Duration of Localized Lockdowns in the SARS-CoV-2 Pandemic

Jessica Pavani

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1 Introduction

In the beginning of 2020, when the pandemic was declared, the Chilean government has implemented localized lockdowns in small geographic areas to prevent the spread of the COVID-19. The criteria considered to start a lockdown were given by:

- Number of active cases;
- Increment in the incidence of active cases;
- Active cases per km^2;
- Capacity of the COVID integrated network of health.

On the other hand, its ending was decided based the following criteria:

- Level of occupation in intensive care units $\leq 85\%$ at national level;
- Reproductive number (at municipality or regional level) ≤ 1;
- Rate of new cases (mobile average per week) $< 10/100{,}000$;
- Mean positive of PCR exams at regional level in the last seven days $\leq 10\%$;
- Proportion of isolated cases of probable contagious 80% in the first 48 hours;
- Proportion of new cases that come from contacts under follow-up 60%;
- Proportion of contacts in quarantine 60% in the first 48 hours;
- Active surveillance in population at risk.

However, as at the beginning of the pandemic none really knew about the diseases, the criteria considered to start and ended a lockdown could be challenged. Thus, the main goal of this study is to investigate which demographic/socioeconomic and epidemiological factors are related to the duration of lockdowns in Chile.

2 Methods

2.1 Dataset

Chile is divided into 16 regions, which are the country's first-level administrative division. Each region is divided into provinces, which are the second-level administrative division, resulting in a total of 56 provinces. The third and last level administrative division are the municipalities (or communes), a total of 346 is currently considered.

2.1.1 Outcome

In this study, the considered outcome was the number of days that a municipality was under lockdown between March 12, 2020, to December 25, 2020. If a municipality was still under lockdown on December 25, it was considered as a right-censored observation. During such time period 147 municipalities were at lockdown at least once and 19 were twice, which totals 166 lockdowns in Chile in that period.

- **Censored municipalities**: Angol, Arauco, Cabo de Hornos, Canete, Curanilahue, Lautaro, Los Angeles, and Natales.
- **Municipalities with two lockdown**: Angol, Antofagasta, Arica, Chilan, Chilan Viejo, Curanilahue, Hualpen, Isla de Maipo, Las Condes, Lo Barnechea, Lonquimay, Mejillones, Ñuñoa, Osorno, Padre las Casas, Providencia, San Pedro de la Paz, Temuco, and Vitacura.

2.1.2 Covariates

There were two subgroups of covariates available: demographic/socioeconomic factors and epidemiological factors. For the first subgroup, the information does not vary over time, which means that values are fixed throughout the whole period. Thus, the information considered is:

- **Population density**: Number of people per km^2;
- **Per capita income** (thousands of Chilean pesos);
- **Scholarship**: Years of schooling (0 - 15);
- **Poverty**: Proportion of population in poverty;
- **Sewerage**: Proportion of households that have sewers or septic tanks;
- **Immigrants**: Proportion of immigrants (number of immigrants each 100,000 people);
- **Population** (in scale of 100,000 people);
- **Overcrowding**: Number of people over number of households. It is calculated by:

$$\text{Overcrowding} = \frac{\text{Population}}{\text{Number of dwellings}};$$

- **Socioeconomic development index** (SDI, 0 - 1): Includes the economy component (monthly per capita income and poverty), education (average years of schooling), and housing and sanitation (good and acceptable housing material and sewerage or septic tank). It is calculated by:

$$\text{SDI} = \frac{\text{Log-income index} + \text{Poverty index} + (\text{Schooling index} \times 2) + \text{Housing materiality index} + \text{Sanitation index}}{6};$$

- **Human development index** (HDI, 0 - 1): Includes the economy component (monthly per capita income and poverty), education (average years of schooling), and health (life expectancy at birth);

$$\text{HDI} = \frac{\text{Log-income index} + \text{Poverty index} + (\text{Schooling index} \times 2) + (\text{EVN index} \times 2)}{6};$$

- **Rural index**: Includes the percentage of rural population, the proportion of local employment occupied in primary sectors and the population density;
- **Type of municipality 1**: Regional capital or not;
- **Type of municipality 2**: Province capital or not;
- **Infrastructure 1**: Presence or absence of Commercial Airport;
- **Infrastructure 2**: Presence or absence of Commercial Harbour;

For the second subgroup, the information is a little inconsistent mainly due to the time period that it is available. Besides, some information is made available by region while other is made available by commune. Here, it was considered the number of cases/ICU/PCR each 100,000 people. The information considered as well as its time period are:

- **Active cases**: Number of active cases per commune (available from April 13th);

An active confirmed case is understood to be a living person who meets the definition criteria of suspected cases with a positive sample of SARS-CoV-2, whose date of onset of symptoms in the notification is less than or equal to 11 days to date of the current report.

- **Symptomatic cases**: Number of symptomatic cases per region (available from March 3rd);
- **Asymptomatic cases**: Number of asymptomatic cases per region (available from April 29th);

Number of new confirmed cases per day according to the result of the diagnosis and that have presented symptoms or not, respectively, by region of residence, reported by the Ministry of Health.

- **ICU**: Number of patients in Intensive Care Unit (ICU) per region (available from April 1st);
- **Deaths**: Number of deaths per commune according to their residence (available from June 12th);
- **PCR**: Number of PCR per region (available from April 9th).

Apart from demographic/socioeconomic and epidemiological covariates, we also consider the information about if is the first time a commune is on lockdown. To do so, we built a binary indicator as:

$$\text{Lockdown indicator} = \begin{cases} 0, \text{if it is the first time the commune is on lockdown} \\ 1, \text{if it is the second time the commune is on lockdown} \end{cases}$$

2.1.3 Data source

Variable	Source
Population density	`https://github.com/MinCiencia/Datos-COVID19/blob/master/input/Otros/InformacionComunas.csv`
Immigrants	`http://www.censo2017.cl/microdatos/`
Population	`https://github.com/MinCiencia/Datos-COVID19/blob/master/input/Otros/InformacionComunas.csv`
Overcrowding	`http://www.censo2017.cl/microdatos/`
SDI	`http://ochisap.cl/index.php/nivel-socioeconomico-y-de-salud-de-las-comunas-de-chile`
Rural index	`http://www.censo2017.cl/microdatos/`
Active cases	`https://github.com/MinCiencia/Datos-COVID19`
ICU	`https://github.com/MinCiencia/Datos-COVID19`
Deaths	`https://github.com/MinCiencia/Datos-COVID19`
Symptomatic cases	`https://github.com/MinCiencia/Datos-COVID19`
Asymptomatic cases	`https://github.com/MinCiencia/Datos-COVID19`
PCR	`https://github.com/MinCiencia/Datos-COVID19`
Regional capital	`https://www.bcn.cl/siit/nuestropais/div_pol-adm.htm`
Province capital	`https://www.bcn.cl/siit/nuestropais/div_pol-adm.htm`
Commercial airport	`https://www.dgac.gob.cl/aeropuertos/red-aeroportuaria-nacional/`
Commercial harbor	`https://www.camport.cl/estadisticas/`
Duration of lockdown	`https://github.com/MinCiencia/Datos-COVID19`

Table 1: Duration of lockdowns (in days).

2.1.4 Dataset preparation (extra information)

1. All demographic/socioeconomic covariates are available for every commune. So, no manipulation was needed.
2. Each epidemiological covariate is available for a different time period, so it was necessary to merge datasets. In order not to lose too much information, dataset were merged one by one, following the steps:
    - **Data 1**: Demographic/socioeconomic covariates + number of symptomatic cases.

- **Data 2**: Data 1 + number of patients in ICU. observations.
- **Data 3**: Data 2 + number of PCR.
- **Data 4**: Data 3 + number of active cases.
- **Data 5**: Data 3 + number of asymptomatic cases.
- **Data 6**: Data 5 + number of deaths.

2.2 Modeling

There are a bunch of ways to carry out a survival analysis. Throughout of this study different approaches were considered, which are presented following:

2.2.1 Proportional hazard model

In survival analysis, there is a large family of models, which was introduced by Cox (1972). This kind of strategy focuses directly on the hazard function $h(t)$. The simplest way in this family is the proportional hazards model. Under this approach, the hazard at time t for an individual with covariates x is assumed to be:

$$h(t \mid x, \beta) = h_0(t) \exp\{x^\top \beta\}, \tag{1}$$

where $h_0(t)$ is the baseline hazard function and the second term, which includes a p-dimensional vector of predictors x, and a vector of regression coefficients β, is written in exponential form because it must be positive. Note that the hazard function depends on both time and covariates.

There are different ways to define the baseline hazard function in a proportional hazard model. The version proposed by Cox is considered semiparametric since $h_0(t)$ is modeled as a non-parametric function of t. On the other hand, there are several ways to define parametric versions of a survival model. It is just necessary to define $h_0(t)$ as a Exponential, a Gamma, or a Weibull function, or other distributions (more details in Ibrahim et al. (2001, Chapter 2)).

