sepsis as an acute and overwhelming reaction to an infection that may result in tissue damage, organ failure, amputation, and death. The etiology of sepsis can be bacterial, viral, fungal, or parasitic. Common sites of infection are the kidney, skin, lungs, and gastrointestinal tract.[6] Although anyone can become septic, some populations are particularly vulnerable: those younger than 1 and older than 65 years, immunocompromised individuals, and those with chronic conditions such as diabetes.[6] Sepsis is considered a "silent" critical illness, requiring attentive assessment of subtle changes in a person's condition for early and accurate detection.

Key symptoms of sepsis include confusion or disorientation, shortness of breath, rapid heart rate, fever or shivering, feeling very cold, extreme pain or discomfort, and clammy or sweaty skin.

Prevention of infection through proper hand hygiene and immunizations helps to reduce the incidence of sepsis. However, early detection and treatment of sepsis are critical to reducing the risk of negative outcomes, including death. Therefore, a growing global focus on sepsis has resulted in many checklists and initiatives designed to facilitate early detection, some of which have been incorporated into health systems' electronic health records.

Notwithstanding the previously varying definitions of sepsis that have resulted in insufficient tracking, it is indisputable that survival from sepsis is poor, at only 30%.[7,8] In those who do survive, the lingering effects of sepsis are often devastating, with an estimated 50% of survivors experiencing significant complications consistent with postsepsis syndrome, including organ damage and loss of limb or limbs.[9]

Early Intervention

Recently, some sepsis awareness initiatives have focused on the importance of attunement to subtle changes in a person's condition in order to detect the event early. Although patient presentation is variable, consensus has emerged on the most common signs and symptoms of sepsis. The CDC has reported that key symptoms include confusion or disorientation, shortness of breath, rapid heart rate, fever or shivering, feeling very cold, extreme pain or discomfort, and clammy or sweaty skin.[6] The Sepsis Alliance uses the acronym TIME: temperature (higher than normal), infection (signs and symptoms of), mental decline (confusion, difficulty to rouse), and extremely ill (severe pain or discomfort).[1] The CDC, the Sepsis Alliance, and other international groups have undertaken initiatives to educate the public and health care providers, particularly physicians and nurses, about the signs and symptoms of sepsis as well as the need for early intervention to prevent negative outcomes.[1,6] Research has indicated that mortality from sepsis increases by 8% for every hour that diagnosis and treatment are delayed, yet early identification of the symptoms of sepsis with subsequent treatment has the potential to prevent 80% of sepsis-related deaths.[10-12]

Evidence consistently suggests that sepsis rates are increasing. This increase is due in part to an aging

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population, people living longer with multiple comorbidities, improved surveillance tracking the condition, and more frequent use of the diagnostic codes capturing sepsis.[5] Sepsis is financially costly to hospitals. A report from the Agency for Healthcare Research and Quality (AHRQ) on data from 2011 indicated that of all hospital conditions, sepsis was the most expensive to treat, costing $23.7 billion per year and accounting for 6.2% of the aggregate costs.[13] Nineteen percent of those discharged after a diagnosis of sepsis are readmitted within 30 days, further contributing to the associated costs.[14]

Nurse Intuition

Complementing the growing emphasis on sepsis checklists and treatment guidelines aimed at early intervention,[9,15,16] some recent research, primarily by nurses, indicates that nurses' intuition may play an important role in the early recognition of sepsis. In a systematic review of "nurse worry," Douw and colleagues[17] identified 18 studies that supported nurse worry as an early indicator of a critical event preceding any change in the patient's vital signs or other evidence of deteriorating condition. Nurse worry has also been found to correlate with activation of the rapid response team and early intervention to manage the critical event.[18]

To date, little is known about nurse worry related specifically to sepsis. However, in a study involving 181 nurses in a neonatal intensive care unit, Boettiger et al[19] found that 73% of participants were able to determine that a neonate was septic before identification of any diagnostic criteria correlating with that diagnosis. The Sepsis Alliance[1] focuses on educating nurses to both assess for and report indicators of sepsis and suggests that nurses need not be afraid to report and/or escalate their concerns when they sense that something is wrong with a patient, suggesting that the importance of nurse worry is widely recognized.[20]

