Crowd wisdom of participatory risk mapping for African swine fever

H. Bergmann*[1], J. Gethmann[1], P. Wysocki[1], H.H. Lentz[1], N. Denzin[1], F.J. Conraths[1], C. Sauter-Louis[1]

[1] *Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health, Institute of Epidemiology, Südufer 10, 17493 Greifswald-Insel Riems, Germany*
* hannes.bergmann@fli.de

Objective: African swine fever [ASF] is an internationally spreading viral pig disease with a massive socio-economic impact. For the identification of regions with a high risk of ASF introduction, we developed a novel participatory mapping system (Participatory risk mapping network for animal diseases, PRMNAD) that exploits efficient heuristic decision-making processes. PRMNAD users with diverse experiences employ differing strategies to reach spatially explicit disease spread predictions. We hypothesised that aggregation of multiple spatial estimates would diminish the role of individual errors.

Materials and methods: During a study that applied PRMNAD to ASF in European wild boar, participating users were asked to evaluate map-based risk information and the current ASF disease status to predict ASF spread, whilst recording the underlying risk factors they considered. Users also provided information about their ASF-related experiences to help understand user prediction strategies. At the end of each risk assessment cycle, individual user predictions were spatially aggregated, followed by congruence-based comparison of aggregate- and individual-predictions against the true disease status that emerged.

Results: We found that spatial aggregates of multiple, individual participatory risk mapping predictions for ASF occurrence outperformed even the best individual estimates in most scenarios. The accuracy of the predicted disease occurrence area increased relative to the size of the targeted prediction area overall, indicating that aggregation of multiple spatial estimates, indeed diminished the role of errors in this unprecedented context.

Conclusion: Our findings extend the statistical phenomenon of crowd wisdom to spatial disease mapping applications, thereby revealing a potent mechanism for improving the accuracy of spatial estimates.

Key words: Wisdom of the crowd, African swine fever, risk factors, participatory epidemiology, heuristics

(273 words)