# Multi-drug resistant pathogens are associated with higher risks of mortality in patients admitted with acute exacerbations of COPD: A territory wide study with propensity score analysis

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Background Information

- Drug resistance has attributed to 0.7 million deaths every year globally
- Predicted to be the leading cause of mortality by 2050, with 10 million deaths
- COPD: 3rd leading cause of death globally in 2016

Top 10 global causes of deaths, 2016
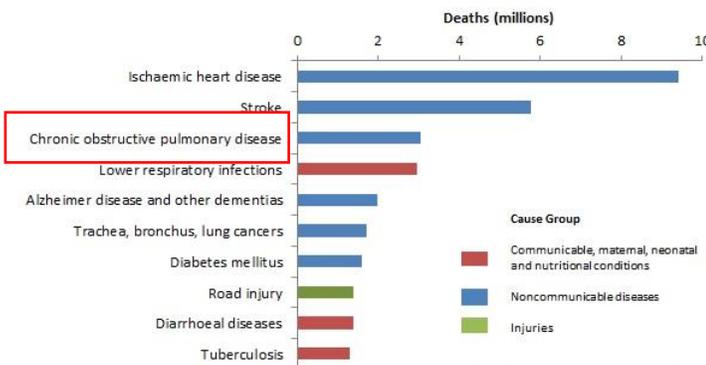
- Importance: A recent population-based survey in 9 Asia-Pacific countries showed a COPD prevalence rate of 6.2%, with 46% of patients experiencing acute exacerbations of COPD (AECOPD)
- The most common cause was identified to be bacterial infection

Project objectives

Primary outcome: Episode mortality

Secondary outcomes

ICU admission

Hospital length of stay

Time to next AECOPD
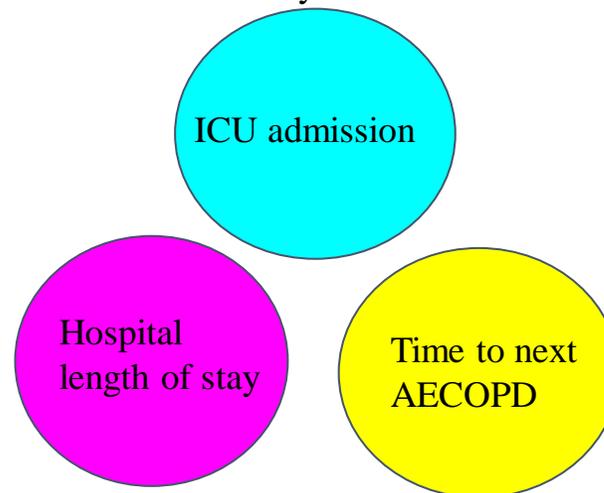
Materials and methods

- Territory wide study, using a local electronic healthcare database (CDARS)
- Duration of study: December 2018 to December 2019

Selection criteria

All patients admitted to hospital with AECOPD between December 2018 to December 2019 (n=10,747)

Excluded those without sputum culture (n=8532)

All patients with their sputum cultured (n=2215)

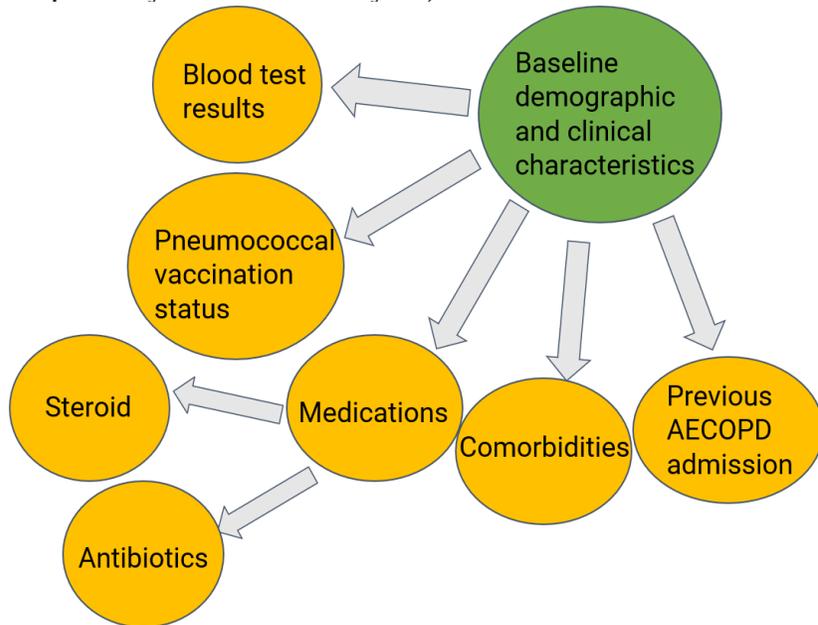All patients with pathogenic bacteria cultured (n=536)