In a concept analysis of failure to rescue across all critical conditions, Mushta and colleagues[21] identified 3 components of failure to rescue: failure to recognize, failure to escalate, and poor decision-making. Failure to recognize includes the nurse's inability to recognize a patient's physical cues of sepsis. This ability is often dependent on the nurse's previous experience. Failure to escalate involves nurses' lack of confidence in approaching the medical team with vague concerns that may not correlate with physical symptoms or a sense of intimidation by hierarchy that can make them afraid to express their concerns. Poor decision-making is the nurse's lack of ability or awareness, again often based on experience or lack thereof, to pull the clinical picture together and know what to do.[21] The authors suggested that frequent rounding is necessary to build teamwork and educate nurses on assessment cues and help them "tune into" subtle changes in patients' conditions and encourage them to escalate situations that concern them. Previous research in the area of failure to rescue indicated that an inability to perform such frequent rounding often stems from poor staffing levels.[22,23]

Methods

Study Design

This cross-sectional study analyzing factors associated with the rate of sepsis after surgery in Massachusetts hospitals used publicly available, deidentified data from 2015 provided by the Massachusetts Hospital Association[24] and therefore was exempt from institutional review board approval. The sample used to examine the relationship between registered nurse staffing and sepsis rates consisted of 53 Massachusetts hospitals with intensive or critical care units and medical-surgical units and 25 Massachusetts hospitals with step-down units. The sample used to examine the relationship between physician staffing and sepsis rates consisted of 54 Massachusetts hospitals with physicians and medical residents, 41 Massachusetts hospitals with hospitalists, and 33 Massachusetts hospitals with intensivists.

Some recent research indicates that nurses' intuition may play an important role in the early recognitioin of sepsis.

Data Sources

This study used the measure of sepsis reported by the AHRQ in 2017 as the number of postoperative sepsis cases (secondary diagnosis) per 1000 elective surgical discharges for patients aged 18 years and older.[25] Rates of wound dehiscence after surgery, poor glycemic control, and iatrogenic pneumothorax were also rates per 1000 discharges as measured by the AHRQ.[25] The 2 hospital-acquired infection measures analyzed in this study, catheter-associated urinary tract infection (CAUTI) and surgical site infection from colon surgery, were standardized infection ratios as measured by the Centers