The probability of an individual survive until time t is given by a survivor function. Under the Cox approach such function is given by:

$$S(t \mid x, \beta) = S_0^{\exp\{x^\top \beta\}}, \tag{2}$$

where $S_0(t)$ is the base survival function that assumes $S(0) = 1$ or $S(\infty) = 0$.

Focusing on the interpretation, it is important to consider that the hazard ratio (HR) is a measure of effect of an intervention on an outcome of interest over time. In this case, the outcome is positive (time to get out of lockdown). Thus:

- $\hat{\text{HR}} = 1$: No effect;
- $\hat{\text{HR}} < 1$: Reduction in the hazard of experiencing the event of interest, which means a greater delay to get out of lockdown;
- $\hat{\text{HR}} > 1$: Increase in the hazard of experiencing the event of interest, which means the municipality will get out of the lockdown faster.

Results from this model can be found in the Section 4.1.

2.2.2 Frailty model

Another usual strategy in survival analysis is to aggregate random effects into the model, which is known as frailty model. This approach is derived from the fact that in the context of survival models random effects are known as frailty elements (Aalen, 1994). As usual, random effects can approach individual characteristics, heterogeneity in groups or clusters, and so on (more details in Ibrahim et al. (2001, Chapter 4)).

There are two popular ways of including random effects into the survival model: as a multiplicative component or as an additive one. In the first case, the multiplicative frailty model is given by:

$$h(t \mid x, \beta, \omega_i) = \omega_i h_0(t) \exp\{x^\top \beta\}, \tag{3}$$

where ω_i is the frailty term associated to group i. On the other hand, the additive frailty model is given by:

$$h(t \mid x, \beta, b_i) = h_0(t) \exp\{x^\top \beta + b_i\}, \tag{4}$$

where b_i is the frailty term associated to group i. In both cases, the baseline hazard function can be defined as a non-parametric function, as the Cox proportional hazard model, or as a parametric function, as a Exponential, a Gamma, or a Weibull model.

Results from this model can be found in the Section 4.2.

2.2.3 Survival model using time-dependent covariates

One of the strengths of the survival model is its ability to encompass time-varying covariates. Overall, these covariates occur when the information changes over time during the follow-up period, which is very common in clinical research. The time-varying covariates can be classified into two groups: Internal or external Zhang et al. (2018). The first type is related to when the path is affected by survival status. On the other hand, the second type is related to when the covariate is fixed/defined.

One approach for using time-varying covariate data is to extend the proportional hazard model to allow time-varying covariates. Thus, in this case, the hazard function can be given by:

$$h(t \mid x, z(t), \beta, \alpha) = h_0(t) \exp\{x^\top \beta + \alpha\, z(t)\}, \tag{5}$$

where β and α are coefficients of time-fixed and time-varying covariate, respectively, and $z(t)$ denotes time-dependent covariates.

Note that since covariates depend on time, the relative hazard is also time-dependent. This means that the hazard of death at time t is no longer proportional to the baseline hazard, and the model is no longer a proportional hazards model. Besides, $h_0(t)$ can be defined as either non-parametric or parametric function.

Results from this model can be found in the Section 4.3.

2.2.4 Joint Model

Joint modeling of longitudinal and time-to-event data (Rizopoulos, 2012) is a useful strategy to deal with endogenous covariates. The idea behind this approach is to couple a survival model with a model for repeated measurements that can help to explain the event of interest. Probably, the most common joint model specification is to connect a mixed effects submodel fitted to the longitudinal information with a proportional hazard submodel fitted to the survival information. Thus, the standard joint model used in this study is formulated as follow:

$$\begin{aligned} y_i(t) &= m_i(t) + \epsilon_i(t) \\ &= x_i^\top(t)\beta + z_i^\top(t) b_i + \alpha m_i(t) \\[1em] h_i(t) &= h_0 \exp\{\gamma^\top w_i + \alpha m_i(t)\} \end{aligned} \tag{6}$$

In this model, $y_i(t)$ represents the longitudinal measurement for the ith commune at time t. This outcome is modeled by a mixed effects submodel, where $x_i(t)$ is the design vector and β the parameter for the fixed effects. Besides, $z_i(t)$ is the design vector for the random effects b_i for the commune i. Finally, $\epsilon_i(t)$ represents the error term. The joint model is completed with the time-to-event submodel. In this case, the outcome is modeled by a proportional hazard. This kind of strategy focuses directly on the hazard function $h_i(t)$, considering the baseline hazard function, $h_0(t)$, and a second term that includes baseline covariates, w_i, and the true and unobserved value of longitudinal outcome for the commune i at time t denoted by $m_i(t)$ and modeled by the longitudinal submodel. Finally, α represents the association between the longitudinal and time-to-event outcome.

Results from this model can be found in the Section 4.4.

3 Descriptive analysis

Before applying the survival model, a brief summary of the considered dataset is presented in the Table 2, where continuous data are expressed as mean ± standard deviation and categorical data are expressed as percentage. In addition, a graphical analysis is also presented, Figures 1, 2, and 3. When analyze the outcome, we notice that the shorter lockdown took only one week, meanwhile the longer took 172 days.

Type of municipality 1 (%)	9.6
Type of municipality 2 (%)	15.7
Infrastructure 1 (%)	5.4
Infrastructure 2 (%)	6
Population density	2287.91 ± 0.13
Per capita income	220.53 ± 179.10
Scholarship	9.85 ± 1.60
Poverty	16.08 ± 8.00
Sewerage	85.87 ± 16.45
Immigrants	2634.38 ± 3809.27
Population	1.13 ± 1.15
Overcrowding	2.75 ± 0.40
Socio-economics index	0.60 ± 0.14
Human development index	0.55 ± 0.13
Rural index	41.62 ± 16.17
Active cases	84.06 ± 80.13
Symptomatic cases	7.83 ± 5.45
Asymptomatic cases	3.98 ± 3.01
ICU	5.04 ± 2.51
Deaths	60.68 ± 49.79
PCR	185.16 ± 111.15

Table 2: Characteristics of the dataset.

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
7.00	30.00	51.50	63.34	87.00	172.00

Table 3: Duration of lockdowns (in days).

When analyzing Figure 1, we realize that are not a big difference between categories, which can indicate these covariates are not significant in the duration of lockdown. On the other hand, when analyzing Figure 2, we notice per capita income does not seen to be relevant in the lockdown. However, scholarship, sewerage, human development index, population, socio-economics index, population density, overcrowding, and immigrants have a positive linear relation with the duration of lockdown, which means that bigger values of these covariates imply larger lockdown. Apart from that, poverty and rural index have a negative linear relation meaning that smaller values of these covariates imply shorter lockdown.

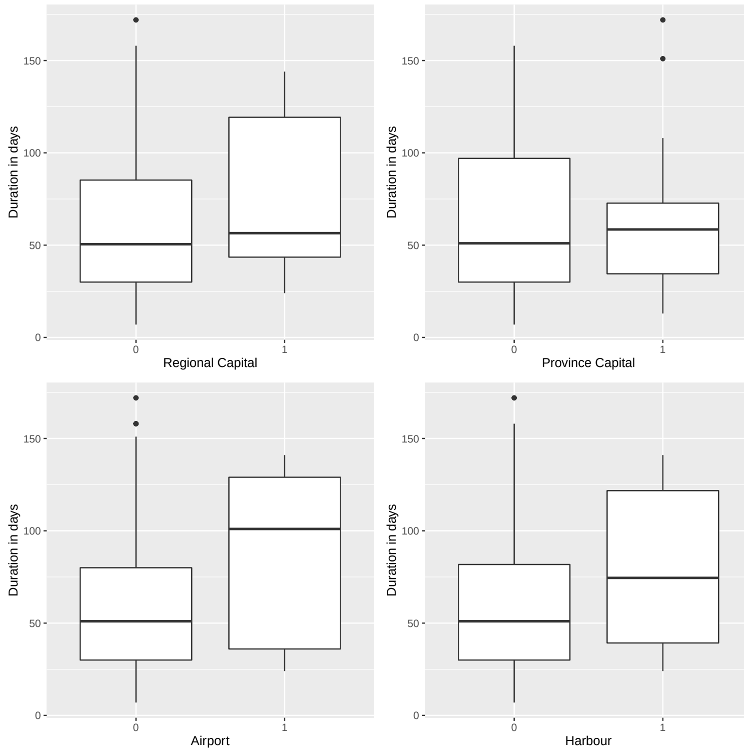

Figure 1: Boxplot of categorical variables.

