

## Supplementary Information S3 : Longitudinal submodel

The non-linear structural function  $m$  is defined as :

$$m(t_{ij}, \psi_i) = \phi \left[ b_{0i} + a_i \times \left( e^{b_{1i} \times (t_{ij} - t_{lag_i})} - e^{b_{2i} \times (t_{ij} - t_{lag_i})} \right) \right]$$

$b_0$  is the SOFA value at time  $t_{lag}$ , for example if  $t_{lag} = 0$ ,  $b_0$  is the SOFA value at admission, and if  $t_{lag} = -1$ ,  $b_0$  is the SOFA value one day after patient admission. Parameter  $a$  plays a role on the slope of the SOFA evolution. The figure below illustrates the possible and relevant clinical evolution depending on parameters  $b_1$ ,  $b_2$ , and  $a$  and when  $t_{lag} = 0$ . If  $t_{lag} > 0$  the curves shift to the right, and if  $t_{lag} < 0$ , to the left. The dotted line corresponds to a doubling of parameter  $a$ . For an initial SOFA value at  $b_0$ , plot A represents the best scenario for the patient with a monotonous decrease of the SOFA over time. Plot B is the worst scenario with a monotonous increase of the SOFA over time. Plots C and D presents when the patient knows a clinical state change during the ICU stay, for example an increase of the SOFA during the first days and then a decrease (C) or vice-versa (D).

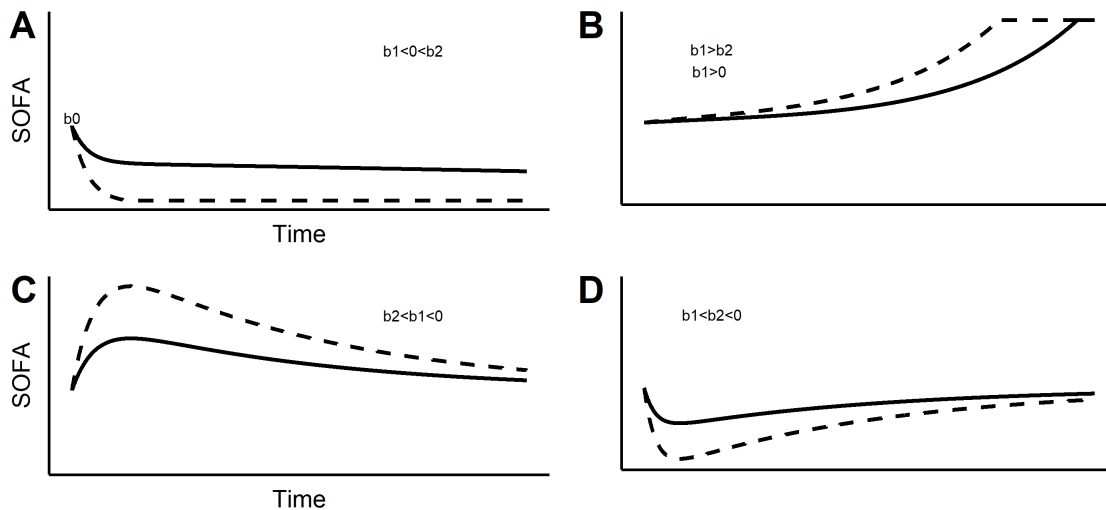


Figure: Possible shapes of the non-linear function depending on parameters  $\beta_1$ ,  $\beta_2$ , and  $a$ . The dotted curve represents a doubling of parameter  $a$ .