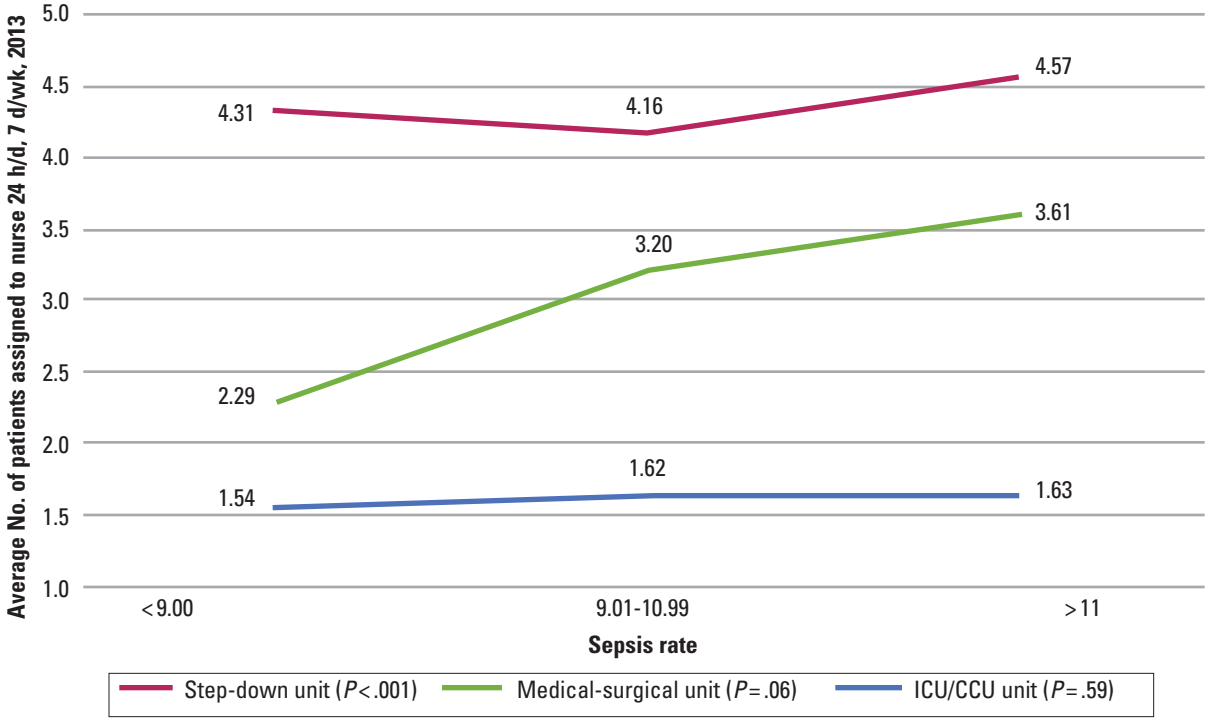

Figure 1 Relationship between average number of patients assigned to nurse (2013)[24] and number of bloodstream infections per 1000 discharges after surgery (July 1, 2013, to June 30, 2015)[25] in 53 Massachusetts hospitals with intensive or critical care units (ICU/CCUs) and medical-surgical units and 25 Massachusetts hospitals with step-down units.

for Medicare and Medicaid Services (CMS).[26] Hospital demographic factors reported to be associated with sepsis rates that were included in the analysis were teaching hospital status and CMS case mix.

Registered nurse staffing on step-down, medical-surgical, and intensive or critical care units was measured as the average number of patients assigned to a registered nurse 24 hours a day, 7 days a week.[26] Physician, medical resident, hospitalist, and intensivist staffing were measured as full-time-equivalent (FTE) hours per patient day.[27] Registered nurse staffing data are available at the unit level from the Massachusetts Hospital Association, but physician staffing data are not; therefore, physician staffing data at the hospital level from the American Hospital Association were used. The health care–acquired conditions and demographic factors were entered in separate linear regressions to evaluate the unique effects of registered nurse and physician staffing on the rates of sepsis.

Data Analysis

Statistical analyses were conducted using IBM SPSS Statistics, version 24. Covariates positively and negatively associated with sepsis, as well as demographic factors known to be associated with sepsis, were included in the linear model analysis. Scatterplots of the candidate predictors and the response were examined for applicability of the linear model, outliers, or unusual distributional shapes. All terms were initially placed in the model and then eliminated by stepwise modeling if they remained associated at $P = .05$ and were removed from the model at $P = .10$. The inclusion or elimination of terms in the model was determined by stepwise procedures and likelihood ratio tests. A likelihood ratio test shows that the 2-way interactions did not significantly improve the model once all the main effects were included.

Results

Analysis of variance showed a statistically significant association between nurse staffing and sepsis rate for patients in step-down units, with the sepsis rate ranging from 9 or fewer cases per 1000 discharges when registered nurses on step-down units cared for an average of 2.29 patients to 11 or more cases per 1000 discharges when they cared for an average of 3.61 patients ($P < .001$; Figure 1).

