**Concentration in a space with Emitting Persons, Ventilation, and Decay: Model description.**

Model developed in cooperation with Nico van Loon and Jan van Kasteel.

The first part of the model is based on three processes: The emission by the infected person, as the immission to the location; virion decay, and dilution by ventilation:

- U: the immitted virions per hour, considered to be an exponential function, with a start value of A; immission is doubled after r minutes.

- H: the decay of virions, measured as HalfLife of h minutes, after which only half the virions are still active, is defined as a negative exponential function, representing the fraction of virions still active at moment t, with a decay constant

- V: ventilation of the location, with a ventilation rate of v times the volume of the location per hour, also defined as a negative exponential function, representing the fraction of virions still present in the room at moment t, with a ventilation constant .

The total decline D is the sum of H and V with a decline constant .

The convolution of the immission function U and the decay function D results in S, the stock of virions present in the room and active at time t, under regimes of HalfLife h and ventilation rate v.

The second part of the model specifies how many virions are inhaled by a person present. The Inhalation E over a given timespan is defined as the integral of S over the timespan, divided by m, the volume of the space, and multiplied by b, the volume of breath taken, to arrive at the inhalation of virions in the timespan.

In formulas:

Immission:

HalfLife:

Ventilation:

Decline:

Stock of virions:

Inhalation:

In this paper we assume as standards a production doubling time r = 1680 minutes, HalfLife h = 120 minutes, room volume m = 20 cubic meters. The ventilation rate is varied. Doubling time and HalfLife are varied in sensitivity analysis. One emitting person is present. The emission by the infected person in the first hour is 100,000 virions, the Standard Person. Inhalation breath volume is assumed to be ½ cubic meter per hour (60 minutes, 1000 tidal breath flows) by each person present. Filtering effect of breathing is neglected.

Programming is in wxMaxima, version 20.06.6, under Ubuntu 20.04.