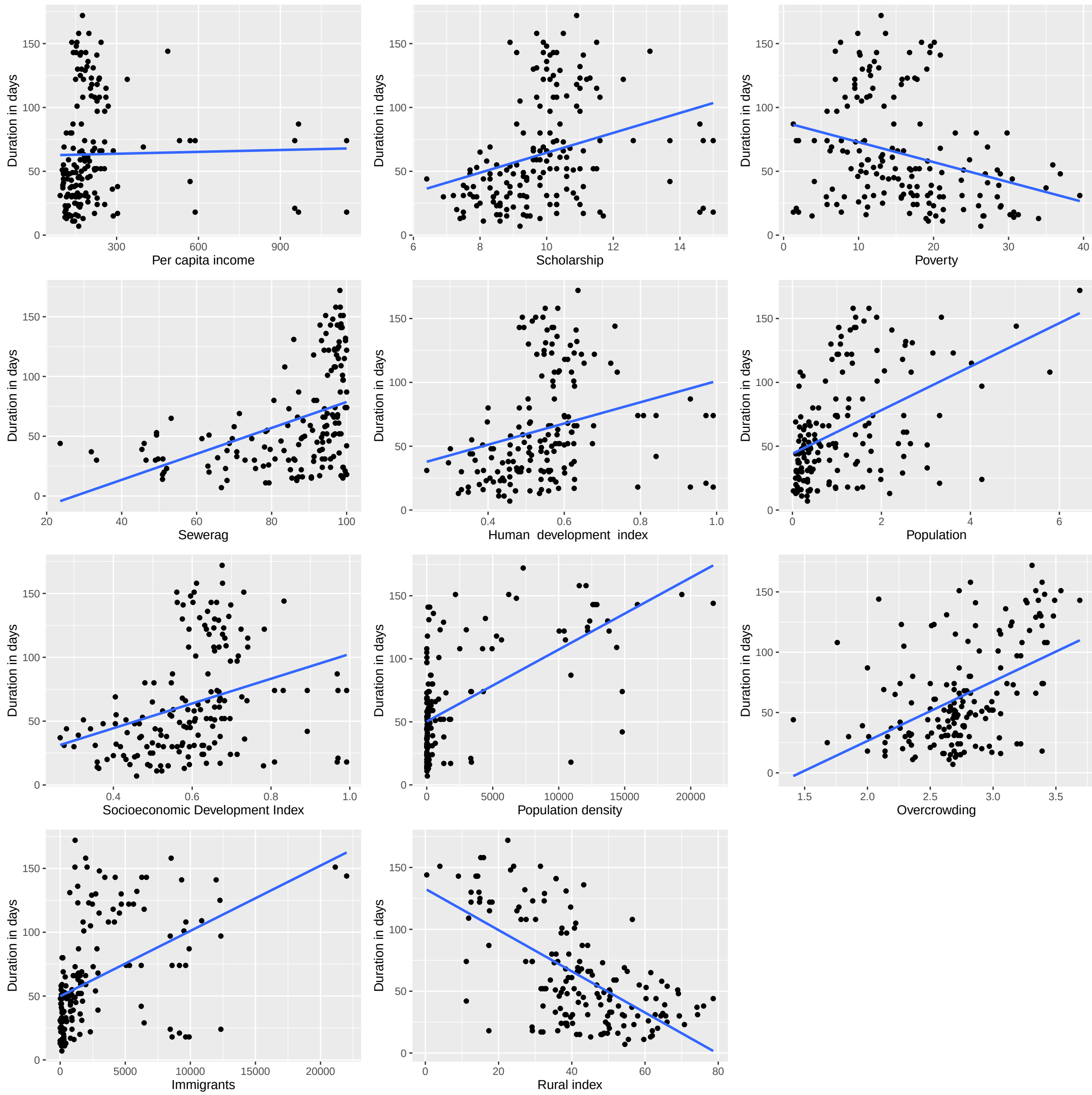

Figure 2: Scatter plot of continuous variables - Socio-demographic.

When focusing on epidemiological information (Figure 3), we notice that the number of PCR per 100,000 people does not seen to be relevant in the lockdown. On the other hand, the number of ICU beds and deaths have a positive linear relation with the duration of lockdown, meaning that bigger values imply larger lockdown. Regarding to the number of asymptomatic cases, symptomatic cases and active cases, a negative linear association can be noticed.

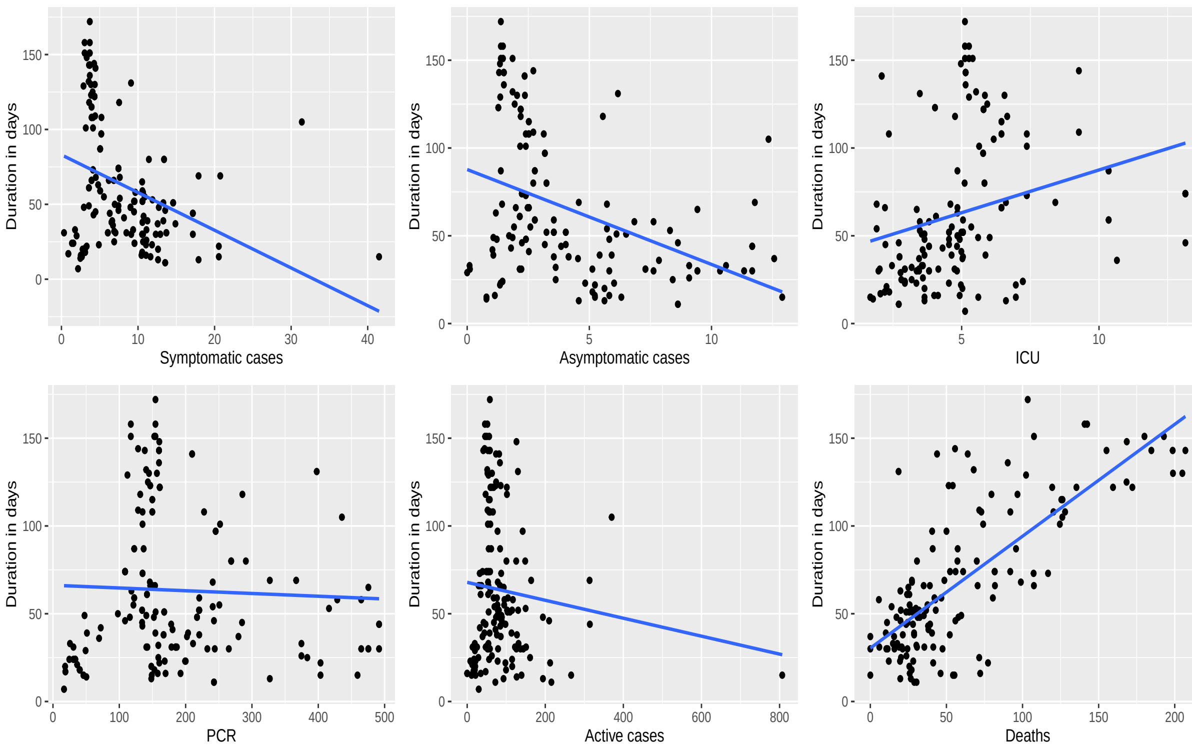

Figure 3: Scatter plot of continuous variables - Epidemiological.

4 Results

4.1 Cox proportional hazard model

For this Cox proportional hazards model, only demographic/socioeconomic covariates and lockdown indicator were considered. It implies that the whole sample was examined, which total 166 observations. Besides, considering that SDI, income, scholarship, poverty, sewerage, and HDI are directly related to each other, only SDI was kept on the model (more details about how it is obtained in Section 2.1.2). Thus, we obtained:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.295	0.111	-2.643	0.008
Population density	0.000	0.000	-1.575	0.115
SDI	1.801	1.063	1.694	0.090
Overcrowding	-0.753	0.238	-3.162	0.002
Immigrants	0.000	0.000	-2.409	0.016
Province capital	-0.537	0.269	-1.990	0.046
Regional capital	0.399	0.444	0.897	0.369
Rural index	0.028	0.012	2.275	0.023
Airport	-0.307	0.532	-0.576	0.564
Harbour	-0.502	0.606	-0.828	0.408
Lockdown indicator	0.628	0.307	2.046	0.041

Table 4: Estimated coefficients - Cox proportional hazards model.

Note that not every covariate is significantly associated to the duration of the lockdown, p-valor > 0.05. So, we fit a new model considering only covariates that have p-value < 0.05. This final version of the model was built using a manual process of eliminating variables. Starting from the full model, where all the predictors were considered (Table 4), we remove covariates with the highest p-value, one at a time until all predictors were below the significance threshold (p-value < 0.05). More details about the variable selection can be found in the Appendix 6.1. Finally, we had:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.303	0.092	-3.285	0.001
SDI	1.965	1.011	1.943	0.052
Overcrowding	-0.621	0.219	-2.836	0.005
Immigrants	0.000	0.000	-3.114	0.002
Rural index	0.039	0.008	4.500	<0.001
Lockdown indicator	0.751	0.296	2.538	0.011

Table 5: Estimated coefficients - Cox proportional hazards model.

Since we have identified which cavariates are associated to the duration of lockdown (p-valor < 0.05), we can focus on the hazard ratio corresponding to each one, Table 4.1.

Predictor	$\hat{\text{HR}}$	$\text{IC}_{95\%}$
Population	0.738	(0.616, 0.885)
SDI	7.134	(0.983, 51.792)
Overcrowding	0.537	(0.350, 0.825)
Immigrants	0.999	(0.999, 1.000)
Rural index	1.040	(1.022, 1.058)
Lockdown indicator	2.119	(1.187, 3.784)

Table 6: Estimated hazard ratios and the corresponding 95% intervals.