All patients with commensal bacteria cultured (n=1679)
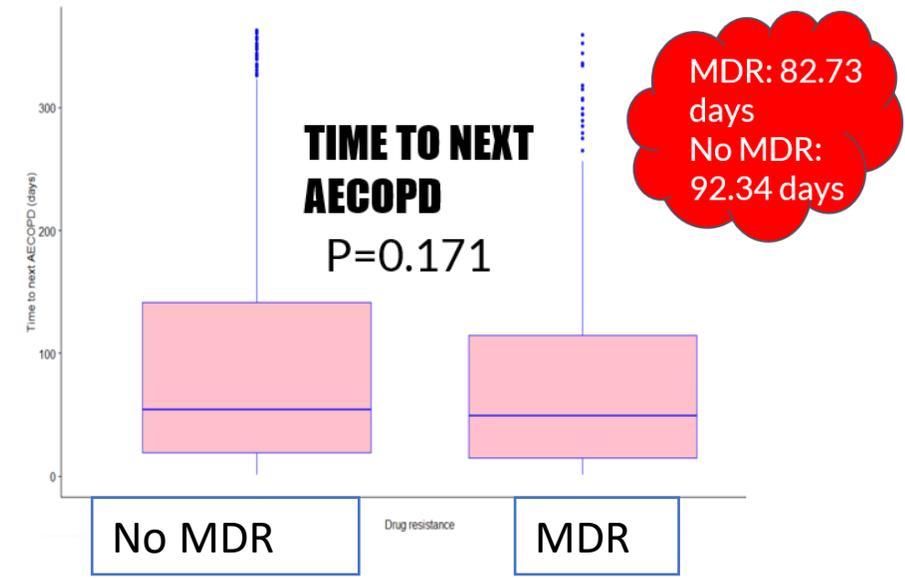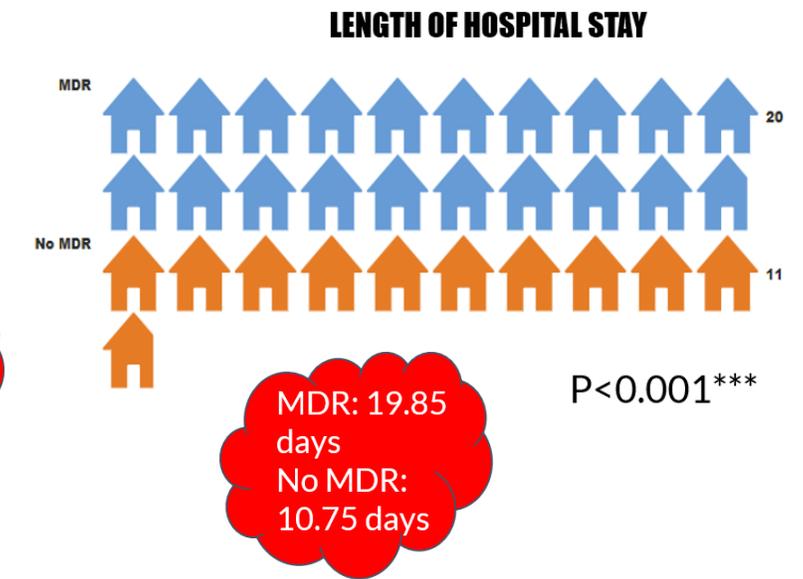
Materials and methods (continued)

Pathogenic bacteria (as identified through a detailed literature search):
- [ ] Enterobacter cloacae complex
- [ ] Enterobacter aerogenes
- [ ] Enterobacter species
- [ ] Pseudomonas aeruginosa
- [ ] E.coli
- [ ] Moraxella catarrhalis
- [ ] Streptococcus pneumoniae

