

Introduction

- Middle Eastern Respiratory Syndrome Coronavirus (MERS-CoV) was first reported in Jeddah in 2012.
- As of April 2016, there have been 1,698 cases, with 609 deaths in 26 countries (≈36% mortality)
- Hospital outbreaks, which affect patients, visitors, and healthcare workers, are major cause of concern

Objectives

- Describe differences in mortality rates of MERS-CoV patients among different regions and healthcare providers
- Examine relationship between patient mortality and predictors

Methods

- Ministry of Health (MoH) collected data through national MERS-CoV surveillance
- 1,283 confirmed MERS-CoV cases from September 2012 to December 2015 included
- Chi-square tests for association of outcome with all predictors and cross-sectional multi-level analysis to generalize estimating equations (GEE)
- Analyzed cases as observations within hospitals and hospitals were grouped into regions

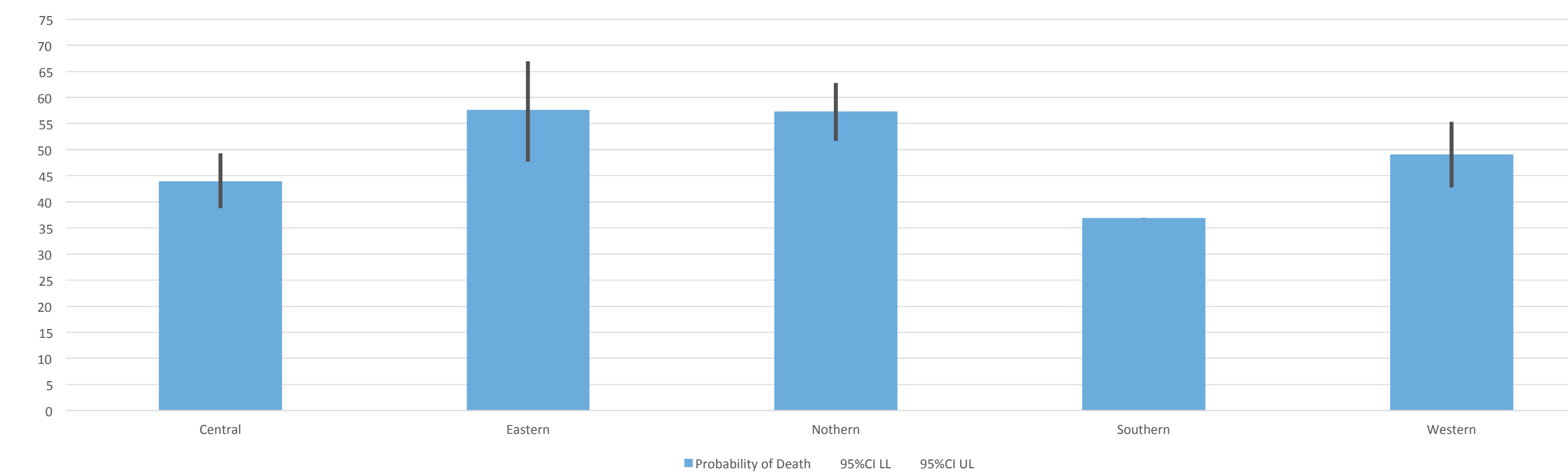
Results

- Overall mortality rate was 43%
- Chi-square tests showed significant association between mortality and sector of healthcare provider, patient's age, gender, nationality, source of infection, and year of acquisition

Table 1: Descriptive Analysis of Predictors of Mortality for Middle Eastern Respiratory Syndrome, Kingdom of Saudi Arabia, 2012 – 2015: (n=1283)

