Title
Magnitude of ebola relative to other causes of death in liberia, sierra leone, and guinea

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Magnitude of Ebola relative to other causes of death in Liberia, Sierra Leone, and Guinea

With more than 20,000 cases reported, the outbreak of Ebola virus disease (EVD) in west Africa is by far the largest in recorded history. Despite the scale of the current outbreak, EVD is often perceived as a “small-scale killer”.

By comparison, malaria caused an estimated 854,000 deaths worldwide in 2013. However, although limited at the global level, the impact of EVD on mortality could be substantial in countries with intense transmission. We thus aimed to compare EVD with other causes of death in Liberia, Sierra Leone, and Guinea in 2014.

We did an uncertainty analysis of EVD mortality (see appendix), based on two parameters: the extent of under-reporting of EVD cases and the case fatality rate (CFR)—ie, the proportion of EVD cases who die. Similar to other analyses of EVD spread, we hypothesised that there were up to 2·5 times more EVD cases than reported. This factor derives from a mathematical model, which compared the reported number of EVD cases to the number of beds in use in Ebola treatment units in August, 2014. We assumed that the CFR varied between 60% and 85%. The lower rate corresponds to CFRs seen among hospitalised EVD patients with known disease outcomes. Lower CFRs have been documented, but only in Ebola treatment units that implement non-standard treatment protocols. The upper rate corresponds to CFRs seen in non-hospitalised EVD patients.

We estimated the number of EVD deaths as the product of (1) the reported number of EVD cases, (2) the under-reporting factor and (3) the CFR. Based solely on confirmed and probable EVD cases, the number of EVD deaths in 2014 ranged from 2928 to 10,372 in Liberia, from 4468 to 15,824 in Sierra Leone, and from 1739 to 5548 in Guinea.

We used the most recent (2013) national estimates of non-EVD mortality, together with projections of population growth, to calculate the expected number of deaths from non-EVD causes in Liberia, Sierra Leone, and Guinea in 2014. For all combinations of model parameters, we mapped how the estimated number of EVD deaths ranked relative to the expected number of deaths from non-EVD causes.

In Liberia, for virtually all model parameters, EVD deaths exceeded the expected number of deaths due to the leading non-EVD cause of death (figure). In Sierra Leone, a broad range of model parameters also indicated that EVD might have killed more people in 2014 than the leading non-EVD cause of death (ie, malaria). In other sets of model parameters, EVD still killed more people than the second

<table>
<thead>
<tr>
<th>Country</th>
<th>Ratio of true: reported EVD cases</th>
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<tbody>
<tr>
<td>Liberia</td>
<td>10k</td>
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<tr>
<td>Sierra Leone</td>
<td>15k</td>
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<tr>
<td>Guinea</td>
<td>5k</td>
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<table>
<thead>
<tr>
<th>Country</th>
<th>Expected number of deaths due to non-EVD causes in 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberia</td>
<td>15,500 (2500 EVD deaths, etc)</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>25,000 (3500 EVD deaths, etc)</td>
</tr>
<tr>
<td>Guinea</td>
<td>10,500 (1500 EVD deaths, etc)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Country</th>
<th>Ranking of EVD deaths relative to non-EVD causes of death</th>
</tr>
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<tbody>
<tr>
<td>Liberia</td>
<td>EVD=1st cause of death</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>EVD=3rd cause of death</td>
</tr>
<tr>
<td>Guinea</td>
<td>EVD=2nd cause of death</td>
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</table>

This figure compares the expected number of deaths from non-EVD causes with the number of EVD deaths for all model parameters. The red area represents combinations of model parameters where EVD deaths exceeded the expected number of deaths due to the leading non-EVD cause of death. The blue area represents combinations of model parameters where EVD deaths were lower than the expected number of deaths due to non-EVD causes. The green area represents combinations of model parameters where EVD deaths were equal to the expected number of deaths due to non-EVD causes.
Correspondence

(ei, lower respiratory infections) or the third (ei, HIV/AIDS) leading causes of death. In Guinea, EVD never ranked higher than the top three non-EVD causes of death (figure). The highest estimate of EVD deaths was slightly lower than the expected number of deaths from diarrhoeal diseases—ei, the fifth leading non-EVD cause of death in that country (see appendix).

Our analyses have limitations. First, we do not account for increases in non-EVD deaths due to lower healthcare use during the outbreak. Second, the estimates of non-EVD mortality are based largely on imprecise survey or census data. Despite statistical corrections, they might underestimate the number of non-EVD deaths. Third, the range of model parameters we considered might be too broad. In one study of EVD viral sequences collected in June, 2014, in Sierra Leone, there were only up to 1·7 times more cases than reported. Case reporting might also have improved in the autumn of 2014, as new Ebola treatment units were opened. Fourth, we only include confirmed and probable EVD cases, whereas EVD deaths might also be common among suspected cases (ie, cases without laboratory or clinical data).

Nonetheless, our analyses identify a large discrepancy between the high impact of EVD on mortality in Liberia and Sierra Leone (and to a lesser extent Guinea), and its low impact on mortality at global or continental levels. Since assessments of the burden of disease should inform the allocation of health investments, this discrepancy could create conflicting priorities among actors of the health sector in these countries. External actors operating across multiple countries and regions (eg, donors, non-governmental organisations) might emphasise tackling diseases more common throughout sub-Saharan Africa than EVD. National governments, on the other hand, might stress the need to prevent future EVD outbreaks. The emergence of EVD will thus require increased coordination between national and external actors to ensure that important components of the disease burden do not go unaddressed.

Focusing on building high-quality health systems, capable of addressing a broad range of diseases including EVD, could help overcome this tension. We thank Bruno Masquelier and Jemima A Frimpong for comments. We declare no competing interests.

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