

# Predicting the 2014 Ebola Outbreak in West Africa using Network Analysis

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## APPENDIX

TABLE I: Parameter estimation for Ebola SEIR model (Guinea & Sierra Leone)

Incidence Dependent Parameters	Guinea			Sierra Leone		
	Value		Comments	Value		Comments
Initial Case $t_0$	December 2, 2013		one person fell ill	April 23, 2014		one person fell ill
$S_0$	0		-	0		-
$E_0$	0		-	0		-
$I_0$	1		-	1		-
$R_0$	0		-	0		-
$C_0$	1		-	1		-
Intervention time	March 2, 2014		Gov. of Guinea informed WHO	June 12, 2014		Country declared emergency
$\tau$	110		-	50		-
Estimated Parameters	Value	95% CI	Comments	Value	95% CI	Comments
Incubation Time $1/k$	6.3	-	based on previous works	6.3	-	based on previous works
Infection Time $1/\gamma$	5.4957	[5.43, 5.545]	-	6.386	[6.2112, 6.4733]	-
$\beta_0$	0.2407	[0.2374, 0.244]	-	0.356	[0.3391, 0.3643]	-
$\beta_1$	0.2084	[0.2033, 0.2135]	-	0.195	[0.1926, 0.1988]	-
$q$	32	[0.1, 100]	-	0.47	[0.1, 7.07]	-
Fatality Rate	0.67	-	-	0.289	-	-
$R_0$	1.323	[1.295, 1.341]	-	2.27	-	-
$R_1$	1.145	-	-	1.24	-	-

TABLE II: Parameter estimation for Ebola SEIR model (Liberia & West Africa overall)

Incidence Dependent Parameters	Liberia			West Africa		
	Value		Comments	Value		Comments
Initial Case $t_0$	March 31, 2014		official confirmation two infected	December 2, 2013		one person fell ill in Guinea
$S_0$	0		-	0		-
$E_0$	0		-	0		-
$I_0$	2		-	1		-
$R_0$	0		-	0		-
$C_0$	2		-	1		-
Intervention time	July 30, 2014		School shutdown	March 2, 2014		Gov. of Guinea informed WHO
$\tau$	120		-	110		-
Estimated Parameters	Value	95% CI	Comments	Value	95% CI	Comments
Incubation Time $1/k$	6.3	-	based on previous works	6.3	-	based on previous works
Infection Time $1/\gamma$	10.5	[8.32, 10.7]	-	6.8	-	-
$\beta_0$	0.1697	[0.167, 0.199]	-	0.2	-	-
$\beta_1$	0.0001	[0.0001, 0.097]	-	0	-	-
$q$	0.0068	[0.0059-0.0187]	-	0	-	-
Fatality Rate	0.575	-	-	-	-	-
$R_0$	1.78	-	-	1.36	-	-
$R_1$	0.001	-	-	-	-	-

### Contribution from individual team members

- Shafi: Project idea and research, introduction (Section I), literature review (Section II), country level analysis and prediction using compartmental model (Section III), world-wide analysis and prediction (Section V - subsection V-F and V-G). Coding, simulation and plots related to Figures 2, 4, 6 and Tables I, IV, V.
- Mike: Project idea and research, helped with literature review, data processing and generation of inter-country migration numbers (Sections V-B, V-C), helped with performance optimization, parallelization, and EC2 simulation of intra-country percolation model (Section IV), generation of global networks, implementation and execution of global network-based SEIR simulation (Section V-D), proof-reading of report.
- Romit: Project idea and research, introduction (Section I), exploring the MCMC approach for compartmental model and developed code. Data collection and analysis, coding the two simulation model based on percolation theory and running the simulations on EC2, analyzing results and plotting the graphs and generating prediction numbers (Section IV) Figures 3(a), 3(b) Tables IV-A, III.