Variable	Levels	N (%)	Mean (SD)
Age			50.54 (18.80)
Gender	Male	826 (64.38)	
	Female	457 (32.62)	
Nationality	Saudi	872 (67.97)	
	Non-Saudi	411 (32.03)	
Source of Infection	Primary	374 (29.15)	
	Secondary case hospital acquired	163 (12.70)	
	Secondary case healthcare worker	240 (18.71)	
	Secondary case household contact	190 (14.81)	
	Unclassified	316 (24.63)	
Symptoms	Symptomatic	1130 (88.07)	
	Asymptomatic	153 (11.93)	
Outcome	Deceased	551 (42.95)	
	Survived	732 (57.05)	

Figure 1 Unadjusted Probability of Mortality by Geographic Divisions for Symptomatic MERS Cases, Kingdom of Saudi Arabia, 2012 – 2015

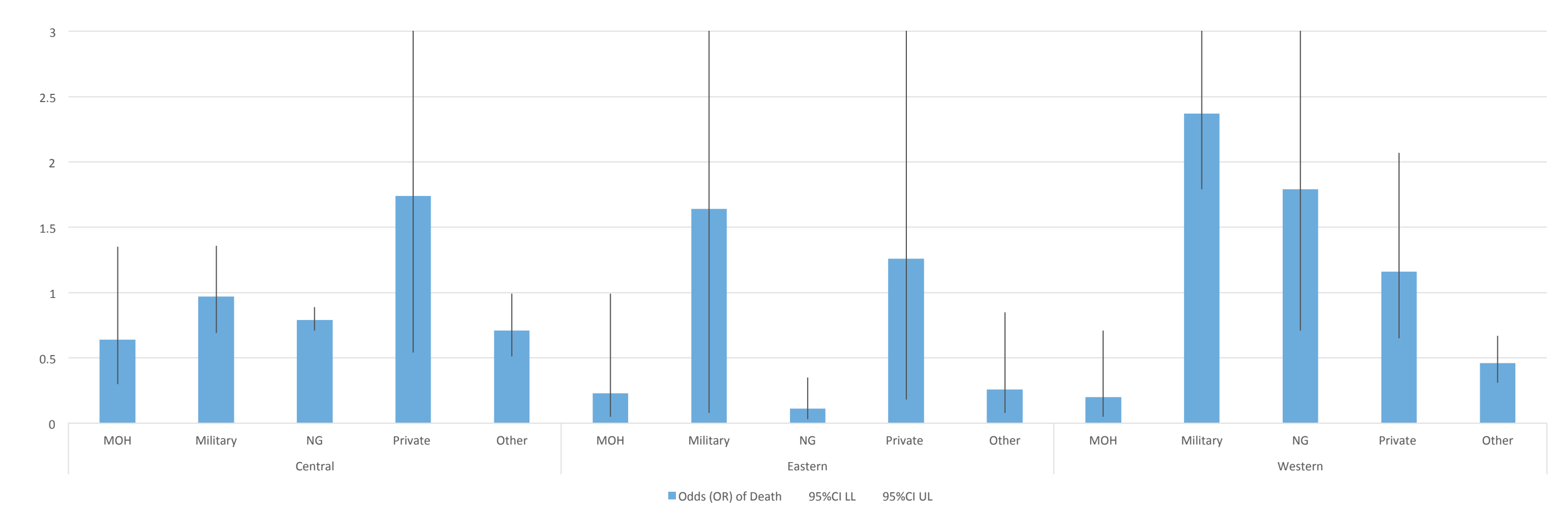


- Probability of death for symptomatic patients in MoH hospitals (adjusted for age, gender, nationality, and infection source) was 39% in Central division, 19% in Eastern division, and 16% in Western division

Table 4: Adjusted Analysis of Generalized Estimating Equations Probability of Mortality, Odds of Mortality, and Odds Ratios by Geographic Divisions for Symptomatic Middle Eastern Respiratory Syndrome Cases, Kingdom of Saudi Arabia, 2012 – 2015 (n=1130, alpha=0.05 for CI and p-value)