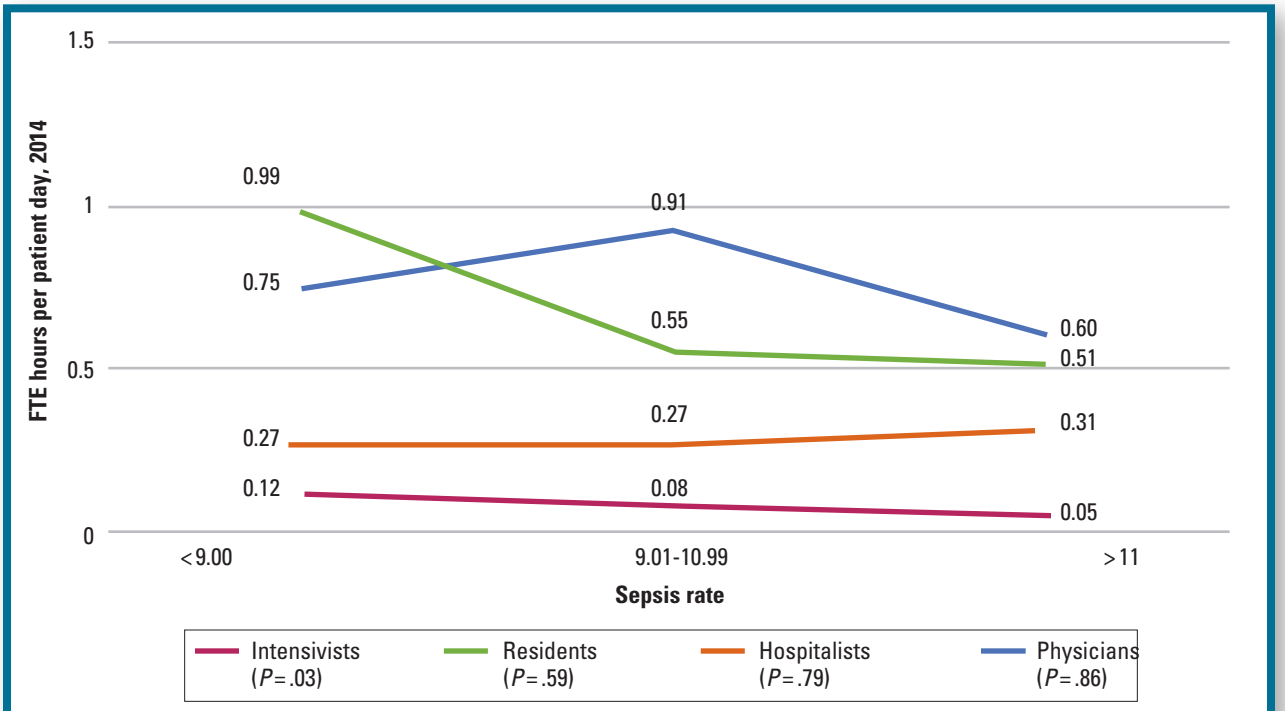

Figure 2 Relationship between full-time-equivalent (FTE) hours per patient day (2014)[27] and rate of bloodstream infections per 1000 discharges after surgery (July 1, 2013, to June 30, 2015)[25] in 54 Massachusetts hospitals with physicians and medical residents, 41 Massachusetts hospitals with hospitalists, and 33 Massachusetts hospitals with intensivists.

The findings indicated that adding 1 more patient to the nurse's care in a step-down unit increased the risk that 2 or more patients per 1000 discharges would become septic. Analysis of variance also showed a statistically significant relationship between intensivist hours and sepsis rate, with the sepsis rate ranging from 9 or fewer cases per 1000 discharges when intensivist hours were 0.12 per patient day to 11 or more when they were 0.05 per patient day ($P = .03$; Figure 2).

Model predictors correlated with sepsis are described separately for nurse staffing and physician staffing (Table 1). In both models, CAUTI was the health care–acquired condition most strongly associated with sepsis ($P = .005$ in the nurse model and $P = .002$ in the physician model). The hospital staffing factors most strongly associated with rates of sepsis were step-down patients per nurse ($P = .009$), medical-surgical patients per nurse ($P = .01$), and intensivist FTE hours per patient day ($P = .003$). Teaching hospital was significant in the nurse model ($P = .02$) but not in the physician model. The CMS case mix was not significant in either model.

In the linear regression examining the impact of nurse staffing on sepsis rate with 7 predictors, higher rates of CAUTI ($P = .001$) and greater numbers of step-down patients assigned to registered nurses ($P = .001$) were associated with a statistically significant increase in the rate of sepsis ($P < .001$; Table 2). These 2 factors explained 54% of the variance in the rate of sepsis. In the linear regression examining the impact of physician staffing on sepsis rate, higher rate of CAUTI ($P < .001$), higher rate of wound dehiscence after surgery ($P < .001$), greater hospitalist hours ($P = .001$), and greater physician hours ($P = .05$) were associated with significantly higher rates of sepsis, while greater intensivist hours were associated with a significantly lower rate of sepsis ($P = .002$; Table 3). These 5 factors explained 78% of the variance in the linear regression examining the relationship of 7 predictors with physician staffing.

