

# THE LANCET

## **Supplementary appendix**

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Bogoch II, Creatore MI, Cetron MS, et al. Assessment of the potential for international dissemination of Ebola virus via commercial air travel during the 2014 west African outbreak. *Lancet* 2014; published online Oct 21. [http://dx.doi.org/10.1016/S0140-6736\(14\)61828-6](http://dx.doi.org/10.1016/S0140-6736(14)61828-6).

Appendix A: Sensitivity analyses\* looking at impact of increased case burden and reduced air traffic flows on potential risk of Ebola case exportation from Guinea (A1), Liberia (A2) and Sierra Leone (A3). Estimates represent cumulative number of outbound travellers between September and December, 2014.

**A1: Guinea**

Case burden** scenarios	Cumulative number of outbound infected travellers under selected travel restriction scenarios		
	Normal air travel volume	50% reduction in air travel	75% reduction in air travel
2x case burden	2·9	1·5	0·7
5x case burden	7·3	3·7	1·8
10x case burden	14·6	7·3	3·7
Exponentially† increasing case burden	45·3	22·7	11·3

\*Model assumptions include: EV disease risk is equally distributed across the population; an individuals' risk of EV infection is independent of the probability of international air travel. Projected numbers of EV infected, internationally outbound travelers are a cumulative total between September to December using the following formula: [number of 'active cases'/country population] x monthly number of international outbound air travelers). Travel volumes are based on IATA reported outbound, passenger-level monthly traveler volumes from Guinea, Liberia and Sierra Leone, between September-December 2013.

\*\*Case data are based on WHO reported active case counts as of September 21<sup>st</sup>, 2014.

†Exponential model based on WHO Ebola Response Team, NEJM, 2014 [6].

## A2: Liberia

Case burden** scenarios	Cumulative number of outbound infected travellers under selected travel restriction scenarios		
	Normal air travel volume	50% reduction in air travel	75% reduction in air travel
2x case burden	32·1	16·1	8·0
5x case burden	80·3	40·1	20·1
10x case burden	160·5	80·3	40·1
Exponentially† increasing case burden	52·1	26·0	13·0

\*Model assumptions include: EV disease risk is equally distributed across the population; an individuals' risk of EV infection is independent of the probability of international air travel. Projected numbers of EV infected, internationally outbound travelers are a cumulative total between September to December using the following formula: [number of 'active cases'/country population] x monthly number of international outbound air travelers). Travel volumes are based on IATA reported outbound, passenger-level monthly traveler volumes from Guinea, Liberia and Sierra Leone, between September-December 2013.

\*\*Case data are based on WHO reported active case counts as of September 21<sup>st</sup>, 2014.

†Exponential model based on WHO Ebola Response Team, NEJM, 2014 [6].

### A3: Sierra Leone

Case burden** scenarios	Cumulative number of outbound infected travellers under selected travel restriction scenarios		
	Normal air travel volume	50% reduction in air travel	75% reduction in air travel
2x case burden	10·9	5·5	2·7
5x case burden	27·3	13·7	6·8
10x case burden	54·6	27·3	13·7
Exponentially† increasing case burden	7·5	3·7	1·9

\*Model assumptions include: EV disease risk is equally distributed across the population; an individuals' risk of EV infection is independent of the probability of international air travel. Projected numbers of EV infected, internationally outbound travelers are a cumulative total between September to December using the following formula: [number of 'active cases'/country population] x monthly number of international outbound air

travelers). Travel volumes are based on IATA reported outbound, passenger-level monthly traveler volumes from Guinea, Liberia and Sierra Leone, between September-December 2013.

\*\*Case data are based on WHO reported active case counts as of September 21<sup>st</sup>, 2014.

†Exponential model based on WHO Ebola Response Team, NEJM, 2014 [6].

Appendix B: Final destinations (top 25) of travelers departing Guinea, Liberia and Sierra Leone from September to December, 2013

City	Country	Traveler Volume	% Total Volume	Cumulative %
Accra	Ghana	25,267	17.5%	17.5%
Dakar	Senegal	20,805	14.4%	31.9%
London	United Kingdom	11,063	7.7%	39.6%
Banjul	Gambia	9,849	6.8%	46.4%
Paris	France	8,647	6.0%	52.4%
Abidjan	Cote D'Ivoire	8,266	5.7%	58.1%
Casablanca	Morocco	7,514	5.2%	63.3%
Brussels	Belgium	5,541	3.8%	67.1%
Lagos	Nigeria	4,046	2.8%	69.9%
Bamako	Mali	3,680	2.5%	72.5%
Nairobi	Kenya	2,371	1.6%	74.1%
Beijing	China	2,095	1.5%	75.6%
Beirut	Lebanon	1,706	1.2%	76.8%
Mumbai	India	1,348	0.9%	77.7%
Bissau	Guinea-Bissau	1,340	0.9%	78.6%
Johannesburg	South Africa	1,296	0.9%	79.5%
Dubai	United Arab	911	0.6%	80.1%

	Emir			
Nouakchott	Mauritania	870	0·6%	80·7%
Guangzhou	China	804	0·6%	81·3%
Addis Ababa	Ethiopia	794	0·5%	81·9%
New York	United States	788	0·5%	82·4%
Delhi	India	751	0·5%	82·9%
Montreal	Canada	610	0·4%	83·3%
Ouagadougou	Burkina Faso	583	0·4%	83·7%
Wuhan	China	550	0·4%	84·1%



Appendix C: Final destinations (top 25) of travelers departing Lagos and Port Harcourt, Nigeria from September to December, 2013

City	Country	Traveler Volume	% Total Volume	Cumulative %
London	United Kingdom	92,092	17.0%	17.0%
Dubai	United Arab Emir	46,670	8.6%	25.7%
Accra	Ghana	38,437	7.1%	32.8%
Johannesburg	South Africa	37,239	6.9%	39.7%
New York	United States	11,707	2.2%	41.8%
Douala	Cameroon	11,131	2.1%	43.9%
Houston	United States	10,894	2.0%	45.9%
Paris	France	10,817	2.0%	47.9%
Guangzhou	China	9,435	1.7%	49.6%
Amsterdam	Netherlands	8,784	1.6%	51.3%
Abu Dhabi	United Arab Emir	8,497	1.6%	52.8%
Mumbai	India	7,826	1.4%	54.3%
Nairobi	Kenya	7,272	1.3%	55.6%
Delhi	India	6,926	1.3%	56.9%
Addis Ababa	Ethiopia	6,744	1.2%	58.1%
Beijing	China	6,398	1.2%	59.3%
Istanbul	Turkey	5,955	1.1%	60.4%
Beirut	Lebanon	5,688	1.1%	61.5%

Atlanta	United States	5,430	1·0%	62·5%
Dakar	Senegal	5,260	1·0%	63·5%
Libreville	Gabon	5,120	0·9%	64·4%
Cape Town	South Africa	4,908	0·9%	65·3%
Kuala Lumpur	Malaysia	4,845	0·9%	66·2%
Abidjan	Cote D'Ivoire	4,518	0·8%	67·0%
Rome	Italy	4,358	0·8%	67·9%