were not vaccinated and became cases (among them 205 deaths) between Dec 31, 2018, and July 30, 2019. Vaccination coverage among health-care workers is high but incomplete.

The initial response should be to generate, maintain, and constantly update the primary databases, then sharing them among all players. Parallel databases should not exist. Because of the field difficulties and the inadequate personnel resources, a single team staffed by the most experienced partners should oversee this task. During the autumn of 2014, a Conakry informal taskforce, consisting of one member from each main partner (Guinea Ministry of Health, WHO, Médecins Sans Frontières, Centers for Disease Control and Prevention) met at least once a week, allowing real fact-based understanding and management of the Ebola situation. This approach needs to be replicated for this outbreak at each level.

Laboratory support from national and external partners is needed and should provide timely support for clinical management of patients receiving experimental therapeutics or difficult epidemiological investigations, such as cases with multiple or unknown origins. As in the west African outbreak, point-of-care rapid diagnostic tests should be fielded, at least as an evaluation of community deaths.

The existing vaccination strategy and implementation on the ground, should be drastically changed. A single combined team should follow and vaccinate contacts and contacts of contacts. This policy, combined with a rapid and complete inclusion of all high-risk contacts, should reduce, or at least improve the outcome of, secondary Ebola cases and affect the transmission curve.

Even if the infection prevention and control efforts have yielded some progress, the relatively large proportion of cases due to reuse of material (eg, syringes, needles, and perfusion tubes) is unacceptable. More emphasis on the multiple risks of this practice should be advertised among the care providers and the population.

Helping the existing local health-care providers to regain the population's confidence is crucial. This should be done by introducing a comprehensive health system with actions that encompass the health-related problems encountered daily by the population—eg, malaria, vaccine-preventable diseases, childbirth, and quality of care.

Together with the presence of violence and insecurity, Ebola virus disease has a real chance of becoming endemic in this part of DRC. Only multiple and immediate changes, starting within the leadership and coordination of all the partners involved through inclusive, flexible, and unified response efforts, will be able to reverse the trend.

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Precision public health and HIV in Africa

Laura Dwyer-Lindgren and colleagues[1] have published an important mapping study that shows changes in the prevalence of HIV across Africa between 2000 and 2017. They used multiple data sets and statistical modelling to estimate both the prevalence of HIV among adults aged 15–49 years (figure) and the number of HIV-infected adults in this age group (figure 3 in Dwyer-Lindgren and colleagues[1]), at a spatial resolution of 5 × 5 km. They are the first to map HIV epidemics across the entire continent of Africa; previous mapping studies have focused on specific countries such as Lesotho[2] and Zimbabwe.[3]

The continental map shows that HIV epidemics in sub-Saharan Africa are not distinct entities contained within a country, but cross-national borders (figure). Neighbouring countries that have a similar prevalence of HIV at their national borders have a strong epidemiological linkage—for example Botswana and

Zimbabwe, or Botswana and South Africa. This pattern indicates that their borders are porous and individuals can move relatively freely between the countries—notably, HIV prevalence is high in all three countries. To be successful in eliminating HIV, governments of epidemiologically linked countries will need to coordinate their efforts and develop a regional control strategy. However, a substantial difference is noted in HIV prevalence between certain neighbouring countries—for example, in Namibia the average prevalence is 13%, whereas in Angola it is 2%.[1] In such cases, it might not be necessary for the countries to coordinate their HIV control strategies. Taken together, the results shown emphasise the necessity of determining the strength of connectivity among the country-specific HIV epidemics that traverse Africa (figure).

The continental prevalence map provides a static picture of the 2017 African epidemic, but it also shows the importance of human mobility. The observed large-scale spatial diffusion of HIV across southern and eastern Africa reflects historical movement patterns and migration flows.[4] HIV began spreading in the 1920s from Kinshasa, the capital of the then Belgian Congo (now Democratic Republic of the Congo).[4] At that time, rail transportation networks were already well established and heavily used. In the Belgian Congo in 1922, about 300 000 passengers travelled by train.[5] Human mobility continues to drive the spatial diffusion of HIV in Africa, as shown by phylogenetic[6–8] and epidemiological[9–11] studies. However, UNAIDS and WHO recommended HIV control strategies are based on a static view of the epidemic and do not consider mobility. Novel interventions that can reduce mobility-driven HIV transmission are clearly needed. Interventions that take mobility into account are already widely used for the control of other infectious diseases such as malaria.

The density of infection (DoI) map shows the spatial distribution of HIV-infected individuals throughout Africa; the density varies from one HIV-infected individual to about 38 000 HIV-infected individuals, per 25 km² (figure 3 in Dwyer-Lindgren and colleagues[1]). The distribution reflects the spatial demographics of African countries where populations are predominantly rural—for example, in Lesotho, only about 20% of the population live in urban centers.[2] In rural areas, settlements are small and widely dispersed, and consequently, population density (and the density of HIV infection) is low. In the urban centres, population density (and the density of HIV infection) is high. Prevalence is lower in rural areas than in urban centres; however, because of the level of urbanisation, most HIV-infected individuals live in rural areas. Notably, if the DoI map is used as a health policy tool to design resource allocation strategies, difficult ethical decisions will need to be made as to whether to maximise cost-effectiveness or to reduce urban–rural inequities in access to health care.[2] Current UNAIDS and PEPFAR strategies are based on maximising cost-effectiveness by preferentially allocating resources to urban centers.[12]

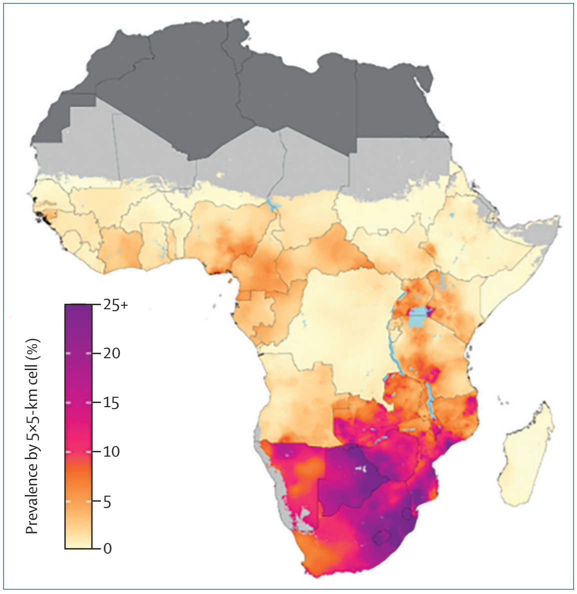

Figure: **Map of HIV prevalence in Africa for adults aged 15–49 years in 2017**
Reproduced from reference 1, by permission of Dwyer-Lindgren and colleagues.

The maps constructed by Dwyer-Lindgren and colleagues clearly show the magnitude of the problem of reducing HIV transmission in Africa. However, the maps mask important gender differences. In all sub-Saharan African countries, HIV prevalence is substantially higher in women than in men, with highest annual incidence in adolescent girls and young women. This fact implies that prevention resources should be preferentially allocated to protect women, rather than men, against infection. As the maps show, to achieve elimination, development of interventions that take into account movement and migration patterns, along with spatial demographics, are necessary. Notably, these interventions should help to reduce the urban-rural inequities that exist in access to health care in Africa.

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