Division*	Variable	Level	Reference	Probability	95% CI	Odds (OR)	95% CI odds	P-value
Center	Intercept			38.84	23.02 57.44	0.64	0.30 1.35	0.2378
	Sector	Military	MOH			0.97	0.69 1.36	0.8701
		NG			0.79	0.71 0.89	<.0001	
		Private			1.74	0.54 5.55	0.3510	
		Other ^s			0.71	0.51 0.99	0.0440	
	Age	30 to 49	less than 30			0.75	0.36 1.54	0.4307
		50 to 69			2.24	1.01 4.95	0.0460	
		70 and above			5.94	2.88 12.24	<.0001	
		Unclassified			1.08	0.81 1.45	0.5828	
	Gender	Male	Female			0.89	0.68 1.16	0.3915
	Nationality	Saudi	Non-Saudi			1.04	0.63 1.72	0.8824
	Source of Infection	Secondary case hospital acquired	Primary			0.08	0.03 0.24	<.0001
		Secondary case healthcare worker				0.14	0.05 0.34	<.0001
		Secondary case household contact				0.80	0.55 1.15	0.2314
Unclassified				18.64	5.04 49.69	0.23	0.05 0.99	0.0481
East	Intercept					1.64	0.08 34.80	0.7515
	Sector	Military	MOH			0.11	0.03 0.35	0.0002
		NG			1.26	0.18 9.05	0.8155	
		Private			0.26	0.08 0.85	0.0263	
		Other ^s			0.44	0.07 2.58	0.3621	
	Age	30 to 49	less than 30			0.62	0.19 2.03	0.4301
		50 to 69			2.31	0.32 16.55	0.4030	
		70 and above			1.22	0.59 2.53	0.5843	
		Unclassified			5.95	1.67 21.16	0.0059	
	Gender	Male	Female			8.34	2.77 25.10	0.0002
	Nationality	Saudi	Non-Saudi			0.27	0.04 1.99	0.1986
	Source of Infection	Secondary case hospital acquired	Primary			0.32	0.04 2.53	0.2779
		Secondary case healthcare worker				0.92	0.29 2.87	0.8818
		Secondary case household contact			16.41	5.18 41.36	0.20	0.05 0.71
Unclassified				2.37	1.79 3.15	<.0001		
West	Intercept					1.79	0.71 4.53	0.2182
	Sector	Military	MOH			1.16	0.65 2.07	0.6257
		NG			0.46	0.31 0.67	<.0001	
		Private			1.00	0.44 2.28	0.9998	
		Other ^s			2.78	1.25 6.19	0.0125	
	Age	30 to 49	less than 30			5.93	2.30 15.30	0.0002
		50 to 69			1.18	0.65 2.13	0.5876	
		70 and above			1.03	0.65 1.63	0.9089	
		Unclassified			1.62	0.89 2.96	0.1167	
	Gender	Male	Female			0.14	0.07 0.28	<.0001
	Nationality	Saudi	Non-Saudi			0.52	0.22 1.24	0.1411
	Source of Infection	Secondary case hospital acquired	Primary			1.02	0.62 1.68	0.9457
		Secondary case healthcare worker						
		Secondary case household contact						
Unclassified								

Figure 2 Adjusted Odds and OR of Mortality by Geographic Divisions and Healthcare Providers for Symptomatic MERS Cases, Kingdom of Saudi Arabia, 2012 – 2015



Discussion

- Discrepancies were observed in probability of death for MERS-CoV patients across different divisions and healthcare provider sectors
- Patient age and source of infection are strong predictors of mortality in all regions

Conclusion

- Several factors play a role in mortality of MERS-CoV patients, but gaps in outbreak surveillance and case reporting limit a full understanding of these
- Observed results reflect variability in standard of care across healthcare providers
- Infection control and prevention has proven to be a meaningful factor in limiting MERS-CoV outbreaks

Recommendations

- To improve data availability and integrity, strict compliance of healthcare providers to case reporting should be enforced.
- MoH should set, supervise, and assure MERS-CoV standards of care across all types of healthcare providers, and these should be equally maintained.
- Lack of compliance to protocols issued by the scientific advisory board should be reported.

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