

# Evaluation of a real-time PCR method for detection of nasal Methicillin-Resistant *Staphylococcus aureus* (Xpert MRSA NxG®) in patients with carriage risk factors at the time of admission to a general hospital.

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## Background

Methicillin-Resistant *Staphylococcus aureus* (MRSA) is a major cause of healthcare-acquired infections. On admission to acute hospitals, patients with MRSA carriage risk factors (MRSACRFs) are treated in isolation until culture results are available. This complicates management of hospital beds as test results are typically reported in 4 to 5 days. Real-time PCR assays could improve this situation since they provide MRSA results in a few hours. Limitations of previous PCR assays have been discordant culture/PCR results. New real-time PCR assays are best adapted to MRSA molecular diversity and their evaluation in patients with MRSACRFs could be useful to determine performance.

## Methods

From April to October 2016, we conducted a prospective MRSA carriage screening study in a general hospital with the aim of assessing new real-time PCR assay performance in patients with MRSACRFs. At the time of admission, we performed a single swab for each anterior naris to determine the presence of MRSA by culture and by real-time PCR Xpert MRSA NxG® assay. We registered demographic data, MRSACRFs, and compared culture and molecular assay results. Also compared were patient demographics and MRSACRFs between culture positive and PCR positive (C+/PCR+), with discordant results (C-/PCR+).

## Results (I)

### Samples and patients characteristics

We evaluated 188 samples corresponding to 167 patients. Median age of patients was 82 years (IQR 73-83) and 50.8% were female. Time from hospital admission to screening mean was 0.4±1.5 days. Table 1 and Figure 1.

**MRSA screening criteria** were long-term care facility (LTC) resident, history of MRSA and recent hospital discharge [123(65.4%), 48(25.5%) and 15(8%), respectively].

Most frequent **environmental MRSACRFs** found were LTC residents, recent inpatient at acute care hospitals or intensive care units [157 (83.5%), 86(45.7%) and 5(2.7%), respectively].

Most frequently found **patient MRSACRFs** were history of MRSA on 117 patients with previous screening [56 (47.9%), 37 (66%) of them had previously had mupirocin-based decolonization], recent antibiotic consumption [68(36.7%)] and presence of skin ulcers [22(11.7%)]. Frequent underlying conditions were diabetes mellitus and renal impairment [61(32.4%) and 47(25%), respectively].

### PCR assay performance

Of the 188 specimens evaluated, 29(15.4%) were culture and PCR positive, 141(75%) were culture and PCR negative, 18(9.6%) were culture negative and PCR positive, while none culture positive and PCR negative. Compared with the results of culture, the sensitivity, specificity, and negative and positive predictive values (PV) of the PCR assay were 100%, 88.7%, 100%, and 61.7%, respectively. Table 2.

Table 1: Samples and Patients Characteristics

Samples and Patients Characteristics		PCR/Culture Result				p
		-/-	+/+	+/-	Total	
Patients	n	122	27	18	167	
	%	73	16.2	10.8	100	
Samples	n	141	29	18	188	
	%	75	15.4	9.6	100	

Demographics		-/-	+/+	+/-	Total	p
Age (years)	Md	82	80	83	82	0.879
	IQR	73-89	71-86	65-87	73-83	
Female	n	62	14	8	85	0.886
	%	50.8	48.1	55.6	50.9	

\*Md: median

Screening criteria (patients can have only one criteria)		-/-	+/+	+/-	Total	p
Long-term care facility Residents	n	101	17	5	123	0.001
	%	71.7	58.6	27.8	65.4	
Recent hospital discharge	n	11	4	0	15	
	%	7.8	13.8	0	8	
History of MRSA	n	27	8	13	48	
	%	19.1	27.6	72.2	25.5	
Other reason	n	2	0	0	2	
	%	1.4	0	0	1.1	

Environmental MRSACRFs (Patient can have multiple risk factors)		-/-	+/+	+/-	Total	p
Long-term care facility Residents	n	118	25	14	157	0.746
	%	83.7	86.2	77.8	83.5	
Recent inpatient Acute Care Hospital	n	67	13	6	86	0.521
	%	47.5	44.8	33.3	45.7	
Recent inpatient Intensive Care Unit	n	1	3	1	5	
	%	0.7	10.3	5.6	2.7	

Patient MRSACRFs (Patient can have multiple risk factors)		-/-	+/+	+/-	Total	p
History of MRSA/Total category 117 patients with previous MRSA screening	n	30/82	13/21	13/14	56/117	<0.001
	%	36.6	61.9	92.9	47.9	
Recent antibiotic consumption	n	47	10	11	68	0.045
	%	32.9	34.5	61.1	36.2	
Recent surgery	n	14	2	0	16	0.344
	%	9.9	6.9	0	8.5	
Skin ulceration	n	9	6	7	22	<0.001
	%	6.4	20.7	38.9	11.7	
Diabetes mellitus	n	45	11	5	61	0.743
	%	31.9	37.9	27.8	32.4	
Renal impairment	n	38	4	5	47	0.316
	%	27	13.8	27.8	25	
Central venous catheter	n	0	3	0	3	
	%	0	10.3	0	1.6	
Haemodialysis	n	0	0	0	0	
	%	0	0	0	0	
Immunosuppression	n	0	0	1	1	
	%	0	0	5.6	0.5	

## Results (II)

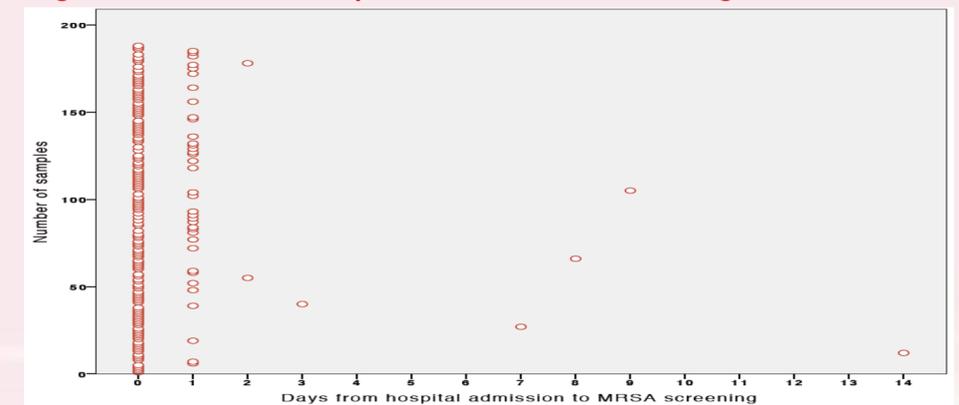
### PCR discordant analysis

Data of univariate analysis are showed in table 1. In the multivariate analysis, discordant results were more frequent when the reason for screening was history of MRSA ( $p=0.003$ ) and recent antibiotic consumption ( $p=0.07$ ).

Table 2: Xpert MRSA NxG® PCR assay performance

Culture Result		PCR Result		Total	Sensitivity	
		-	+		100%	
-	-	141	18	159	Specificity	
	+	0	29	29	88.7%	Negative predictive value
		141	47	188	100%	
					Positive predictive value	
					61.7%	

Figure 1: Time from hospital admission to screening



## Conclusions

- Xpert MRSA NxG® performed well as a screening test in patients with MRSACRFs (100% negative PV).
- We found an elevated number of PCR positive discordant results (9.6%), more frequently in patients with a history of MRSA and recent antibiotic consumption.
- More studies are needed to determine whether these discordant cases are real MRSA carriers or false positives.