Indicative solution of the Cholera Epidemic in Zimbabwe case (EN)

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September 2012

By the end of December 2008, alarming reports and articles concerning the cholera outbreak in Zimbabwe started to receive international media coverage. By that time 30000 cases of cholera infections and 1600 cholera deaths had been reported. In the first week of January 2009, a hypothetical System Dynamics simulation model related to this cholera epidemic was created (see (Pruyt 2009)) which was turned into a teaching and testing case. Although the model was not validated by Cholera experts [and contains 2 bold assumptions], the dynamics of the model is sufficiently interesting for teaching/testing purposes. This case is a classic System Dynamics case in the sense that students are asked to:

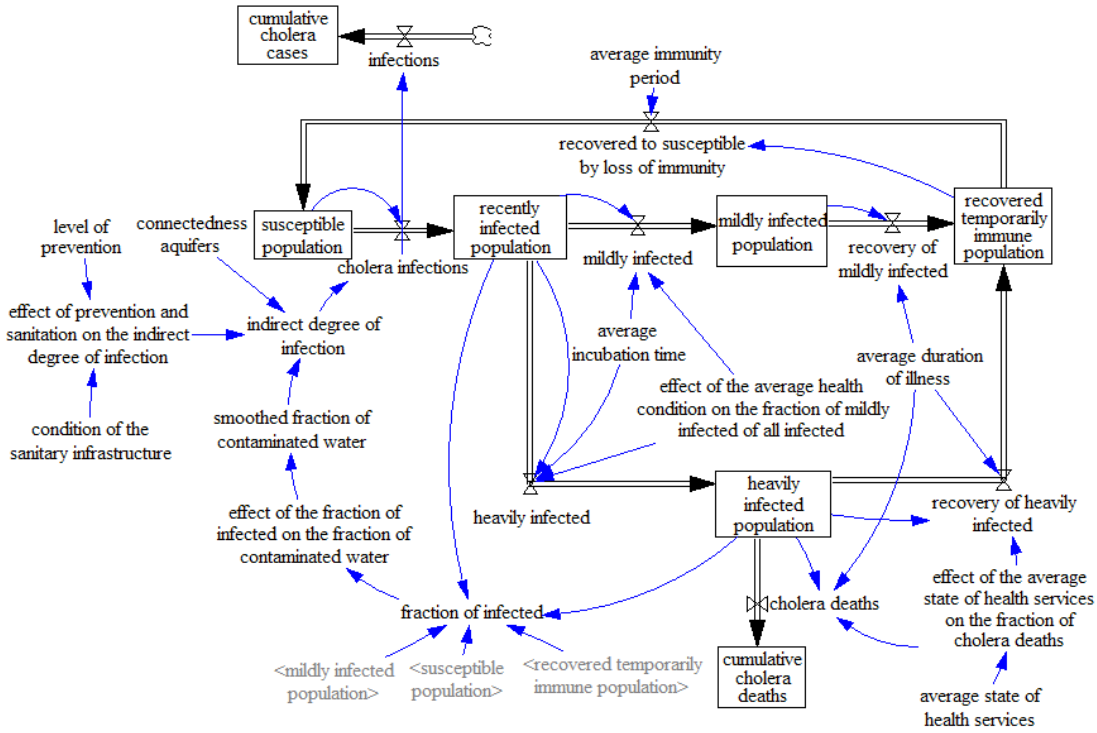


Figure 1: Stock-Flow Diagram of the Simulation Model of the Cholera Case

1. *Make a System Dynamics simulation model corresponding to the case description.* The Stock-Flow Diagram of the resulting model is depicted in Figure 1. The model is simple: it contain a few lookup/graph, max, and smoothing functions.

2. *Make an aggregated feedback loop diagram of the simulation model.* A possible aggregated feedback loop diagram is depicted in Figure 2. The behaviour may already be deduced from it.

