

## Controlling Ebola: next steps



The Ebola epidemic is paradoxical: it is out of control yet readily controllable. The key to epidemic control is rapid diagnosis, isolation, and treatment of infected individuals.<sup>1</sup> This approach was used in past Ebola outbreaks through contact tracing, in which anyone exposed to a person with Ebola was monitored, tested if they developed symptoms, and, if positive, securely transported to a health facility for treatment.<sup>2</sup> Moreover, while 60–90% of untreated patients with Ebola die, effective medical care could reduce this rate to below 30%.<sup>3</sup> This strategic approach was not taken in time during the present Ebola outbreak in west Africa. According to estimates from the US Centers for Disease Control and Prevention, about 60% of all Ebola infections in west Africa remain undiagnosed in the community with the potential for hundreds of thousands of cases by mid-2015.<sup>4</sup> Infected individuals become contagious when they begin to show symptoms. Without effective isolation, each Ebola patient is estimated to transmit the virus to around 1·8 additional people, leading to the exponential growth of infections with a doubling time of around 20 days. Control strategies based on rapid diagnosis, patient isolation, and treatment, can reduce the transmission to well under one additional person per infected case, thereby rapidly containing the epidemic.<sup>4</sup>

No coherent national or international approach has so far been implemented to integrate the intervention chain from case identification to diagnosis, to secure transport, to isolation and treatment. While efforts to create new vaccines, medicines, and diagnostics are underway, we recommend that three measures be adopted in a concerted way.

First, individuals with Ebola-like symptoms must be tested early so that cases of Ebola are identified rapidly and moved to isolation and treatment. Without laboratory testing, early diagnosis is difficult, because Ebola causes symptoms seen in many other infections, including malaria, typhoid, and influenza.<sup>5</sup> Distinguishing a case of Ebola requires testing a patient's blood with PCR. In past outbreaks where all infected individuals were known, only contacts, who were exposed to someone with Ebola, were tested if they developed symptoms. In the present epidemic, most Ebola patients—much less their contacts—are unknown.<sup>4</sup> Thus, everyone can be

considered a potential contact, and testing is needed for anyone with symptoms to minimise the possibility of transmission to others.

International efforts to bolster the capacity of west Africa's fragile and underfunded health systems to respond to Ebola have been woefully inadequate, but are now starting to move. There are currently fewer than two dozen established or planned laboratories equipped to use PCR in Sierra Leone, Guinea, and Liberia,<sup>6–8</sup> the three countries most affected by Ebola. To cope with the severe shortage of diagnostic capacity, for example, patients at Médecins Sans Frontières (MSF) Ebola treatment centres in west Africa are separated on the basis of clinical judgment of whether they are low-probability, high-probability, or confirmed cases.<sup>9,10</sup> Yet PCR machines are relatively inexpensive, and training in their use is fairly straightforward.<sup>11</sup> Within weeks, many new testing sites could and should be established with urgency in local districts across Liberia, Sierra Leone, and Guinea. The USA recently announced five new mobile testing laboratories,<sup>12</sup> which shows that an intensive effort can bring rapid results although much more in this direction is needed.

Improving the speed and coverage of case identification and testing for Ebola also requires reaching symptomatic people in their homes. Many people live in remote areas that would remain difficult to reach even with more laboratories established for testing. Transmission is also possible during unprotected travel to a testing site and at the laboratory.<sup>11</sup> People

Published Online  
October 8, 2014  
[http://dx.doi.org/10.1016/S0140-6736\(14\)61696-2](http://dx.doi.org/10.1016/S0140-6736(14)61696-2)



Associated Press

who might have Ebola should be isolated in the home using home protection kits, such as those distributed by MSF, until testing is complete to minimise the risk of transmission.<sup>13</sup> New cadres of community health workers, supported by smartphone-based information and communications systems, should be quickly trained and deployed to identify people in the community who develop suspicious symptoms.<sup>14</sup> Phlebotomists with protective equipment should then be dispatched to collect samples at the home and bring them to a local PCR testing site. Portable point-of-care devices and rapid diagnostic tests that provide immediate results with a single drop of blood are under development and, when available, could replace this approach.<sup>11</sup>

Second, patients confirmed with Ebola should be transported securely by dedicated vehicles that have protective equipment, disinfectants, and trained local transport operators.<sup>15</sup> There is a need for many ambulances to be deployed in the affected areas within weeks. Yet even without ambulances, the major mining and agricultural companies that operate in the region could organise makeshift yet safe transport in trucks and other vehicles, supported by use of smartphone systems to locate and call the vehicles as needed.

Third, there is an urgent need to scale up tent-based treatment facilities in local areas around the region. The rapid deployment of such facilities and health workers is an established practice of humanitarian relief agencies and armies,<sup>16,17</sup> but has not been rolled out in west Africa. The US army is presently building 17 treatment units, although the time involved will apparently be months, not weeks.<sup>18</sup> Tent-based facilities need to be staffed and equipped with water, solar-powered electricity, and other equipment to provide life-saving treatment. Without the provision of effective treatment, Ebola patients will continue to remain hidden in their communities. Isolation without treatment is doomed to fail. Communities need to believe that treatment is possible and that response efforts can tame this epidemic.

This comprehensive approach requires a unified central command in each national government to coordinate the different agencies on the ground and assure effective execution of plans. The newly formed UN Mission for Ebola Emergency Response (UNMEER) would provide one key interface between these national command units and the international agencies. These measures require building trust with local communities and

ensuring the safety and training of the large numbers of health workers needed.<sup>19,20</sup> The national government's role is indispensable, and can be strengthened but not replaced by international agencies.

This process must also be supported by a sound information system that starts with community-level mobile reporting on possible cases of Ebola, continues to the facility level with information on patients under treatment and the availability of key supplies, and aggregates into dashboards at the national level. Recent innovations in smartphone technology make it possible to deploy a GIS-tagged bottom-to-top information system within a few weeks.<sup>21</sup> With smartphones in the hands of all community health workers, drivers, facility managers, and district health officials, it should be possible to create a map of the epidemic in real time.<sup>22</sup> Such a map will be crucial for management, logistics, and contact tracing and allow control efforts to remain ahead of new outbreaks. Such systems have been useful in the Millennium Villages Project<sup>23</sup> and the Nigeria MDG Information System.<sup>21</sup>

We believe that with a dedicated effort that integrates early diagnosis, secure transport, and effective treatment, the Ebola epidemic could be contained within 6 months in Liberia and Sierra Leone, and in an even shorter time in Guinea. That is not the current trajectory but could become so if the affected governments and UNMEER quickly adopt a bottom-to-top, integrated, and scaled-up strategy to get ahead of the epidemic.

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We declare no competing interests.

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