

# Estimating the probability of discharge among Covid-19 hospitalizations using cure models

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This Master thesis is focused on cure models and their applicability in handling survival models with long-term survival due to immunity. These models have gained increased attention in recent years due to medical advances within several disease treatments. Cure models are indicated whenever a dataset contains a large proportion of right-censored individuals at the follow-up time that can be suspected to include individuals who will never experience the event of interest due to being cured (or immune).

Cure models assume that the population is divided into two populations - one that is susceptible to the disease, and one that is immune to the event. In this study, the main objective is to estimate the probability of cure, referred to as the incidence. Various cure models will be investigated and applied to a dataset comprising 4000 hospitalized Covid-19 patients from the metropolitan south area of Barcelona during four waves of the pandemic. The purpose of the study is to explore which cure models are more appropriate to model the behaviour of Covid-19 patients concerning time to death and time to discharge

Mixture cure models allow the subpopulations to have different survival distributions while non-mixture cure models are easily interpreted due to similarities with proportional hazards models. Estimation of the survival of the uncured population, called the latency function, has mainly been done parametrically. However, recent research provides new complex and accurate non-parametric methods that will be applied in this study. A comparison of the various estimation methods is provided with a discussion of the advantages and disadvantages of each one of the approaches.

Due to the recent increase in the number of applications within cure models, an extension has been suggested considering a background survival for the overall mortality of the non-sick population. Previous research within cure models has mainly examined children as it is a group with a low background mortality rate or a nonfatal outcome such as disease recurrence. Since this dataset consists of adult Covid-19 patients this extension is an option to contemplate.

**Keywords:** Cure models, cure proportion, Covid-19