The changing epidemiology of ebola virus in West Africa

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Current situation

www.who.int/csr/disease/ebola/situation-reports/en/
Data: WHO linelist & MOH sitreps

Confirmed + Probable cases by week of notification, up to 4 January
Overall pattern

Guinea
Liberia
Sierra Leone

WHO
SitReps

weekly cases

time
Modelling

- Use a stochastic transmission model (SEIR).
- The model was parametrized using empirical estimates for the incubation (about 9 days) and infectious periods (about 11 days).
- Fitted to incidence data using Bayesian methods.
- Changes in the reproduction number over time were modelled using a time-varying contact-rate parameter (beta).
Fit and long-term projections

Model: fit forecast

 Guinea  Liberia  Sierra Leone

**Weekly reported cases**

**Reproduction number**

R is currently around the epidemic control threshold

R is currently below the epidemic control threshold

Average R over last 3 weeks fitted


Heterogeneity at the district level & through time

Increasing since November

Two unsafe burials
Guinea: district level

- Beyla
- Conakry
- Coyah
- Dabola
- Dubréka
- Faranah
- Forécariah
- Gueckedou
- Guinea
- Kankan
- Kerouane
- Kindia
- Kissidougou
- Kouroussa
- Lola
- Macenta
- Nzérékoré
- Siguiri
- Telimele

Weekly cases over time:
- July
- August
- September
- October
- November
- December
- January
Fit and projection at the district level

Model: fit forecast

Conakry

Montserrado

Western Area

Increase (R > 1)

Decrease (R < 1)

Weekly reported cases

Reproduction number
Other districts with \( R > 1 \)
Changing risk to HCW
Changing case-fatality ratios

Monthly CFR WHO

Case fatality rate (in %)

Month of exit from treatment centre

All

Guinea

Liberia

Sierra Leone
Other features not changing e.g. risk by age
Overall summary

• Epidemiology changing rapidly
• Incidence generally declining in Sierra Leone and Liberia, but locally very variable
• Not clear what has caused decline in incidence
  – Scale up of response (beds, reduced stock-outs...)
  – Behavioural change
• Not able to predict whether decline in incidence will continue
  – E.g. recent increases in incidence Guinea
• Other epidemiological features also changing – e.g. incidence in HCW
• Clinical trials very difficult to plan
• Forecasts can help
  – Limited in accuracy over longer time periods
• Assessments and forecasts are updated weekly
  – Will become more difficult when vaccines rolled out!
Acknowledgements & further details

More detailed weekly assessments and district-level forecasts at:
http://cmmid.lshtm.ac.uk/research/ebola/

Data:
• MoHs
• WHO

Funded by:
Liberia

Weekly cases by region over time.