

Modelling the potential impact of limited hospital beds on Ebola virus disease dynamics

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During the 2014 Ebola virus disease outbreak, admission into a health facility depended on the availability of hospital beds and health personnel. The limited number of such important logistics contributed to the escalation of the epidemic. In order to estimate resource availability to the public, health planners use hospital bed-population ratio, i.e the number of hospital beds available for 10,000 population [1]. The number of beds available per every 10,000 people in Guinea was very low compared to the number of beds in other low income countries [2]. So, the number of beds allocated to EVD patients was largely insufficient to accommodate the unexpected increase in the number of cases.

We use a compartmental model to study the dynamics of Ebola virus disease when there is a limited number of beds for patients. We use a non linear hospitalisation rate and formulate the rate at which the time dependent number of available beds evolves. The model shows an hysteresis and a backward bifurcation. Simulation results show that bed supply and maintenance in Ebola treatment units contribute to the reduction of the number of individuals infected by Ebola virus. The model fitting results suggest that a timely supply of sufficient beds to Ebola treatment units limits the spread of the disease. Despite the fact that bed supplies to Ebola treatment units are not in themselves a control measure, they contribute to the reduction of the disease spread, by keeping the infectious in one place, during their infectious period. These results have important implications to the management and control of the disease.

References

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