# Review of: "Exploring the Impact of Reaction-Diffusion on an Ecological Diversity Mathematical Paradigm for Understanding Hantavirus Infection Dynamics"

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Potential competing interests: No potential competing interests to declare.

**Summary**

This work aims to investigate the Hantavirus infection dynamics where the main factors leading to the geographical dissemination (i.e., the diffusion and the spatial distance) are taken into account. More specifically, the authors studied the spatial effects, including the movement of rodent and predator populations between different spatial locations within a finite habitat. The authors found that when the diffusion constant is moderate and the distances are (in meters) 1, 5, 10, and 100, the rodent and alien populations survive. However, the infection will die away when the rate of the diffusion constant is quite small and the distance is less than 10 meters.

**Minor**

i) English should be double-checked; several typos were detected.

ii) The equations are not numbered. This is inconvenient for the reader when he/she wants to refer to a particular mathematical expression.

iii) The impact of the intrinsic fluctuations, which may influence the Hantavirus infection dynamics significantly, has not been mentioned and treated.

iv) The dynamics of the system, analyzed by using the reaction-diffusion equations, is of a local type. So, the effects due to medium- and long-ranged interactions have been neglected.

The following suggestions may help to fill some gaps.

v) The limitations of the authors' model have not been mentioned and discussed.

The following recommendations may help to fill some gaps.

**Recommendations**

**1)** For clarity, please explain why the differential equations on page 4 of the manuscript do not satisfy the conservation law for the total rodents $r=r_s+r_i$, which reads $dr/dt=(b-c)r$.

**2)** The author proposes the partial differential equations on page 5 of the manuscript as the model describing the movement of rodents. However, the authors should mention that this model assumes that the movement of rodents is governed by local dynamics. So, other important contributions, such as the movement of rodents in a direction corresponding to a gradient of increasing or decreasing the concentration of a particular substance (*chemotaxis*), are neglected.

**3)** The authors' model describing the diffusion of one rodent and one alien is given by Eq. (2) on page 9. Even these equations are of the local type. It may be objected that this model is not realistic as it is purely deterministic, i.e., the effects due to intrinsic fluctuations in the system have been neglected. In other words, it would have been more realistic to propose a model where the dynamics are governed by stochastic partial differential equations (SPDEs) in which the fluctuating, additive term is of the white-noise type with variance derivable from non-equilibrium statistical mechanics. The author is asked to dispel this possible objection.

**4)** The authors followed the approach of Murray to carry out the analysis of Eqs (2). However, Eqs (2) are partial differential equations whose solution requires the specification of boundary conditions (BCs). As Murry also does in his books, please specify the BCs, justifying them from a biological point of view.

**5)** Another limitation of the model comes from the fact that the effects due to time delay have also been neglected. Realistic models should be described by SPDEs with time delay. The authors are invited to discuss, albeit briefly, this important point.

**Conclusions**

The research subject is interesting and topical. However, as mentioned above, the PDEs proposed by the authors to model the movement of a rodent and an alien (as a predator) are subject to very strong assumptions. Since the ultimate aim of this work is to investigate the relationship between the spread and dynamics of Hantavirus infection when the spread constant and spatial distance are taken into account, these assumptions may limit, if not invalidate, the correctness of the results obtained. This could be the main source of objections from the reader. The suggestions expressed above are intended to avoid such objections by making the work more attractive.