Ebola Virus Disease : Transmission Dynamics and Nonstandard Finite Difference Schemes Revisited

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The talk starts with an update and World Health Organization (WHO) external situation reports of the Ebola Virus Disease (EVD) in Africa, particularly in the Democratic Republic of Congo. This background reinforces the need to incorporate three factors in effective modelling of the EVD. These are:

- The direct or fast transmission route, which involves contact with blood or body fluid and objects that have been contaminated by body fluid;
- The indirect or slow transmission channel, whereby individuals are infected through the environment (e.g. contact with infected animals, such as fruit bats and primates);
- Self-protection measures (e.g. avoiding the manipulation of infected dead individuals before their burial).

We consider a SIR-type model in which the three factors are incorporated, through the addition of four compartments for dead, vaccinated and trained individuals as well as for the environment. We prove that the disease-free equilibrium is globally asymptotically stable whenever the basic reproduction number is less than or equal to unity, and unstable when this threshold number is greater than 1. In the latter case, the existence of at least one endemic equilibrium, which is locally asymptotically stable, is shown. At the endemic level, it is shown that the number of infectious individuals is much smaller than that obtained in the absence of any intervention. We revisit the nonstandard finite difference (NSFD) methodology by bringing into play strategies such as sub-equations, productive - destructive decomposition, conservation laws, exact schemes and Mickens' rules. This is then used to construct NSFD schemes that are dynamically consistent with respect to the above features of the continuous model.