Editorials

The tail of the epidemic and the challenge of tracing the very last Ebola case

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Citation style for this article:
Kaasik-Aaslav K, Coulombier D. The tail of the epidemic and the challenge of tracing the very last Ebola case. Euro Surveill. 2015;20(12):pii=21075. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=21075

Article submitted on 25 March 2015 / published on 26 March 2015

One year ago, on 23 March 2014, the World Health Organization (WHO) announced that it had been notified 'of a rapidly evolving outbreak of Ebola virus disease (EVD) in forested areas of south-eastern Guinea'. At that time, 49 cases, including 29 deaths had been reported. In the following months and weeks, the outbreak spread to the two neighbouring countries Sierra Leone and Liberia and peaked six months later, in October 2014, with up to 1,500 cases reported on a weekly basis. It was then when several scientific publications presented forecasts for the coming months that ranged from 60,000 EVD cases for the most conservative estimates, up to several hundred thousands of EVD cases [1-4] for the more forthcoming ones. As of 22 March 2015, the toll of the epidemic has been 24,907 reported cases including 10,326 deaths [5]. Despite these far too high numbers, the even higher forecasts were fortunately not attained. This can be partly attributed to the unprecedented mobilisation of resources generated by these high estimates.

In the past eight weeks, the number of new confirmed, probable and suspected EVD cases has been stabilising at around 365 notifications per week [6,7]. However, this trend results from the combination of heterogeneous patterns: while Liberia has almost interrupted human-to-human transmission, and the 'historical' epicentre of the epidemic in the forested area at the border of Sierra Leone and Guinea reports few new cases, there has been a shift of the epidemic towards the capital cities of Freetown and Conakry and their surrounding districts where there is sustained and even increasing transmission [8].

The elimination of human-to-human transmission of the Ebola virus in the affected countries is achievable. Liberia has shown that strict and comprehensive implementation of control measures are effective to interrupt this form of transmission [9]. This can be achieved since sufficient Ebola treatment units and laboratory capacity are currently available in the region [10]. It should also be feasible because the mobilisation of field epidemiologists trained in the various field-training programmes around the world has dramatically increased in recent months.

Upon entering what seems to be the tail of the epidemic and, as in any such moment, the 'Ebola endgame' strategy requires adaptation to the heterogeneity of the epidemiological situation. The tools for EVD control need to be fine-tuned and the commitment from the teams supporting local authorities in affected countries needs to be sustained. While the pressure on clinical and laboratory expertise gradually decreases, the demand shifts towards field epidemiologists to assist local public health experts and support community workers to engage in active surveillance and to monitor remaining transmission chains in affected communities. The priority at this stage of the epidemic is the early detection of possible re-emergence of transmission, in relation with importation of cases from areas still experiencing active transmission. Other contributing factors to re-emergence of transmission could be delayed secondary transmission, as suspected recently through sexual contact in Liberia and Macenta, Guinea or new primary zoonotic transmission from the animal reservoir given the long duration of the present outbreak [11,12]. However, no conclusive evidence is available for sexual transmission of the disease by convalescent EVD-negative individuals [13]. Moreover, no new primary zoonotic transmission has been documented in the affected countries.

A paper by Rexroth et al. in this issue of *Eurosurveillance*, presents results from a survey of European infectious disease epidemiologists and microbiologists about their decisions to apply for Ebola response missions in West Africa [14]. It sheds light on the motivation and concerns of experts with regards to apply for deployment in affected countries. The need to deploy larger number of international experts to support the local outbreak response became evident when the epidemic went out of control in West Africa during the autumn of 2014. At the same time, limited secondary transmission occurred from an imported case in the United States and a medically evacuated case in Spain [15,16]. This gave rise to fear of the possibility that more imported cases and secondary transmission could occur, anywhere in our globally connected world [17]. Along with the dramatic forecasts, this led to concerns about the evolution of the epidemic and its potential spread, and an increase in deployed resources to the affected region.

The main concern for deployment of experts enrolled in the study was the concerns of their family and the lack of support from their employers. The study covers the period from 19 November to 7 December 2014. From March 2014 until 7 December, the European Centre for Disease Prevention and Control (ECDC) had facilitated the mobilisation of 13 experts to the affected countries through the WHO Global Outbreak And Response Network (GOARN) mechanism, all but three from the various field epidemiological training programmes in the European Union. In the three and half months since the study end, an additional 33 staff were mobilised. Currently, 19 experts mobilised through ECDC are deployed to West Africa: 14 in Guinea and five in Sierra Leone.

