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Pattern Analysis of Inpatient MRSA Cases at Sentara Bayside and Princess Anne Hospitals

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BACKGROUND AND SIGNIFICANCE

Methicillin-resistant *Staphylococcus aureus* (MRSA) has been associated with higher mortality rates, longer hospital stays and higher hospital costs, with an increased prevalence of community-acquired MRSA among certain populations. The concern is that admission to hospitals of MRSA positive patients can and does result in the spreading of the infection to others in the hospital. An estimated 25,100 hospital acquired MRSA infections occurred in the US in 2005 alone, illustrating the actuality of the problem. The key to preventing the spread of MRSA in the hospital lies in detecting, isolating and treating those patients found to be positive on admission. Unfortunately, there is no clear consensus among the US and/or international based hospital health care systems on what specific populations should be screened as there are many variables to consider. There is also concern that universal screening is cost prohibitive and too time intensive versus unit or population based screening. Instead, identifying patients with high risk factors is a more cost-effective solution (Hubben, et al, 2011).

The purpose of this epidemiologic research study was to examine similarities and differences in the patient population of inpatient hospital admissions that were positive for Methicillin-Resistant *Staphylococcus aureus* (MRSA) at Sentara Bayside Hospital (SBH) and Sentara Princess Anne Hospital (SPAH). Results of this analysis can provide an epidemiologic baseline for the transfer of services from SBH to SPAH, which can be used to base new MRSA protocols and swabbing procedures at the SPAH.

METHODOLOGY

This retrospective study utilized electronic data abstracted from the infection control records for documented inpatient MRSA cases during the two years prior to closing Sentara Bayside Hospital (SBH) and the first year of operations at Sentara Princess Anne Hospital (SPAH).

ANALYSIS

Records included in the analysis represent all patients admitted to SBH's ICU from August 2009 – August 2011, and those admitted to SPAH's ICU from August 2011 – July 2012 who were screened for MRSA by nasal swabbing per hospital protocol and found to have a positive MRSA nasal swab screening. A total of 375 records were included in the analysis, 252 for SBH's ICU and 123 for SPAH's ICU. Independent samples t-tests were used to analyze continuous measures (number of negative cultures prior to positive culture, length of stay in days). Chi-square tests of independence were conducted for the 25 categorical measures included in the infection control database. All analyses were conducted using SPSS version 22.

Table 1. Patient characteristics, comparative analysis of continuous measures

		N	mean (SD)	Difference	95% CI		Power[2]
Negative cultures (#)[1]				t(132) = 13.3, p<.001	0.078	0.879	0.72
	SBH	37	1.14 (.54)				
	SPAH	97	.10 (.39)				
Length of stay (days) [1]				t(372) = 2.72, p=.007	0.193	0.145	0.99
	SBH	251	.82 (2.24)				
	SPAH	123	.30 (1.19)				

[1]Statistically significant at α=.05

[2] power calculated at medium effect size (r = .30)

RESULTS

Results of independent samples t-tests indicate statistically significantly lower mean number of negative cultures prior to positive culture for MRSA positive patients at SPAH (M=.10, SD=.39) than for those at SBH(M=.1.14, SD=.54). Likewise, results identified statistically significantly shorter mean average length of stay for the MRSA positive patients at SPAH (M=.30, SD=1.19) than for those at SBH (M=.82, SD=2.24), $t(372) = 2.72$, $p=.007$ (Table1).

Statistically significant differences were also identified between SBH and SPAH MRSA positive patients relative to being in long-term care immediately prior to admission, being transferred from a medical floor prior to transfer to the ICU, having a MRSA history prior to admission, and having negative cultures during admission prior to having a positive MRSA culture (Table 2).