Propensity score analysis with 31 covariates: (propensity score regression adjustment as the primary mode of analysis)

Results

MORTALITY

MDR: 22.8%
No MDR: 12.8%

P<0.001***

LENGTH OF HOSPITAL STAY

MDR: 19.85 days
No MDR: 10.75 days

P<0.001***

ICU ADMISSION

MDR: 2.6%
No MDR: 1.0%

P=0.011*

TIME TO NEXT AECOPD

P=0.171

MDR: 82.73 days
No MDR: 92.34 days
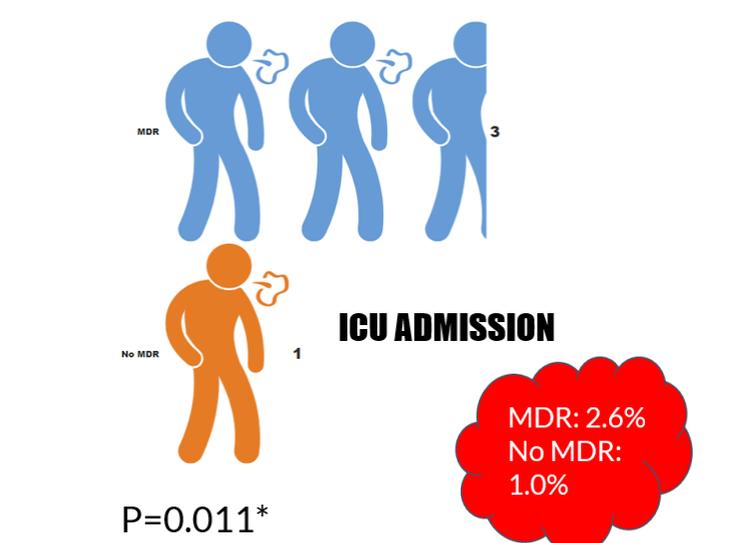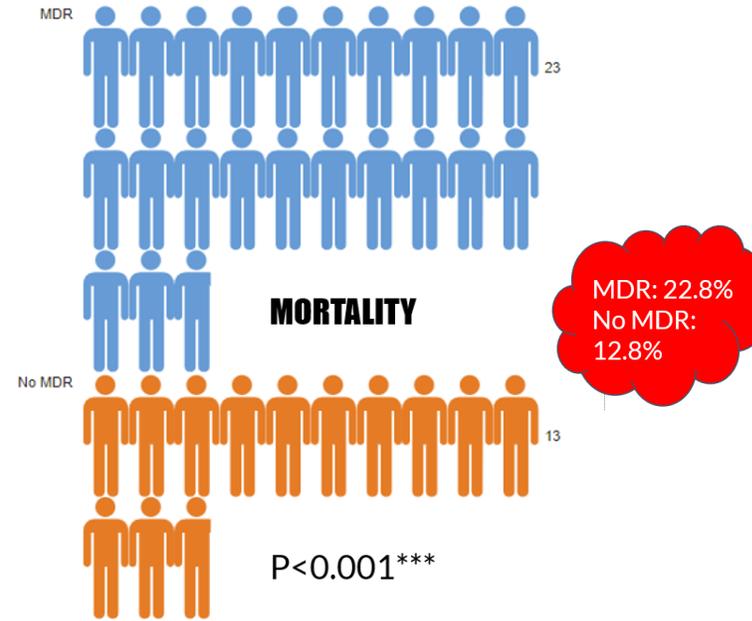
Results

Table 1: Associations of MDR bacteria and mortality

	OR [95% CI]	p value
Univariate analysis	2.01 [1.56-2.57]	<0.001
Propensity score regression adjustment	1.46 [1.09-1.96]	0.0114
Sensitivty analysis		
Multivariate logistic regression	1.48 [1.10-1.98]	0.0096
Inverse probability treatment weighting	1.05 [1.02-1.09]	0.003
Propensity score matching	1.37 [1.00-1.88]	0.048
Subgroup analysis		
Pathogenic bacteria	2.43 [1.42-4.11]	<0.001
Commensals	0.88 [0.61-1.31]	0.539