- **Population**: The increment in 100,000 people in the population implies a reduction of 26.2% in the hazard of getting out of the lockdown (i.e. greater population implies longer lockdown).
- **SDI**: The increment in 0.1 point of the sociodemographic development index implies an increase of 71.3% in the hazard of getting out of the lockdown (i.e. greater sociodemographic development index value implies shorter lockdown).
- **Overcrowding**: The increment in one point in the overcrowding implies a reduction of 46.3% in the hazard of getting out of the lockdown (i.e. greater overcrowding implies longer lockdown).
- **Immigrants**: The increment in 100 immigrants per 100,000 people implies a reduction of 1% in the hazard of getting out of the lockdown (i.e. greater immigrants implies longer lockdown).
- **Rural index**: The increment in one point of the rural index implies an increase of 4% in the hazard of getting out of the lockdown (i.e. greater rural index implies shorter lockdown).
- **Lockdown indicator**: To be on the second lockdown increase 111% in the hazard of getting out of the lockdown (i.e. second lockdown is shorter).

4.2 Frailty model

At the end, when adjusting the frailty models, the random effect (commune) was not significant. This probably occurs because there are few municipalities where more than one lockdown was carried out.

4.3 Survival model using time-dependent covariates

At this point, two different strategies were considered: Cox proportional hazards model and weibull model. In both cases, the epidemiological information worked as time-dependent covariates. To do so, the epidemiological information was considered as the average number of cases each 7 days between the beginning and the end of lockdown. Such information was also corrected by the population of each municipality (see Section 2.1.2 for more details). Apart from these, demographic/socioeconomic covariates and the lockdown indicator were also considered.

4.3.1 Cox proportional hazards model with time-dependent covariates

As discussed before in the Section 2.1.4, the sample size changes according to the considered epidemiological covariates. Thus, six scenarios were considered. For each one, a full model was adjusted and then the covariates, which presented p-value > 0.05, were removed one by one. The process was similar to the one carried out before and more details can be found in the Appendix 6.4.

4.3.1.1 Number of symptomatic cases

For this first model, it was considered the information between March 12, 2020 and December 25, 2020 (the whole observed time period) totaling 166 events. Thus, we have:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.355	0.088	-4.048	< 0.001
Population density	0.000	0.000	-2.865	0.004
Overcrowding	-1.125	0.218	-5.159	< 0.001
Immigrants	0.000	0.000	-1.998	0.046
Lockdown indicator	0.866	0.286	3.030	0.002
Symptomatic cases	-0.155	0.027	-5.752	< 0.001

Table 7: Estimated coefficients - Cox time-dependent model.

Predictor	$\widehat{\text{HR}}$	$\text{IC}_{95\%}$
Population	0.701	(0.590, 0.833)
Population density	1.000	(1.000, 1.000)
Overcrowding	0.325	(0.212, 0.498)
Immigrants	1.000	(1.000, 1.000)
Lockdown indicator	2.378	(1.358, 4.165)
Symptomatic cases	0.857	(0.813, 0.903)

Table 8: Estimated hazard ratios and the corresponding 95% intervals.

Table 7 present some results about significant covariates, i.e. covariates whose p-values < 0.05. In addition, on the Table 8 are presented estimated hazard ratios.

4.3.1.2 Number of patients in ICU

For this model, it was considered the information between April 09, 2020 and December 25, 2020, which totals 158 events. Thus, we have:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.331	0.097	-3.407	0.001
SDI	2.133	1.080	1.975	0.048
Rural index	0.023	0.009	2.637	0.008
Lockdown indicator	0.634	0.275	2.303	0.021
Symptomatic cases	-0.089	0.026	-3.380	0.001
ICU	-0.251	0.040	-6.247	< 0.001

Table 9: Estimated coefficients - Cox time-dependent model.

Predictor	$\widehat{\text{HR}}$	$\text{IC}_{95\%}$
Population	0.718	(0.593, 0.869)
SDI	8.444	(1.017, 70.134)
Rural index	1.023	(1.006, 1.041)
Lockdown indicator	1.885	(1.099, 3.232)
Symptomatic cases	0.915	(0.869, 0.963)
ICU	0.778	(0.719, 0.842)

Table 10: Estimated hazard ratios and the corresponding 95% intervals.

4.3.1.3 Number of PCR

For this model, we considered the information between April 13, 2020 and December 25, 2020, which totals 158 events. Thus, we have:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.247	0.120	-2.050	0.040
Population density	0.000	0.000	-0.257	0.797
SDI	3.482	1.236	2.817	0.005
Overcrowding	-0.412	0.272	-1.514	0.130
Immigrants	0.000	0.000	-1.435	0.151
Regional capital	-0.497	0.435	-1.143	0.253
Province capital	-0.613	0.265	-2.313	0.021
Rural index	0.022	0.012	1.884	0.060
Airport	0.022	0.012	1.884	0.060
Harbor	-0.245	0.573	-0.428	0.669
Lockdown indicator	0.710	0.299	2.373	0.018
Symptomatic cases	-0.084	0.034	-2.450	0.014
ICU	-0.270	0.048	-5.670	0.000
PCR	0.000	0.001	-0.120	0.905

Table 11: Estimated coefficients - Cox time-dependent model.

Note that number of PCR is not significantly associated to the duration of lockdown. So, this model will not be considered.

4.3.1.4 Number of active cases

For this model, it was considered the information between April 16, 2020 and December 25, 2020, which totals 156 events. Thus, we have:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.342	0.091	-3.753	0.000
Population density	0.000	0.000	-2.392	0.017
Overcrowding	-0.511	0.257	-1.992	0.046
Lockdown indicator	0.861	0.298	2.890	0.004
ICU	-0.171	0.044	-3.924	0.000
PCR	0.005	0.001	4.145	0.000
Active cases	-0.031	0.003	-11.306	0.000

Table 12: Estimated coefficients - Cox time-dependent model.

Predictor	$\hat{HR}$	$IC_{95\%}$
Population	0.711	(0.595, 0.849)
Population density	1.000	(1.000, 1.000)
Overcrowding	0.600	(0.363, 0.992)
Lockdown indicator	2.365	(1.319, 4.239)
ICU	0.843	(0.774, 0.918)
PCR	1.005	(1.002, 1.007)
Active cases	0.970	(0.964, 0.975)

Table 13: Estimated hazard ratios and the corresponding 95% intervals.

4.3.1.5 Number of asymptomatic cases

For this model, we considered the information between April 30, 2020 and December 25, 2020 totaling 146 events. Thus, we have:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.254	0.131	-1.937	0.053
Population density	0.000	0.000	-1.237	0.216
SDI	-0.554	1.335	-0.415	0.678
Overcrowding	-0.537	0.286	-1.876	0.061
Immigrants	0.000	0.000	0.018	0.985
Regional capital	0.096	0.485	0.198	0.843
Province capital	-0.253	0.285	-0.888	0.375
Rural index	0.005	0.014	0.337	0.736
Airport	-0.451	0.587	-0.768	0.442
Harbor	-0.026	0.611	-0.043	0.965
Lockdown indicator	0.914	0.320	2.857	0.004
Symptomatic cases	0.013	0.037	0.353	0.724
ICU	-0.163	0.054	-3.020	0.003
PCR	0.006	0.002	3.579	0.000
Active cases	-0.030	0.003 -10.301	0.000	
Asymptomatic cases	-0.085	0.074	-1.144	0.253

Table 14: Estimated coefficients - Cox time-dependent model.

The number of asymptotic cases is not significantly associated to the duration of lockdown. So, this model will not be considered.

4.3.1.6 Number of deaths

For this model, it was considered the information between June 19, 2020 and December 25, 2020 totaling 137 events. Thus, we have:

Predictor	$\hat{\beta}$	se($\hat{\beta}$)	z	p-value
Population	-0.223	0.146	-1.525	0.127
Population density	0.000	0.000	-1.482	0.138
SDI	-0.440	1.447	-0.304	0.761
Overcrowding	-0.709	0.308	-2.298	0.022
Immigrants	0.000	0.000	-0.385	0.700
Regional capital	0.111	0.531	0.209	0.834
Province capital	-0.330	0.305	-1.080	0.280
Rural index	0.010	0.015	0.644	0.519
Airport	-0.828	0.652	-1.271	0.204
Harbor	-0.026	0.672	-0.039	0.969
Lockdown indicator	1.060	0.334	3.173	0.002
Symptomatic cases	0.037	0.044	0.839	0.402
ICU	-0.151	0.060	-2.520	0.012
PCR	0.007	0.002	3.758	0.000
Active cases	-0.030	0.003	-9.780	0.000
Asymptomatic cases	-0.057	0.080	-0.718	0.473
Deaths	0.006	0.004	1.285	0.199

Table 15: Estimated coefficients - Cox time-dependent model.

The number of deaths is not significantly associated to the duration of lockdown. So, this model will not be considered.

