Detection of Key Potential Healthcare Pathogens Using Periodic Point Prevalence Surveillance

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Background

Detection of hospitalized patients colonized with multi-drug resistant organisms (MDRO) can lead to a decrease in transmission to other patients when those colonized are placed on contact precautions or are decolonized. We have documented success with a MRSA admission screening program that is a risk based approach to screening only patients likely to harbor MRSA (Ref 1). In addition to the MRSA program, we perform monthly point prevalence in the ICU and periodic point prevalence hospital wide for drug resistant pathogens.

In order to use the point prevalence testing data to optimize resource utilization and identify MDRO carriers, we sought to determine if a risk based approach could be used and only test those patients at risk of colonization with an MDRO. We also compared whole house surveillance to ICU to see if a significant number of pathogens were found outside the ICU.

Methods

Sample collection: Four point prevalnce surveys were performed from June 2016 to March 2017. Rectal samples from 987 were collected from all 4 facilities in our healthcare system. Specimens were collected with a double-headed rayon swab pre-moistened with Amies culture medium. One swab was plated to VACC agar (Remel) for isolation of Gram negative drug-resistance pathogens (GNMDR) and VRE, and the second was plated to CCFAHT agar (Anaerobe Systems) for *C. difficile*. GNMDR includes carbapenem-resistant Enterobacteriaceae (CRE), ESBL's and organisms susceptible to ≤2 drug classes (MDR).

Statistical analysis: Chart review was performed on patients with GNMDR colonization and an equivalent number of negative controls (n=174). Multiple risk factors for GNMDR colonization were analyzed (Table 3). The Chi-squared test was used for categorical variables, Student's t-test for continuous variables and multivariable logistic regression model on significant predictors.

Results

The number of patients with important pathogens in the ICU vs. non-ICU is described in Table 1. There was a 10% difference in these 2 groups that was statistically significant. An important discovery was that 3 patients colonized with CRE outside of the ICU were previously unknown. ESBL, VRE and *C. difficile* totals were highest outside the ICU.

Table 1. Comparison of Patients in the ICU vs. Non-ICU with Important Hospital Pathogens

		Number of patients with :					
	No. Tests	Important Pathogens (%)	ESBL	CRE	MDR	VRE	Toxigenic Cdif
Non-ICU	833	175 (21%) [a]	79	3	5	64	47
ICU	154	17 (11%) [b]	10	2	1	1	7

a vs. b; $p = 0.006$

Table 2. Univariate Analysis of Patients with GNMDR

	Negative GNMDR (n=84)	Positive GNMDR (n=90)	P-value
Age: Mean ± SD	70 ± 18	77 ± 53	0.24
Race: N (%)			
Caucasian	70 (85.4%)	56 (70.0%)	0.02
Non-Caucasian	12 (14.6%)	24 (30.0%)	
Ethnicity: N (%)			
Hispanic	5 (6.0%)	8 (8.9%)	0.57
Non-Hispanic	79 (94.0%)	82 (91.1%)	
Gender: N (%)			
Male	46 (54.8%)	51 (56.7%)	0.80
Female	38 (45.2%)	39 (43.3%)	
LTCF: N (%)			
Yes	8 (9.5%)	30 (33.3%)	<.001
No	76 (90.5%)	60 (66.7%)	
Recent Surgery Within 6 Months?: N (%)			
Yes	27 (32.1%)	23 (25.6%)	0.34
No	57 (67.9%)	67 (74.4%)	
Recent Hospitalization within last year: N (%)			
Yes	54 (64.3%)	50 (55.6%)	0.24
No	30 (35.7%)	40 (44.4%)	
Length of most recent preceding hospitalization (days): Mean ± SD	2.94 ± 4.42	4.18 ± 8.18	0.23
Number of hospital admissions (over last year): Mean ± SD	1.52 ± 1.78	1.56 ± 2.29	0.92
Karnofsky Score: Mean ± SD	64.46 ± 16.65	56.67 ± 23.08	0.01
Positive MRSA colonization status @ current admission: N (%)			
Yes	10 (11.9%)	18 (20.0%)	0.15
No	74 (88.1%)	72 (80.0%)	
Prior Systemic Antimicrobial Therapy in last 6 mos.: N(%)			
Yes	36 (42.9%)	53 (59.5%)	0.03
No	48 (57.1%)	36 (40.5%)	
Cephalosporin: N (%)			
Yes	18 (21.4%)	23 (25.8%)	0.50
No	66 (78.6%)	66 (74.2%)	

	Negative MDRO (n=84)	Positive MDRO (n=90)	P-value
Recent Use of Indwelling Medical Devices: N (%)			
Yes	33 (39.3%)	42 (46.7%)	0.33
No	51 (60.7%)	48 (53.3%)	
Enteral Tube Feeding: N (%)			
Yes	2 (2.4%)	10 (11.1%)	0.03
No	82 (97.6%)	80 (88.9%)	
Active Malgnancy: N (%)			
Yes	11 (13.1%)	11 (12.2%)	0.86
No	73 (86.9%)	79 (87.8%)	
Chemotherapy: N (%)			
Yes	6 (7.1%)	7 (7.8%)	0.87
No	78 (92.9%)	83 (92.2%)	
Hemodialysis: N (%)			
Yes	1 (1.2%)	8 (8.9%)	0.04
No	83 (98.8%)	82 (91.1%)	
Presence of Trach Collar: N(%)			
Yes	2 (2.4%)	4 (4.4%)	0.68
No	82 (97.6%)	86 (95.6%)	
Current Immunosuppresive Therapy: N (%)			
Yes	7 (8.3%)	12 (13.3%)	0.29
No	77 (91.7%)	78 (86.7%)	
Prior Hx of MDRO Colonization: N (%)			
Yes	3 (3.6%)	13 (14.6%)	0.02
No	81 (96.4%)	76 (85.4%)	

Table 3. Multivariable logistic regression

	OR	CI	P-value
Race (ref='Caucasian')			
Non-Caucasian	3.23	(1.38, 7.55)	0.007
LTCF (ref= ' No')			
Yes	4.11	(1.43, 11.83)	0.009
Karnofsky Score	1.00	(0.98, 1.03)	0.75
Prior Hx of MDRO Colonization (ref='No')			
Yes	3.67	(0.89, 15.03)	0.07
Prior Systemic Antimicrobial therapy in last 6 mos. (ref='No')			
Yes	1.68	(0.83,3.40)	0.15
Enteral Tube Feeding (ref='No')			
Yes	2.68	(0.44, 16.33)	0.29
Hemodialysis (ref='No')			
Yes	4.92	(0.47, 51.84)	0.18

Discussion

The results of Table 1 show that a higher rate (21 v. 11%; p=0.006) of important pathogens are found outside of the ICU in our healthcare system.

We began a risk-based admission screen surveillance program for *C. difficile* a year after this point prevalence (Ref 2).

VRE clinical infections are not prevalent at our institution so routine screening is not performed.

Focusing our analysis on GNMDR revealed that significant predictors for MDRO outcome are ethnicity and admission from a long term care facility.

Conclusion

A risk based approach to surveillance for GNMDR at our healthcare facility would involve screening all patients upon admission who have resided in a long term care facility within the last year.

References

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