3. *Simulate the short term behaviour* and make specific graphs (figures 3a,b,c).

4. *Validate the model.* Here students are required to apply several validation tests and to (roughly) compare the 30000 reported cases of cholera and the 1600 reported cholera deaths reported with the model outputs (as in figures 3b,c). In order to to this, students need to add the `cumulative cholera cases` stock variable.

5. *Simulate the long term behaviour* (10 years) and make graphs of the behaviour of the susceptible population, cumulative numbers of cholera cases and deaths (see Figure 3e,f,g). The short term, medium term, and long term dynamics –with/out policy interventions– are analysed in (Pruyt 2009).

6. *Perform sensitivity/uncertainty analyses.*

7. *Propose and test policies, and formulate a policy recommendation.*

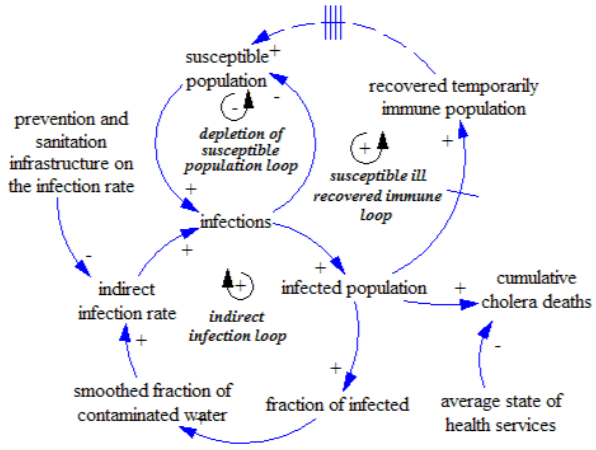
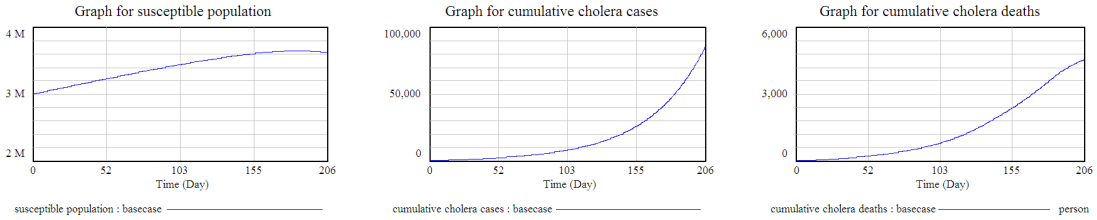


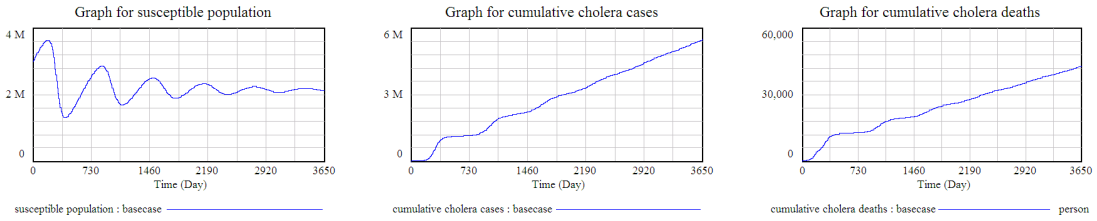
Figure 2: Aggregated causal loop diagram of the Cholera Model

References

Pruyt, E. (2009, July). Cholera in Zimbabwe. In *Proceedings of the 27th International Conference of the System Dynamics Society*, Albuquerque, USA. 1, 2



(a) susceptible population (ST) (b) cumulative cholera cases (ST) (c) cumulative cholera deaths (ST)



(d) susceptible population (LT) (e) cumulative cholera cases (LT) (f) cumulative cholera deaths (LT)

Figure 3: Behaviour of the Cholera Model in the short [(a)(b)(c)] and long term [(d)(e)(f)]