4.3.1.7 Model selection

Among the models fitted over the last few sections, in only three of them the epidemiological covariates were significantly associated to the duration of lockdown. To select the best among them, it was considered the Akaike information criteria (AIC) as criteria of goodness-of-fit. Based on Table 16, the model presented in Section 4.3.1.4 is the best.

Model	Section 4.3.1.1	Section 4.3.1.2	Section 4.3.1.4
AIC	1148.347	1112.933	900.677

Table 16: Model selection - AIC.

Based on Table 27, the model presented in Section 4.3.2.6 is the best. It was formulated as:

$$h(t \mid x, z(t), \beta, \alpha) = h_0(t)\exp\{\beta_1 \text{ population} + \beta_2 \text{ population-density} + \beta_3 \text{ overcrowding} + \beta_4 \text{ lockdown-indicator} + \alpha_1 \text{ ICU}_i + \alpha_2 \text{ PCR}_i + \alpha_3 \text{ active-cases}_i\}. \tag{7}$$

Finally, their interpretation is presented as follow:

- **Population**: The increment in 100,000 people in the population implies a reduction of 28.9% in the hazard of getting out of the lockdown (i.e. greater population implies longer lockdown).
- **Population density**: It has no effect in the hazard of getting out of the lockdown.
- **Overcrowding**: The increment in one point in the overcrowding implies a reduction of 40% in the hazard of getting out of the lockdown (i.e. greater overcrowding implies longer lockdown).
- **Lockdown indicator**: To be on the second lockdown increase 136% in the hazard of getting out of the lockdown (i.e. second lockdown is shorter).
- **ICU**: The increment in one ICU per 100,000 people implies a reduction of 15.7% in the hazard of getting out of the lockdown (i.e. greater ICU occupancy implies longer lockdown).
- **PCR**: The increment in 100 PCR per 100,000 people implies an increase of 50% in the hazard of getting out of the lockdown (i.e. greater PCR number implies shorter lockdown).
- **Active cases**: The increment in one active cases per 100,000 people implies a reduction of 3% in the hazard of getting out of the lockdown (i.e. greater active cases implies longer lockdown).

4.3.2 Weibull model with time-dependent covariates

Alternatively, we can fit a Weibull Survival model using time-dependent covariates by using of `flexsurvreg` function. In addition to the estimates for the regression coefficients, we also have the estimated parameters of Weibull distribution (shape and scale parameters). In this stage, we replicate same steps carried out to the Cox model. However, the `flexsurvreg` function does not provide the p-value associated to the covariate, so we used the confidence interval to identify if the covariate is associated to the duration of lockdown or not.

4.3.2.1 Number of symptomatic cases

Same as before, this first model, it was considered the information between March 12, 2020 and December 25, 2020 (the whole observed time period) totaling 166 events. Thus, we have

Predictor	$\hat{\beta}$	$IC_{95\%}$	se($\hat{\beta}$)
Shape	1.865	(1.623, 2.144)	0.133
Scale	84.985	(58.663, 123.118)	16.072
Population	0.093	(0.004, 0.182)	0.045
Rural index	-0.022	(-0.028, -0.016)	0.003
Symptomatic cases	0.064	(0.037, 0.091)	0.014

Table 17: Estimated coefficients and their corresponding 95% intervals.

Predictor	$\hat{\beta}$	$IC_{95\%}$
Population	1.097	(1.004, 1.199)
Rural index	0.978	(0.972, 0.984)
Symptomatic cases	1.066	(1.037, 1.095)

Table 18: Estimated hazard ratios and their corresponding 95% intervals.

4.3.2.2 Number of patients in ICU

Predictor	$\hat{\beta}$	$IC_{95\%}$	se($\hat{\beta}$)
Shape	2.010	(1.785, 2.264)	0.122
Scale	32.169	(20.206, 51.214)	7.632
Population	0.116	(0.029, 0.203)	0.044
Rural index	-0.010	-0.017, -0.004)	0.003
Symptomatic cases	0.035	(0.011, 0.059)	0.012
ICU	0.120	(0.082, 0.158)	0.019

Table 19: Estimated coefficients and their corresponding 95% intervals.

Predictor	$\hat{\beta}$	$IC_{95\%}$
Population	1.123	(1.029, 1.225)
Rural index	0.990	(0.984, 0.996)
Symptomatic cases	1.036	(1.011, 1.061)
ICU	1.127	(1.085, 1.171)

Table 20: Estimated hazard ratios and their corresponding 95% intervals.

4.3.2.3 Number of PCR

Predictor	$\hat{\beta}$	$IC_{95\%}$	se($\hat{\beta}$)
Shape	1.947	(1.575, 2.406)	0.210
Scale	38.639	(8.470, 176.275)	29.922
Population	0.077	(-0.036, 0.189)	0.057
Population density	0.205	(-0.554, 0.963)	0.387
Immigrants	-0.034	(-0.778, 0.711)	0.380
Overcrowding	0.059	(-0.211, 0.329)	0.138
SDI	-0.531	(-1.854, 0.792)	0.675
Regional capital	0.137	(-0.330, 0.604)	0.238
Province capital	0.210	(-0.054, 0.474)	0.135
Rural index	-0.013	(-0.024, -0.001)	0.006
Airport	0.097	(-0.421, 0.616)	0.265
Harbor	0.257	(-0.358, 0.873)	0.314
Lockdown indicator	-0.320	(-0.618, -0.021)	0.152
Symptomatic cases	0.054	(0.006, 0.101)	0.024
ICU	0.122	(0.078, 0.166)	0.022
PCR	-0.001	(-0.002, 0.001)	0.0010

Table 21: Estimated coefficients and their corresponding 95% intervals.

Same as the Cox model, the number of PCR is not significantly associated to the duration of lockdown. So, this model will not be considered.

4.3.2.4 Number of active cases

Predictor	$\hat{\beta}$	$IC_{95\%}$	$se(\hat{\beta})$
Shape	1.734	(1.492, 2.015)	0.133
Scale	23.640	(14.777, 37.821)	5.668
Rural index	-0.017	(-0.023, -0.011)	0.003
ICU	0.083	(0.042, 0.124)	0.021
PCR	-0.002	(-0.004, -0.001)	0.001
Active cases	0.160	(0.125, 0.196)	0.018

Table 22: Estimated coefficients and their corresponding 95% intervals.

Predictor	$\hat{\beta}$	$IC_{95\%}$
Rural index	0.983	(0.977, 0.989)
ICU	1.090	(1.040, 1.130)
PCR	0.998	(0.996, 0.999)
Active cases	1.170	(1.130, 1.220)

Table 23: Estimated hazard ratios and their corresponding 95% intervals.

4.3.2.5 Number of asymptomatic cases

Predictor	$\hat{\beta}$	$IC_{95\%}$	$se(\hat{\beta})$
Shape	2.208	(1.812, 2.690)	0.223
Scale	7.682	(1.704, 34.622)	5.901
Population	0.095	(-0.008, 0.199)	0.053
Population density	0.787	(-0.093, 1.667)	0.449
Immigrants	0.755	(-0.003, 1.513)	0.387
Overcrowding	0.229	(-0.012, 0.471)	0.123
SDI	-0.553	(-1.821, 0.715)	0.647
Regional capital	-0.113	(-0.462, 0.235)	0.178
Province capital	0.220	(-0.044, 0.485)	0.135
Rural index	-0.004	(-0.016, 0.009)	0.006
Airport	0.397	(-0.184, 0.978)	0.296
Harbor	0.247	(-0.260, 0.754)	0.259
Lockdown indicator	-0.318	(-0.631, -0.006)	0.159
Symptomatic cases	0.014	(-0.031, 0.058)	0.023
ICU	0.135	(0.077, 0.192)	0.030
PCR	0.001	(-0.001, 0.002)	0.001
Active cases	0.009	(0.007, 0.010)	0.001
Asymptomatic cases	-0.029	(-0.088, 0.030)	0.030

Table 24: Estimated coefficients and their corresponding 95% intervals.

Same as the Cox model, the number of asymptomatic cases is not significantly associated to the duration of lockdown. So, this model will not be considered.

4.3.2.6 Number of deaths

Predictor	$\hat{\beta}$	$IC_{95\%}$	$se(\hat{\beta})$
Shape	1.986	(1.641, 2.404)	0.193
Scale	9.227	(16.332, 13.448)	1.773
Population	0.138	(10.065, 0.211)	0.037
ICU	0.062	(10.032, 0.093)	0.016
Active cases	0.009	(10.007, 0.011)	0.001
Deaths	0.007	(10.005, 0.009)	0.001

Table 25: Estimated coefficients and their corresponding 95% intervals.

Predictor	$\hat{\beta}$	$IC_{95\%}$
Rural index	1.150	(1.070, 1.240)
ICU	1.060	(1.030, 1.100)
PCR	1.010	(1.010, 1.010)
Active$_{cases}$	1.010	(1.000, 1.010)

Table 26: Estimated hazard ratios and their corresponding 95% intervals.