Discussion

The findings reported here indicate that staffing influences the rate of sepsis, but the relationship is not causal, and other factors may contribute to increased sepsis rate. Nonetheless, the findings indicate that greater physician and hospitalist hours were correlated with higher rates of sepsis. Consistent with the literature

Table 1 Factors correlated with the rate of bloodstream infections after surgery

	Nurse model (N = 25)		Physician model (N = 29)	
Factor	**Coefficient**	***P***	**Coefficient**	***P***
Health care–acquired factors				
CAUTI SIR[a]	-0.510	.005	-0.524	.002
Postsurgery dehiscence rate[b]	0.379	.03	0.501	.003
Surgical site infection from colon surgery SIR[a]	-0.410	.02	-0.442	.008
Poor glycemic control rate[c]	0.435	.02	0.417	.01
Iatrogenic pneumothorax rate[b]	-0.397	.03	-0.275	.07
Demographic factors				
Teaching hospital (No = 0, Yes = 1)[d]	-0.411	.02	-0.246	.10
CMS case mix, 2014	-0.287	.08	-0.305	.05
Hospital staffing factors				
Step-down patients per nurse, average, 24 h/d, 7 d/wk[e]	0.469	.009		
Medical-surgical patients per nurse, average, 24 h/d, 7 d/wk[e]	0.449	.01		
ICU/CCU patients per nurse, average, 24 h/d, 7 d/wk[e]	0.282	.09		
Intensivist FTE HPPD[d]			-0.503	.003
Resident FTE HPPD[d]			-0.245	.10
Physician FTE HPPD[d]			0.115	.28
Hospitalist FTE HPPD[d]			0.103	.30

Abbreviations: CAUTI, catheter-associated urinary tract infection; CCU, critical care unit; CMS, Centers for Medicare and Medicaid Services; FTE, full-time-equivalent; HPPD, hours per patient day; ICU, intensive care unit; SIR, standardized infection ratio.

[a] Centers for Medicare and Medicaid Services,[26] data for October 1, 2012, to September 30, 2013.
[b] Agency for Healthcare Research and Quality,[28] data for July 1, 2010, to June 30, 2012.
[c] Centers for Medicare and Medicaid Services,[28] data for October 2011 to July 2013.
[d] American Hospital Association,[27] data for 2014.
[e] Massachusetts Hospital Association,[24] data for 2013.

Table 2 Stepwise linear regression of sepsis with nurse staffing and health care–acquired condition predictors (N = 25)[a]

	Unstandardized coefficients		Standardized coefficient			
Model	**B**	**SE(B)**	**β**	***t***	**95% CI**	***P***
(Constant)	6.602	1.486	0	4.444	3.521 to 9.682	<.001
CAUTI score[b]	-1.223	0.314	-0.567	-3.892	-1.874 to -0.571	.001
Step-down patients assigned to registered nurses[c]	1.653	0.455	0.530	3.634	0.710 to 2.596	.001

Abbreviation: CAUTI, catheter-associated urinary tract infection.

[a] $R^2 = 0.538$; adjusted $R^2 = 0.496$; standard error of estimate = 1.66845; sum of squares = 132.485; $P = .001$.
[b] Centers for Medicare and Medicaid Services,[26] data for October 1, 2012, to September 30, 2013.
[c] Massachusetts Hospital Association,[24] data for 2013.

Table 3 Stepwise linear regression of sepsis with physician staffing and health care–acquired conditions predictors (N = 29)[a]

	Unstandardized coefficients		Standardized coefficient			
Model	**B**	**SE(B)**	**β**	***t***	**95% CI**	***P***
(Constant)	8.400	1.099		7.642	6.126 to 10.674	<.001
CAUTI score[b]	-1.342	0.261	-0.511	-5.140	-1.882 to -0.802	<.001
Postsurgery dehiscence rate[c]	3.018	0.629	0.513	4.799	1.717 to 4.318	<.001
Intensivist FTE HPPD[d]	-18.805	5.333	-0.367	-3.526	-29.838 to -7.773	.002
Hospitalist FTE HPPD[d]	9.064	2.294	0.424	3.951	4.318 to 13.810	.001
Physician FTE HPPD[d]	0.222	0.105	0.215	2.120	0.005 to 0.438	.05

Abbreviations: CAUTI, catheter-associated urinary tract infection; FTE, full-time-equivalent; HPPD, hours per patient day.