Table 2. Patient characteristics, comparative analysis of categorical measures

	SBH	SPAH	Difference	Power[2]
Long term care prior to admission[1]	32.1%	20.3%	χ^2 (1, N=375) = 5.69, p = .02	0.99
Transfer from Med floor[1]	7.9%	20.3%	χ^2 (1, N=375) = 12.01, p = .001	0.99
MRSA history prior to admit[1]	22.7%	35.8%	χ^2 (1, N=374) = 7.15, p = .009	0.99
Prior negative culture during this admit[1]	19.2%	6.5%	χ^2 (1, N=316) = 9.87, p = .002	0.99
CAI (Community acquired infection)[4]	100.0%	100.0%	n/a (n = 44)	--
CAI colonization[4]	100.0%	100.0%	n/a (n = 288)	--
Culture reason[3]			χ^2 (1, N=44) = .38, p = .66	0.51
discharge/transfer out of unit	36.8%	50.0%		
standard (weekly) culture	63.2%	50.0%		
Dialysis	6.8%	6.5%	χ^2 (1, N=374) = .01, p = .99	0.99
Discharge[3]	4.8%	0.8%	χ^2 (1, N=375) =3.85, p = .07	0.99
Discharge disposition[3]			χ^2 (3, N=11) =1.32, p = .72	0.11
home	40.0%	100.0%		
rehab	20.0%	0.0%		
NH/SNF	30.0%	0.0%		
other	10.0%	0.0%		
Gender[3] (male)	44.8%	45.5%	χ^2 (1, N=375) = .02, p = .91	0.99
History of multi-drug resistant organism	12.0%	9.8%	χ^2 (1, N=373) = .415, p = .60	0.99
Homeless at admission[3]	0.8%	0.0%	χ2 (1, N=375) = .98, p = .99	0.99
Hospital Acquired MRSA infection[3]	0.8%	0.0%	χ^2 (1, N=375) =.98, p = .99	0.99
Known history of incarceration[3]	0.8%	0.0%	χ^2 (1, N=375) =.98, p = .99	0.99
Open would present on admission	21.4%	24.4%	χ^2 (1, N=375) =.42, p = .51	0.99
Other patient on unit MRSA positive	75.0%	37.5%	χ^2 (1, N=36) = 3.94, p = .09	0.44
Patient expired[4]	100.0%	100.0%	n/a (n = 5)	--
Prior patient in room MRSA positive[3]	11.5%	0.0%	χ^2 (1, N=34) = 1.01, p = .99	0.42
Recent history of hospitalization[3]	51.6%	52.8%	χ^2 (1, N=375) = .53, p = .77	0.99
Tracheostomy in place at admission	1.6%	3.3%	χ^2 (1, N=374) = 1.09, p = .44	0.99
Treatment (antibiotics for MRSA)[3]	0.4%	0.0%	χ^2 (1, N=375) =.49, p = .99	0.99
Ventilator support at admission	0.4%	0.0%	χ^2 (1, N=375) =.49, p = .99	0.99

[1]Statistically significant at α=.05

[2] Power calculated at medium effect size (w = .30)

Long-term care: SPAH MRSA positive patients were less likely to be in long-term care immediately prior to admission than were SBH patients, 20.3% versus 32.1%, $\chi2$ (1, N=375) = 5.69, p = .02. This difference is likely due to the younger population located in proximity to, and served by, SPAH compared to the older population, with many long term care facilities, in the neighborhoods SBH. However, without additional demographic and clinical information, we cannot accurately evaluate the differences between the populations of the two hospitals or the true impact placement in long-term care prior to admission may have relative to the MRSA rate at SPAH.

Negative cultures during admission: SPAH MRSA positive patients were less likely to have a negative culture during admission than were SBH patients, 6.5% versus 19.2%, χ^2 (1, N=316) = 9.87, p = .002, indicating a greater conversion rate of healthcare associated colonization of MRSA while at SBH compared to SPAH. These rates are supported by a monthly calculated rate per patient day at the hospital and documented for reporting purposes.

Transfer from medical unit: SPAH MRSA positive patients were more likely to have been transferred from a medical floor prior to ICU admission than were SBH patients, 20.3% versus 7.9%, χ^2 (1, N=375) = 12.01, p = .001. In the absence of a baseline nasal swab or MRSA infection prior to admission to either facility, these results suggest a greater opportunity to identify MRSA positive patients prior to transfer to the ICU. Earlier identification would lead to implementation of contact precautions in patients who test positive which should result in decreased risk for transmission to other patients.

MRSA history: SPAH MRSA positive patients were more likely to have a positive MRSA history prior to admission than were SBH patients, 35.8% versus 22.7%, χ^2 (1, N=374) = 7.15, p = .009. Because the procedures used for placing known MRSA positive patients in contact precautions upon admission were the same for both SPB and SPAH, this increase in percentage of patients may not be indicative of a change needed in this procedure. It may, however, speak to a potential increase in MRSA prevalence from the SBH to SPAH populations. Additional information necessary to assess this would include a comparison of total numbers of patient admissions covering this time period.

DISCUSSION

The Healthcare Infection Control Practices Advisory Committee's (HICPAC) Management of Multidrug-Resistant Organisms in Healthcare Settings states that early identification and strict adherence to contact isolation precautions and proper hand hygiene has shown a direct correlation with decrease in transmission of MRSA in health care facilities (Siegel, Rhinehart, Jackson, & Chiarello, 2006). The present research has identified two factors, transfer from a medical unit prior to ICU admission and positive MRSA history, which appears to provide an opportunity for earlier identification of MRSA colonization through admission screening on other (medical) inpatient units. This could be accomplished by adding questions about MRSA history to the current admission flow sheet and followed-up with additional nasal swabbing for patients with positive cultures.

REFERENCES

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