4.3.2.7 Model selection

Among the models fitted over the last few sections, in four of them the epidemiological covariates were significantly associated to the duration of lockdown. To select the best among them, it was considered the AIC as criteria of goodness-of-fit.

Model	Section 4.3.2.1	Section 4.3.2.2	Section 4.3.2.4	Section 4.3.2.6
AIC	1464.25	1413.55	1198.699	1113.468

Table 27: Model selection - AIC.

Based on Table 27, the model presented in Section 4.3.2.6 is the best. It was formulated as:

$$h(t \mid x, z(t), \beta, \alpha) = h_0(t) \exp\{\beta_1 \text{ population} + \alpha_1 \text{ ICU}_i + \alpha_2 \text{ active-cases}_i + \alpha_3 \text{ deaths}_i\}, \tag{8}$$

where $h_0(t)$ follows a Weibull distribution.

Finally, their interpretation is presented as follow:

- **Rural index**: The increment in one point of the rural index implies an increase of 15% in the hazard of getting out of the lockdown (i.e. greater rural index implies shorter lockdown).
- **ICU**: The increment in one ICU per 100,000 people implies an increase of 6% in the hazard of getting out of the lockdown (i.e. greater ICU occupancy implies shorter lockdown).
- **PCR**: The increment in 10 PCR per 100,000 people implies an increase of 10% in the hazard of getting out of the lockdown (i.e. greater PCR number implies shorter lockdown).
- **Active cases**: The increment in one active cases per 100,000 people implies an increase of 1% in the hazard of getting out of the lockdown (i.e. greater active cases implies longer lockdown).

4.4 Joint Model

In this model we have two source of information outcomes. For the time-to-event model, we considered the number of days that a commune was under lockdown. To do so, it was considered the period between March 25th and December 25th, 2020. In case where a municipality was still under lockdown on December 25th, it was considered as a right-censored observation. On the other hand, for the longitudinal model, we considered some epidemiological factors. As this information varies over time, it was considered the weekly average value during the period the commune was on lockdown. The epidemiological information was collected based on first or third levels administrative division. It basically consists of the number of active cases per commune; number of asymptomatic and symptomatic cases per region; number of patients in Intensive Care Unit (ICU) per region; number of deaths per commune according to their residence; and the number of polymerase chain reaction (PCR) per region. From the number of asymptomatic and symptomatic cases, and the number of PCR per region, we built a new longitudinal covariate, the percentage of positivity of the PCR. For building this new covariate we considered:

$$\text{positividad} = \frac{\text{asymptomatic cases} * \text{symptomatic cases}}{\text{PCR}}$$

Apart from the survival and longitudinal outcomes, demographic/socioeconomic factors were considered as predictors for the survival model (same predictors as before).

The model was built in two main stages. Firstly, we fitted univariate joint models for each of the longitudinal covariates (active cases, ICU patients, deaths, and positivity). At this point, we identified deaths was no relevant, i.e., p-value was higher than 0.05. Then, a bivariate joint model was fitted considering pairs of the relevant ones. Finally, a trivariate joint model was fitted, however, ICU patients was not relevant. So, the bivariate model including number of active cases and positivity was considered as the final version. All epidemiological markers were logarithmically transformed for joint analysis.

1-variate	UCI Active cases Positivity
2-variate	UCI + Active cases UCI + Positivity Active cases + Positivity
3-variate	UCI + Active cases + Positivity

Table 28: Models.

The second stage contemplated the selection of social-demographic covariates in the bivariate joint model. To do so, we used the stepwise backward elimination approach, starting from a full model, which included all the predictors. Covariates with the highest p-values were removed from the model one at a time until all predictors were below the significance threshold (p-value ≤ 0.05). Finally, the final joint model includes two longitudinal information, number of active cases and positivity. Besides, it includes overcrowding and rural index. More details about model building can be found in the Appendix 6.4.

Longitudinal sub-model:				
	Estimate	Std. Error	p-value	
β_{01} (active cases)	5.399	0.137	< 0.0001	
β_{11} (active cases)	-2.377	0.259	< 0.0001	
β_{02} (positivity)	-1.694	0.078	< 0.0001	
β_{12} (positivity)	-2.653	0.1834	< 0.0001	
Time-to-event sub-model:				
	Estimate	Std. Error	p-value	HR (CI 95%)
Overcrowding	-0.651	0.293	0.026	0.521 (0.294, 0.926)
Rural index	0.029	0.010	0.003	1.030 (1.010, 1.050)
α_1	-0.788	0.160	< 0.0001	0.455 (0.333, 0.622)
α_2	-1.604	0.259	< 0.0001	0.201 (0.121, 0.334)

Table 29: Bivariate joint model. Coefficient estimates, standard errors, and p-values for explanatory variables in both longitudinal and time-to-event sub-model, and hazard ratio (HR) estimates with their corresponding 95% confidence intervals (CI). β_{01}, β_{11}, and α_1 correspond to the active cases. β_{02}, β_{12}, and α_2 correspond to the positivity.

The longitudinal sub model showed the number of active cases and the percentage of positivity decreased during the lockdown (Table 29). However, more than identify this behavior, we want to know if number of active cases and percentage of positivity are associated to the duration of lockdown. Thus, in the joint model, α indicates the change in the hazard for a unit change in the underlying subject-specific value of the longitudinal outcome and thus determines the strength of the association. Specifically, both longitudinal outcomes, number of active cases, and percentage of positivity, and time-to-event outcome are significantly associated too (α_1 and α_2, respectively). The increase in these factors implies a reduction in the hazard of a commune leave a lockdown.

Regarding to demographic/socioeconomic factors, the joint modeling showed that overcrowding and rural index are significantly associated to the duration of lockdown (p-value < 0.005), Table 29. This association suggests that an alteration in these covariates leads to changes in the hazard of a commune leave a lockdown. Specifically, the increment in one point in the overcrowding implies a reduction of 47.9% in the hazard of getting out of the lockdown, i.e., greater overcrowding implies longer lockdown. On the other hand, the increment in one point of the rural index implies an increase of 3% in the hazard of getting out of the lockdown, i.e., greater rural index implies shorter lockdown.

5 Discussion and conclusion

Based on the Weibull model with time-dependent covariates, presented in Section 4.3.2.6, it was elaborated the following dashboard (Figure 4), where the user can choose the commune and see the survival curve. Besides, based on the joint model, presented in Section 4.4, it was elaborated a manuscript to be published.

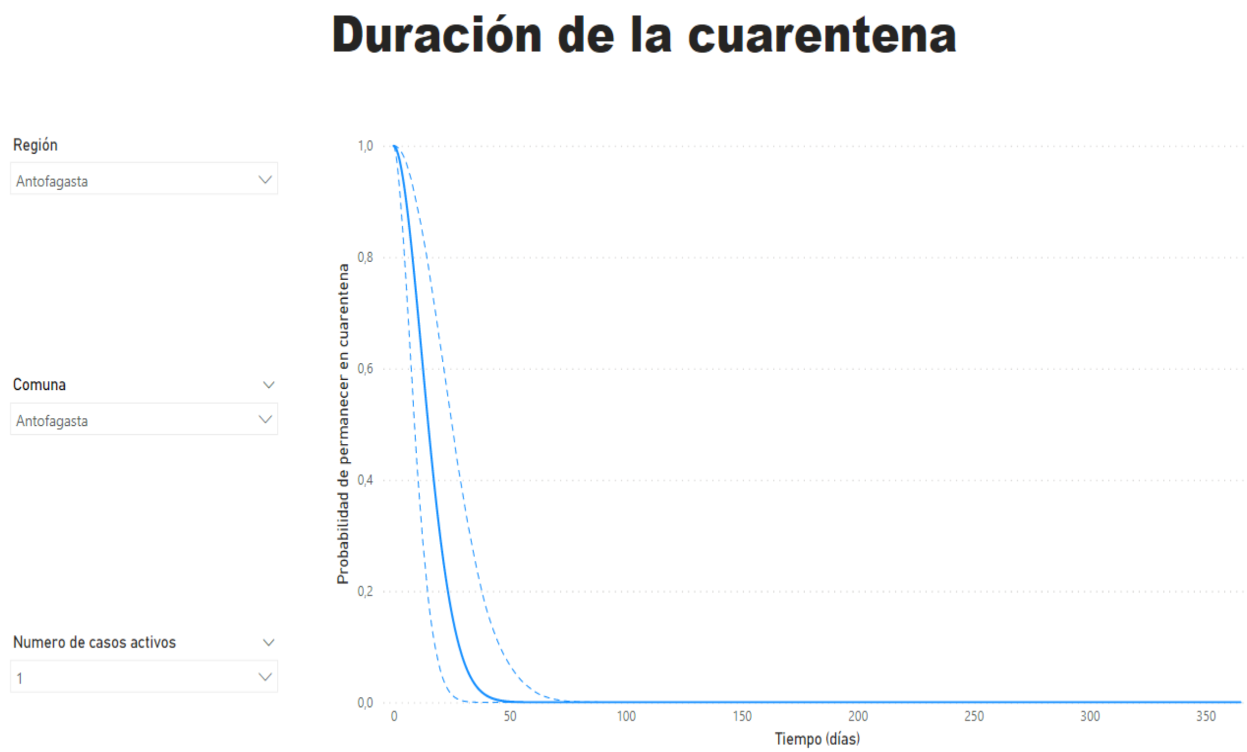

Figure 4: Dashboard.