[a] $R^2 = 0.779$; adjusted $R^2 = 0.731$; standard error of estimate = 1.20565; sum of squares = 151.031; $P < .001$.
[b] Centers for Medicare and Medicaid Services,[26] data for October 1, 2012, to September 30, 2013.
[c] Agency for Healthcare Research and Quality,[28] data for July 1, 2010, to June 30, 2012.
[d] American Hospital Association,[27] data for 2014.

on causes of sepsis, 2 medical conditions—CAUTI and wound dehiscence after surgery—were correlated with higher rates of sepsis. These conditions were associated with greater physician and hospitalist hours but not with greater intensivist hours. The intensivist role may be fulfilled by a physician, a physician assistant, or a nurse practitioner, and the differences between these roles and how they affect patient outcomes require exploration.

Although a higher ratio of patients to nurses was associated with a higher rate of CAUTI, greater intensivist hours and increased nurse staffing were correlated with lower rates of sepsis. These findings specifically address staffing in terms of the number of nurses. They may suggest a correlation between nurses and the type of provider they would report their concerns to: an intensivist, as opposed to a physician or hospitalist. The findings raise a concern about collaboration and communication. Nurses may find some types of providers more approachable than others, possibly owing to presence or time spent on the unit. For example, an intensivist may be assigned to 1 unit and thus be able to get to know the unit staff, whereas a physician or hospitalist may rotate from unit to unit and therefore not have time to forge collaborative relationships.

Further work is needed to understand how these different roles may contribute to better communication and collaboration. The findings from this study may support the work of Mushta and colleagues,[21] who suggested that hierarchy may be a contributing factor in the failure of nurses to escalate their concerns appropriately. However, without knowing which type of provider the intensivist is or if they are assigned to 1 unit or rotate, it is difficult to draw further conclusions.

The finding that greater physician staffing is associated with higher rates of factors contributing to sepsis such as CAUTI and wound dehiscence after surgery, as well as higher rates of sepsis itself, is concerning, but the reasons for this association are unclear. Exploration is needed of whether it is related to a lack of assessment skill, poor communication and/or collaboration skills, the tendency of physicians to rotate through units that prevents them from getting to know the patients and staff on the unit, or other unidentified variables. Our findings also indicate possible barriers to communication between nurses and some types of providers. This topic needs further exploration, but skills training in interdisciplinary communication and collaboration may be needed.

Despite the recent development of consensus on the definition of sepsis,[1,6] there is little evidence to suggest that this agreement has resulted in a decline in rates of sepsis.[5] Our study indicated that a higher ratio of patients to nurses was associated with a higher rate of CAUTI, a contributor to the incidence of sepsis. This finding is consistent with previous research.[29] However, our work does not provide information about education initiatives to address sepsis or about which protocols implemented in institutions are correlated with improved patient safety outcomes such as a reduction in sepsis rates.

Recognition of sepsis often requires not only awareness of its signs and symptoms but knowing the patient well enough to be able to detect subtle changes in their behavior or pain or discomfort threshold.[18] Some attention is now being given to nurse worry or the intuitive sense that something is wrong as a key indicator that should not be ignored.[1,16] Douw and colleagues[30] found that nurse worry as measured by the Dutch Early Worry Indicator Score (DEWIS) was predictive of unplanned intensive care admissions and mortality sooner than changes in vital signs that would trigger concern. The DEWIS includes changes in patient mentation, breathing, circulation, and nurse observations as predictive indicators of a serious change in patient condition. Further work is needed to validate these findings and to more specifically understand what other nurse observations raise concern.

More information is needed about staffing variables, the role of interventionists, nurse worry/intuition and presenteeism, and the role they play in the rates of sepsis.

