COVID-19, dynamic infection rate, a predictor for balneotherapy management

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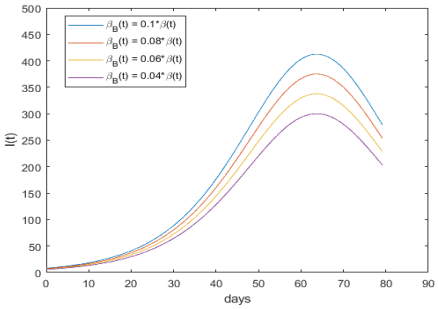
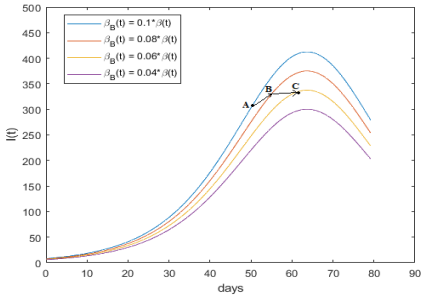
- **The main results are**





An example of management is given in Fig.2. The optimal decision will have results with lag (2 days in our model by restriction to spa or to some procedures to lower the $\beta_B(t)$ influence) resulting a curve with less infected and a faster decrease (the route A→B-→C, C the final point).

- However, the number 10 is very small, and the estimation of parameters for equation model (1) is only a proposal. The further research will collect a more relevant numbers of data in order to calculate the regression coefficients using fitting models (e.g., *lscurvefit*() from MATLAB, of fitting package from R language).
- In conclusion, a theoretical approach is proposed in order to study dynamic infection rate, a predictor for balneotherapy management in the case of variants of COVID-19 with high level of contagion. The further development will include real data along with other consideration as spatial regression (spatial differentiation) for modeling mobility of persons and geographic areas.

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- The main idea is to associate the correlation between weather conditions and Covid-19 pandemic in different geographics locations with corresponded balneotherapy/spa conditions.
- Sulphur balneotherapy and mud-bath applications can contribute to dynamic infection rate (DIR) along with air humidity, temperature and bath treatment. A modified section from a general compartment model is presented in Fig. 1, by introducing an additional compartment, B - B-Balneotherapy Infected that contribute to DIR by an additive factor, $\beta_B(t)$. The DIR will be now $\beta(t)=(\beta_i(t)+\beta_B(t))$, where $\beta_i(t)$ is the initial DIR without compartment B .
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$$\log \beta_B = \alpha + s(temp) + s(humidity) + s(bath) + s(muds) + lag_1(s) + lag_2(s) \quad (1)$$

where α – free parameters, s – linear or nonlinear function (in nonlinear case a sigmoidal function is considered) and lags represent 1- or two-days lags.

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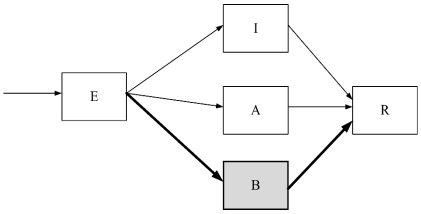

Fig. 1. A section of compartment model: E-Exposed; I-Infected Symptomatic; A-Infected Symptomatic; B-Balneotherapy Infected; R-Recovery (inspired by [20]).