6 Appendix

6.1 Cox proportional hazard model

```
library(survival)
fit_cox0 <- coxph(Surv(tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + puerto + segunda_cuarentena, data = data)
summary(fit_cox0)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.949e-01  7.446e-01  1.116e-01 -2.643  0.00821 **
densidad_poblacional -5.987e-05  9.999e-01  3.801e-05 -1.575  0.11525
idse                  1.801e+00  6.054e+00  1.063e+00  1.694  0.09028 .
hacinamiento         -7.527e-01  4.711e-01  2.381e-01 -3.162  0.00157 **
inmigrantes          -8.010e-05  9.999e-01  3.325e-05 -2.409  0.01599 *
capital_regional      3.987e-01  1.490e+00  4.442e-01  0.897  0.36948
capital_provincial   -5.365e-01  5.848e-01  2.695e-01 -1.990  0.04654 *
indice_ruralidad      2.843e-02  1.029e+00  1.250e-02  2.275  0.02290 *
aeropuerto           -3.065e-01  7.360e-01  5.321e-01 -0.576  0.56453
puerto               -5.018e-01  6.054e-01  6.060e-01 -0.828  0.40762
segunda_cuarentena    6.282e-01  1.874e+00  3.071e-01  2.046  0.04079 *

fit_cox1 <- coxph(Surv(tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + puerto + segunda_cuarentena, data = data)
summary(fit_cox1)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -3.007e-01  7.403e-01  1.114e-01 -2.699  0.00696 **
densidad_poblacional -5.831e-05  9.999e-01  3.793e-05 -1.537  0.12419
idse                  1.812e+00  6.120e+00  1.065e+00  1.701  0.08888 .
hacinamiento         -7.722e-01  4.620e-01  2.358e-01 -3.275  0.00106 **
inmigrantes          -8.324e-05  9.999e-01  3.287e-05 -2.532  0.01134 *
capital_regional      3.927e-01  1.481e+00  4.481e-01  0.877  0.38075
capital_provincial   -5.366e-01  5.847e-01  2.697e-01 -1.990  0.04660 *
indice_ruralidad      2.793e-02  1.028e+00  1.248e-02  2.238  0.02523 *
puerto               -7.005e-01  4.963e-01  5.143e-01 -1.362  0.17317
segunda_cuarentena    6.273e-01  1.873e+00  3.065e-01  2.047  0.04066 *

fit_cox2 <- coxph(Surv(tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                   hacinamiento + inmigrantes + capital_provincial + indice_ruralidad +
                   puerto + segunda_cuarentena, data = data)
summary(fit_cox2)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.688e-01  7.643e-01  1.026e-01 -2.621 0.008759 **
densidad_poblacional -6.405e-05  9.999e-01  3.726e-05 -1.719 0.085638 .
idse                  1.820e+00  6.175e+00  1.060e+00  1.717 0.086008 .
hacinamiento         -8.037e-01  4.477e-01  2.313e-01 -3.475 0.000511 ***
inmigrantes          -8.125e-05  9.999e-01  3.289e-05 -2.470 0.013510 *
capital_provincial   -5.861e-01  5.565e-01  2.624e-01 -2.233 0.025534 *
indice_ruralidad      2.684e-02  1.027e+00  1.234e-02  2.175 0.029595 *
puerto               -4.034e-01  6.680e-01  3.905e-01 -1.033 0.301556
segunda_cuarentena    6.032e-01  1.828e+00  3.070e-01  1.965 0.049427 *


fit_cox3 <- coxph(Surv(tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                   hacinamiento + inmigrantes + capital_provincial + indice_ruralidad +
                   segunda_cuarentena, data = data)
summary(fit_cox3)
```

```
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -3.102e-01  7.333e-01  9.778e-02 -3.172 0.001515 **
densidad_poblacional -5.149e-05  9.999e-01  3.540e-05 -1.455 0.145788
idse                 1.931e+00  6.897e+00  1.060e+00  1.821 0.068600 .
hacinamiento        -7.637e-01  4.659e-01  2.293e-01 -3.331 0.000866 ***
inmigrantes         -8.678e-05  9.999e-01  3.237e-05 -2.681 0.007337 **
capital_provincial  -5.245e-01  5.919e-01  2.561e-01 -2.048 0.040546 *
indice_ruralidad     2.838e-02  1.029e+00  1.232e-02  2.303 0.021290 *
segunda_cuarentena   5.983e-01  1.819e+00  3.057e-01  1.957 0.050348 .

fit_cox4 <- coxph(Surv(tiempo2, fim_cuarentena) ~ poblacion + idse + hacinamiento +
                    inmigrantes + capital_provincial + indice_ruralidad + segunda_cuarentena,
                    data = data)
summary(fit_cox4)
                       coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -2.822e-01  7.542e-01  9.429e-02 -2.992  0.00277 **
idse                2.291e+00  9.882e+00  1.026e+00  2.232  0.02561 *
hacinamiento       -6.784e-01  5.074e-01  2.191e-01 -3.096  0.00196 **
inmigrantes        -9.885e-05  9.999e-01  3.194e-05 -3.094  0.00197 **
capital_provincial -4.307e-01  6.500e-01  2.481e-01 -1.736  0.08254 .
indice_ruralidad    4.105e-02  1.042e+00  8.726e-03  4.704 2.55e-06 ***
segunda_cuarentena  6.551e-01  1.925e+00  3.055e-01  2.145  0.03199 *

fit_cox5 <- coxph(Surv(tiempo2, fim_cuarentena) ~ poblacion + idse + hacinamiento +
                    inmigrantes + indice_ruralidad + segunda_cuarentena, data = data)
summary(fit_cox5)
                       coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -3.031e-01  7.385e-01  9.227e-02 -3.285  0.00102 **
idse                1.965e+00  7.134e+00  1.011e+00  1.943  0.05205 .
hacinamiento       -6.210e-01  5.374e-01  2.190e-01 -2.836  0.00457 **
inmigrantes        -9.846e-05  9.999e-01  3.162e-05 -3.114  0.00184 **
indice_ruralidad    3.933e-02  1.040e+00  8.739e-03  4.500 6.79e-06 ***
segunda_cuarentena  7.510e-01  2.119e+00  2.959e-01  2.538  0.01114 *
```