Figure 1: Survival curves for pathogenic bacteria infection

Table 2: Subgroup analysis

	MDR (n=536)	No MDR (n=1679)	Adjusted OR	P value
Pathogenic bacteria				
Yes	159 (29.7%)	1085 (64.6%)	2.43 [1.42-4.11]	<0.001***
No	377 (70.3%)	594 (35.4%)	0.88 [0.61-1.31]	0.539
Type of pathogenic bacteria				
Enterobacter cloacae complex	12 (2.2%)	23 (1.4%)	1.41 [0.20-6.04]	0.68
Enterobacter species	6 (1.1%)	10 (0.6%)	5.20 [0.90-30.1]	0.055
Enterobacter aerogenes	15 (2.8%)	8 (0.5%)	1.04 [0.22-3.54]	0.959
E coli	69 (12.9%)	52 (3.1%)	1.01 [0.51-1.87]	0.973
Moraxella Catarrhalis	5 (0.9%)	251 (14.9%)	1.04 [0.05-7.52]	0.974
Pseudomonas aeruginosa	88 (16.4%)	681 (40.6%)	2.03 [1.22-3.32]	0.0052**
Strep pneumoniae	38 (7.1%)	133 (7.9%)	0.18 [0.0098-0.85]	0.092

Figure 2: Risk factors for MDR bacteria infection

	OR [95% CI]	p value
Previous antibiotic use in past 2 years		
<3 months	Reference	
3-6 months	0.91 [0.51-1.57]	0.74
6-9 months	2.16 [1.12-3.99]	0.017
>9 months	3.15 [1.82-5.39]	<0.001
pH	0.19 [0.049-0.77]	0.018
All previous and current malignancies	1.93 [1.17-3.10]	0.0081
Sex(M)	2.94 [1.35-7.76]	0.014
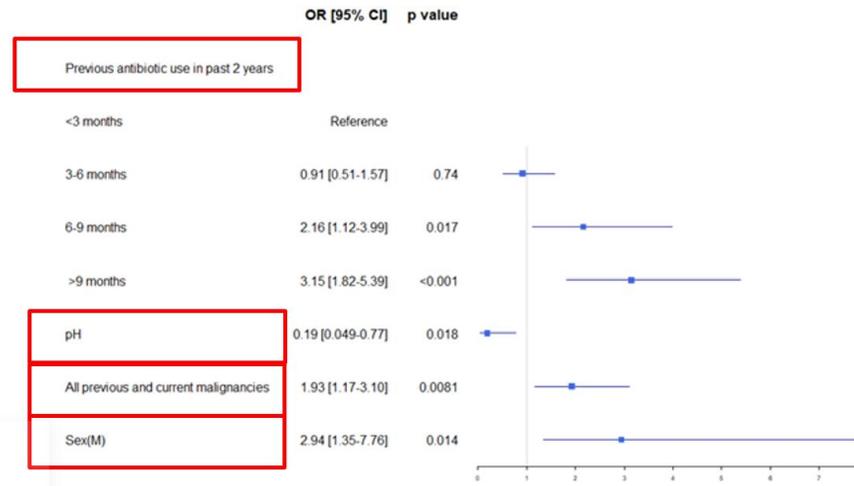
Conclusion

- 22.8% of those infected with MDR experienced mortality, compared to 12.8% in those without MDR (p<0.001)
- Significant differences in secondary outcomes were also observed, except for the time to the next AECOPD
- Propensity score regression analysis revealed MDR bacteria being associated with higher risks of mortality (adjusted OR (aOR) = 1.46 [95% CI 1.09-1.96], p=0.011)
- Associations with mortality arise from MDR pathogens: (aOR = 2.43 [95% CI 1.42-4.11], p<0.001)
- Out of the pathogenic bacteria, Pseudomonas aeruginosa was associated with higher mortality (aOR = 2.03 [95% CI 1.22-3.32], p=0.0052)
- Risk factors include: previous antibiotic use, low pH levels, malignancies and male gender
- We are planning to conduct RCTs assessing the effectiveness of CRP guided antibiotic stewardship in treating AECOPD in the coming months, to reduce antibiotic resistance and hospital costs

QR code to download the poster!