Nurse worry is based on the nurse knowing the patient well enough to be able to detect subtle changes. It is clear that nurses must be vigilant and sensitive to early symptoms in order to reduce the incidence of critical events, yet such vigilance requires adequate staffing.[21,22] In this sense, our findings provide further support for previous results highlighting the relationship between nurse staffing levels and failure to rescue.[21,22] Willis and colleagues[31] found that work intensification (long hours and/or increased pace) was associated with a reduction in activities that help prevent sepsis, including decreased attention to ambulation of patients and their mouth care, hand washing, central catheter dressing changes, blood glucose monitoring, and providing as-needed medication in a timely manner. Thus, other factors such as work

intensification must be considered in addition to patient-to-nurse ratios.

Our findings also do not shed light on other important factors that may contribute to nurse vigilance, including workplace environment, nurse health, professional identity, and work-life balance, collectively known as "nurse presenteeism." Although nurse presenteeism is not a new concept, research on it is limited. Early work on the topic suggests that it is an important factor contributing to quality indicators such as incidence of falls and missed medication doses.[32] Nurse presenteeism encompasses a host of other factors that may contribute to negative patient outcomes. It is an important topic to explore given widespread concern about work-related stress, compassion fatigue, and burnout among nurses, particularly critical care nurses.

Clearly, increased nurse staffing is correlated with lower rates of sepsis and conditions that contribute to sepsis. However, this study has several limitations. Publicly available data can provide insights into staff numbers and staff mix in relation to negative patient outcomes. However, such data do not address the many other factors that may contribute to reductions in sepsis rates, including education initiatives and protocols aimed at addressing negative outcomes, as well as staff-specific factors such as nurse worry, the impact of work intensification, and presenteeism.

Implications and Recommendations for Future Research

In this study, lower rates of sepsis were found to be associated with greater nurse staffing and the presence of an intensivist rather than a physician or a hospitalist. Higher patient-to-nurse ratios were associated with increased rates of CAUTI. This work has several implications. Given the critical consequences of sepsis for the patient and the financial costs to the hospital, more information is needed about staffing, including years of experience, educational preparation, and the ideal mix of staff with different levels of each, and how these factors may be associated with rates of infection. Moreover, a better understanding is needed of the appropriate preparation and role of the intensivist and how these specialists may contribute to enhanced communication and collaboration skills.

The concept of nurse worry deserves increased attention. Nurses' intuition is particularly important given that the cues nurses are tuning into are typically not included in consensus guidelines or sepsis checklists. If nurses are able to sense that something is wrong before the typical indicators point to sepsis, the phenomenon needs to be better understood and the relevant cues need to be incorporated into assessment checklists. It is also important to understand how increased nurse staffing leads to decreased sepsis rates. In addition to staffing ratios, future work in this area should consider the correlation of staffing to other factors, including individual factors such as nurse worry and nurse presenteeism as well as organizational factors such as work intensification, staffing mix, and protocols and education initiatives aimed at reducing the incidence of negative outcomes such as sepsis.

Limitations

This study was limited to 1 state, and the findings cannot be generalized to other areas. The findings of this study are limited in that they are derived from a publicly available data set covering specific information such as nurse staffing and presence of an intensivist. The findings do not take into account years of experience, adherence to existing sepsis protocols, or factors such as nurse worry or presenteeism, which may contribute to lower sepsis rates. Further research is needed on the roles of adequate staffing, nurse worry, and nurse presenteeism in reducing rates of sepsis.

Another limitation of this study is the lack of information about teams (nurse and intensivist), communication within the team, and the presence of rapid response teams. This information is important in light of recent work indicating that a nurse's ability to perceive what is wrong with a patient despite a lack of supporting physical cues and to confidently escalate that concern may be important in reducing sepsis rates.

Conclusion

Previous research has indicated that hospital-acquired infections and greater complexity of patient care needs increase patients' risk for sepsis. The findings of this study suggest that higher patient-to-nurse ratios contribute to increased urinary tract infections, whereas fewer patients cared for by registered nurses on step-down units and greater hours of patient care provided by intensivists significantly lower a patient's risk for sepsis. Although the findings also indicate that higher rates of CAUTI and wound dehiscence after surgery are associated with

sepsis, it is surprising that sepsis is correlated with greater physician and hospitalist staffing. Further research is needed to understand the roles of the intensivist, hospitalist, and physician and the reasons for their varying effects on sepsis rates. CCN

Financial Disclosures
None reported.

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