The paper by Walker et al. on a point-of-care blood test for identification of EVD, highlights the fact that the availability of a rapid diagnostic bedside test would be of great value in isolation facilities, especially when the proportion of patients infected with Ebola virus among suspected cases will have decreased as the epidemic is fading out [18]. The study shows that a 100% predictive negative value can probably be achieved with the presented rapid test, which would greatly reduce the amount of PCR tests necessitating considerable laboratory infrastructure and personnel. As discussed in the paper, applying the rapid test to safely discard suspected patients not infected with Ebola virus would dramatically reduce the burden on isolation unit beds and the need for confirmatory diagnostic PCR tests. For example, of 100 suspected EVD patients that would have to be tested and among which only 10 would be infected with Ebola virus, the rapid test, using a CT score of 6 as a threshold, would safely identify 87 persons as non-EVD patients and only require 13 diagnostic PCR tests to correctly identify these 10 EVD patients. Furthermore, as the epidemic continued to fade out, and if there would be only one Ebola virus infected patient among the 100 tested, the rapid test would identify 96 of the non-EVD patients and the PCR test would only need to be applied to the four remaining ones to identify the single case of EVD.

Complementing the considerations on the need for affordable and sustained field epidemiology and laboratory support, the paper by Fähnrich et al. reminds us that after one year into the epidemic, most affected areas still have no access to an appropriate information system to document the extent of the epidemic and to support the control. An information system able to monitor the epidemiological situation and the performance of the control measures is however, crucial for efficient outbreak response and should be implemented as early as possible. While such systems are still desirable at the current stage of the outbreak, they should eventually cover other epidemic-prone diseases also. Interestingly, the unavailability of computers in the field to register data can be effectively overcome by an approach relying on smart phone technology and cloud platforms [19].

The backbone of good surveillance is the timely provision of quality data to those who need it to steer interventions. Information systems such as the one presented will certainly improve processes involved in data acquisition. However, much still needs to be done to ensure the correct application of case definitions, the appropriate investigation of cases, and the exhaustiveness of reporting across affected districts and countries, in order to improve the ability to effectively depict the epidemiological situation and fully assess the progress and performance of the control programmes.

The paper by Alqahtani et al. on the perception of the risk and protective means regarding EVD among pilgrims from Australia to the Hajj, reports that one in six pilgrims thinks that Ebola transmits by air, one in five that they are at high risk of acquiring EVD during the Hajj, one in two that the use of masks would protect them [20]. These results remind us that misconception affecting pilgrims to the Hajj is certainly also true for members of EVD affected communities. While health advice to travellers should be strengthened in the context of epidemics, the mobilisation of anthropologists should support the surveillance and response teams in the affected communities and contribute to alleviate the fears of the community members towards the required control measures.

Finally, the article by Goodfellow et al. in this issue highlights the importance of the legacy of the international support to respond to the epidemic [21]. The authors stress that most of the laboratory technology now used in the affected countries may not be set up in a sustainable way and thus new strategies are required to ensure that in the aftermath of the epidemic there will be enough capacity to recognise and handle a future probable resurgence of EVD early. The paper calls for an extension of laboratory activities to cover essential clinical and microbiology services. The support activities should be extended beyond laboratory activities in the tail of the epidemic. They should ensure that EVD targeted activities are maintained until the last case of the last chain of transmission is controlled, while ensuring that surveillance and control of other epidemic-prone diseases are reactivated. This is particularly important during the rainy season that may lead to a dramatic increase in diseases such as measles, infectious diarrhoea, malaria, yellow fever or Lassa fever. Considering the low immunisation coverage overall, prior to the EVD epidemic [22], and the interruption of immunisation programmes during the epidemic, all those involved in the control of the EVD outbreak should work hard to ensure that no devastating outbreak of a vaccine-preventable disease, such as measles, will be part of the legacy of the international support to the response to the Ebola outbreak. risk of leptospirosis exposure among these groups.

Conflict of interest

None declared.

Authors' contributions

Denis Coulombier has drafted the editorial, Kaja Kaasik-Aaslav provided epidemiological background.

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