

# Modeling excess weight in Spain by using deterministic and random differential equations

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## Abstract

In this work, the aim is to model the data from the Spanish National Health Survey (ENSE) 2017, which gathers the percentage of overweight and obese adults in Spain from 1987 to 2017. A compartmental system of differential equations is employed, based on the classification “normal weight” ( $\text{BMI} < 25$ ), “overweight” ( $25 \leq \text{BMI} < 30$ ) and “obese” ( $\text{BMI} \geq 30$ ). It is assumed homogeneous mixing, non-constant population, and social transmission of excess weight due to peer pressure. The model is randomized by incorporating a discrete Gaussian error (frequentist regression), random parameters (Bayesian inference), and a Gaussian white noise error (Itô stochastic differential equation). In all those cases, inverse parameter estimation is conducted. Some remarkable results are obtained. The long-term behavior of the system shows that 37% and 24% of Spanish adults will be overweight and obese in the long run, respectively. The sensitivity analyses from the different strategies agree and suggest that prevention strategies are more important than treatment strategies to control adulthood obesity. This methodology and the results are based on the recent papers [1] and [2].

## References

- [1] Calatayud, J., Jornet, M., Mathematical modeling of adulthood obesity epidemic in Spain using deterministic, frequentist and Bayesian approaches. *Chaos, Solitons & Fractals*, 140(110179), 2020.
- [2] Calatayud, J., Jornet, M., Modeling of adulthood obesity in Spain using Itô-type stochastic differential equations. *Chaos, Solitons & Fractals*, 145(110786), 2021.

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