

# Modeling and simulation in Oncology clinical practice

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## Abstract

The incidence and prevalence of cancer is expected to increase in the next few decades. Incidence will increase mainly as a consequence of aging of the general population, with smaller contributions from environmental and genetic factors. On the other hand, the increase in prevalence will be the product of a better understanding of the biological behavior of the disease, better and earlier diagnosis and newer, more efficacious, treatments, that lead to increased survival. The increment in survival means that patients will live longer with the disease, as cure is still not a realistic goal for a large percentage of those affected.

This expected increase in the number of patients is met with an enormous quantity of new technologies, both diagnostic and therapeutic, that add up to the complexity of the multidisciplinary decision-making process. The increasing understanding of the underlying mechanisms of cell proliferation, cell invasion and cancer dynamics; the continuously growing number of drugs that target specific molecules or genetic mutations that are only present in a small number of patients; the development of new immunotherapy treatments and the need for new biomarkers that help us predict response to treatment and/or toxicity; personalized, precision or individualized treatments; drug development and pharma-economic analysis under new pharmacometrics methodologies; patient and disease pathways; clinics operations. These are all areas where mathematical modeling and simulation have been very helpful, if not essential, for success.

But more is needed if we are to face the challenges of the coming years. The areas where new developments are required by the oncology clinical community and the ones in which our department can help in the multi-institutional cooperation will be discussed.