Criss-cross model of tuberculosis for homeless and non-homeless subpopulations

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We analyze a criss-cross model describing tuberculosis (TB) epidemic dynamics. The model was proposed by Romaszko *et al.* [1] to describe actions of active detecting of TB among homeless subpopulation in Warmian-Masurian province of Poland. In the model, the whole population is divided into subpopulations of non-homeless and homeless people. Each of the subpopulations consists of two groups – susceptible and infected individuals. We focus on the analysis of the basic criss-cross model. The most important property of this model is related to its Malthusian origin. This means that in many cases the size of the whole population (meaning homeless and non-homeless together) grows boundlessly or the population goes to extinction. It can also happen that the subpopulation of non-homeless people goes to extinction while the subpopulation of homeless people grows boundlessly, and this situation seems to be completely unreal. We also analyze the influence of active detection onto the model dynamics. Our analysis clearly shows that the model needs to be corrected and we propose such correction eventually.

References

[1] J. Romaszko, A. Siemaszko, M. Bodzioch, A. Buciński and A. Doboszyńska, *Active case finding among homeless people as a mean of reducing the incidence of pulmonary tuberculosis in general population*, Advances in Experimental Medicine and Biology - Neuroscience and Respiration, **911**, 2016, 67–76.