6.2 Cox proportional hazards model with time-dependent covariates

```
library(survival); library(dotwhisker); library(survminer)

# casos_nuevos_con_sintomas

fit1.1 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas,
                  data = data)
summary(fit1.1)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -3.019e-01  7.394e-01  1.201e-01 -2.513  0.01196 *
densidad_poblacional -5.103e-05  9.999e-01  3.787e-05 -1.347  0.17785
idse                 1.044e+00  2.841e+00  1.158e+00  0.902  0.36727
hacinamiento        -1.020e+00  3.605e-01  2.445e-01 -4.174 2.99e-05 ***
inmigrantes         -6.109e-05  9.999e-01  3.448e-05 -1.772  0.07641 .
capital_regional     2.311e-01  1.260e+00  4.474e-01  0.517  0.60545
capital_provincial  -3.745e-01  6.876e-01  2.666e-01 -1.405  0.16007
indice_ruralidad     1.829e-02  1.018e+00  1.194e-02  1.532  0.12555
aeropuerto           8.170e-02  1.085e+00  5.152e-01  0.159  0.87400
puerto              -4.012e-01  6.695e-01  5.733e-01 -0.700  0.48407
segunda_cuarentena   8.188e-01  2.268e+00  3.038e-01  2.695  0.00704 **
casos_con_sintomas  -1.520e-01  8.590e-01  2.825e-02 -5.378 7.53e-08 ***

fit1.2 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + puerto + segunda_cuarentena + casos_con_sintomas, data = data)
summary(fit1.2)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -2.999e-01  7.409e-01  1.193e-01 -2.513  0.01199 *
densidad_poblacional -5.160e-05  9.999e-01  3.770e-05 -1.369  0.17109
idse                 1.044e+00  2.839e+00  1.158e+00  0.901  0.36740
hacinamiento        -1.013e+00  3.630e-01  2.405e-01 -4.213 2.52e-05 ***
inmigrantes         -6.011e-05  9.999e-01  3.388e-05 -1.774  0.07605 .
capital_regional     2.331e-01  1.262e+00  4.460e-01  0.523  0.60124
capital_provincial  -3.758e-01  6.867e-01  2.664e-01 -1.410  0.15840
indice_ruralidad     1.844e-02  1.019e+00  1.189e-02  1.550  0.12110
puerto              -3.551e-01  7.011e-01  4.903e-01 -0.724  0.46885
segunda_cuarentena   8.187e-01  2.268e+00  3.040e-01  2.693  0.00708 **
casos_con_sintomas  -1.516e-01  8.594e-01  2.813e-02 -5.387 7.16e-08 ***

fit1.3 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_provincial + indice_ruralidad +
                  puerto + segunda_cuarentena + casos_con_sintomas, data = data)
summary(fit1.3)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -2.749e-01  7.596e-01  1.074e-01 -2.559  0.01050 *
densidad_poblacional -5.472e-05  9.999e-01  3.716e-05 -1.473  0.14088
idse                 1.040e+00  2.830e+00  1.155e+00  0.901  0.36768
hacinamiento        -1.027e+00  3.582e-01  2.380e-01 -4.314 1.61e-05 ***
inmigrantes         -5.741e-05  9.999e-01  3.349e-05 -1.714  0.08648 .
capital_provincial  -4.121e-01  6.623e-01  2.566e-01 -1.606  0.10829
indice_ruralidad     1.804e-02  1.018e+00  1.182e-02  1.527  0.12684
puerto              -1.972e-01  8.210e-01  3.875e-01 -0.509  0.61090
segunda_cuarentena   8.024e-01  2.231e+00  3.029e-01  2.649  0.00806 **
casos_con_sintomas  -1.518e-01  8.592e-01  2.813e-02 -5.394 6.88e-08 ***
```

```
fit1.4 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_provincial + indice_ruralidad +
                  segunda_cuarentena + casos_con_sintomas, data = data)
summary(fit1.4)
                           coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.964e-01  7.435e-01  1.004e-01 -2.953  0.00315 **
densidad_poblacional -4.903e-05  1.000e+00  3.551e-05 -1.381  0.16730
idse                  1.086e+00  2.962e+00  1.154e+00  0.941  0.34658
hacinamiento         -1.019e+00  3.611e-01  2.380e-01 -4.280 1.87e-05 ***
inmigrantes          -6.052e-05  9.999e-01  3.292e-05 -1.838  0.06602 .
capital_provincial   -3.838e-01  6.812e-01  2.505e-01 -1.532  0.12544
indice_ruralidad      1.858e-02  1.019e+00  1.179e-02  1.575  0.11517
segunda_cuarentena    8.058e-01  2.238e+00  3.026e-01  2.663  0.00774 **
casos_con_sintomas   -1.527e-01  8.584e-01  2.810e-02 -5.433 5.53e-08 ***

fit1.5 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + inmigrantes + capital_provincial + indice_ruralidad +
                  segunda_cuarentena + casos_con_sintomas, data = data)
summary(fit1.5)
                           coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.754e-01  7.593e-01  9.714e-02 -2.835  0.00459 **
densidad_poblacional -5.329e-05  9.999e-01  3.496e-05 -1.524  0.12740
hacinamiento         -1.027e+00  3.581e-01  2.377e-01 -4.320 1.56e-05 ***
inmigrantes          -4.819e-05  1.000e+00  2.959e-05 -1.629  0.10336
capital_provincial   -3.734e-01  6.884e-01  2.501e-01 -1.493  0.13537
indice_ruralidad      1.381e-02  1.014e+00  1.056e-02  1.308  0.19092
segunda_cuarentena    8.579e-01  2.358e+00  2.955e-01  2.903  0.00370 **
casos_con_sintomas   -1.595e-01  8.526e-01  2.774e-02 -5.750 8.93e-09 ***

fit1.6 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + inmigrantes + capital_provincial + segunda_cuarentena +
                  casos_con_sintomas, data = data)
summary(fit1.6)
                           coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -3.331e-01  7.167e-01  8.810e-02 -3.781 0.000156 ***
densidad_poblacional -8.327e-05  9.999e-01  2.639e-05 -3.155 0.001604 **
hacinamiento         -1.154e+00  3.154e-01  2.180e-01 -5.294 1.20e-07 ***
inmigrantes          -5.109e-05  9.999e-01  2.952e-05 -1.731 0.083480 .
capital_provincial   -3.880e-01  6.784e-01  2.488e-01 -1.560 0.118809
segunda_cuarentena    8.009e-01  2.228e+00  2.903e-01  2.759 0.005800 **
casos_con_sintomas   -1.570e-01  8.547e-01  2.735e-02 -5.742 9.38e-09 ***

fit1.7 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + inmigrantes + segunda_cuarentena + casos_con_sintomas,
                  data = data)
summary(fit1.7)
                           coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -3.553e-01  7.010e-01  8.777e-02 -4.048 5.17e-05 ***
densidad_poblacional -7.339e-05  9.999e-01  2.561e-05 -2.865  0.00417 **
hacinamiento         -1.125e+00  3.246e-01  2.181e-01 -5.159 2.48e-07 ***
inmigrantes          -5.887e-05  9.999e-01  2.947e-05 -1.998  0.04572 *
segunda_cuarentena    8.662e-01  2.378e+00  2.859e-01  3.030  0.00245 **
casos_con_sintomas   -1.546e-01  8.568e-01  2.688e-02 -5.752 8.84e-09 ***

# ******************************************************************************** #
# casos_nuevos_con_sintomas + numero_cama_uci

fit2.1 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
```

```
                  idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas +
                  uci, data = data)
summary(fit2.1)
                           coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -2.475e-01  7.808e-01  1.187e-01 -2.084  0.03716 *
densidad_poblacional -9.867e-06  1.000e+00  3.724e-05 -0.265  0.79103
idse                 3.256e+00  2.594e+01  1.214e+00  2.681  0.00734 **
hacinamiento        -4.127e-01  6.618e-01  2.689e-01 -1.535  0.12476
inmigrantes         -4.893e-05  1.000e+00  3.230e-05 -1.515  0.12982
capital_regional    -4.576e-01  6.328e-01  4.351e-01 -1.052  0.29293
capital_provincial  -5.899e-01  5.544e-01  2.634e-01 -2.239  0.02513 *
indice_ruralidad     2.215e-02  1.022e+00  1.166e-02  1.900  0.05746 .
aeropuerto          -1.504e-02  9.851e-01  5.383e-01 -0.028  0.97771
puerto              -2.588e-01  7.720e-01  5.762e-01 -0.449  0.65332
segunda_cuarentena   7.304e-01  2.076e+00  2.921e-01  2.500  0.01241 *
casos_con_sintomas  -8.531e-02  9.182e-01  2.892e-02 -2.950  0.00318 **
uci                 -2.622e-01  7.693e-01  4.486e-02 -5.846 5.05e-09 ***

fit2.2 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + puerto + segunda_cuarentena + casos_con_sintomas + uci,
                  data = data)
summary(fit2.2)
                           coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -2.478e-01  7.805e-01  1.180e-01 -2.099  0.03578 *
densidad_poblacional -9.792e-06  1.000e+00  3.714e-05 -0.264  0.79205
idse                 3.255e+00  2.592e+01  1.214e+00  2.681  0.00735 **
hacinamiento        -4.138e-01  6.611e-01  2.661e-01 -1.555  0.11985
inmigrantes         -4.906e-05  1.000e+00  3.200e-05 -1.533  0.12525
capital_regional    -4.582e-01  6.325e-01  4.349e-01 -1.054  0.29210
capital_provincial  -5.898e-01  5.544e-01  2.634e-01 -2.239  0.02514 *
indice_ruralidad     2.212e-02  1.022e+00  1.161e-02  1.905  0.05674 .
puerto              -2.678e-01  7.651e-01  4.789e-01 -0.559  0.57610
segunda_cuarentena   7.303e-01  2.076e+00  2.921e-01  2.500  0.01242 *
casos_con_sintomas  -8.537e-02  9.182e-01  2.883e-02 -2.961  0.00307 **
uci                 -2.622e-01  7.694e-01  4.486e-02 -5.845 5.05e-09 ***

fit2.3 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + hacinamiento +
                  inmigrantes + capital_regional + capital_provincial + indice_ruralidad +
                  puerto + segunda_cuarentena + casos_con_sintomas + uci, data = data)
summary(fit2.3)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -2.459e-01  7.820e-01  1.177e-01 -2.088  0.03677 *
idse                3.294e+00  2.695e+01  1.204e+00  2.736  0.00621 **
hacinamiento       -3.961e-01  6.729e-01  2.572e-01 -1.540  0.12352
inmigrantes        -5.140e-05  9.999e-01  3.076e-05 -1.671  0.09472 .
capital_regional   -4.450e-01  6.408e-01  4.325e-01 -1.029  0.30352
capital_provincial -5.734e-01  5.636e-01  2.561e-01 -2.239  0.02516 *
indice_ruralidad    2.403e-02  1.024e+00  9.066e-03  2.651  0.00803 **
puerto             -2.558e-01  7.743e-01  4.770e-01 -0.536  0.59181
segunda_cuarentena  7.453e-01  2.107e+00  2.864e-01  2.602  0.00926 **
casos_con_sintomas -8.509e-02  9.184e-01  2.883e-02 -2.952  0.00316 **
uci                -2.639e-01  7.681e-01  4.439e-02 -5.945 2.77e-09 ***

fit2.4 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + hacinamiento +
                  inmigrantes + capital_provincial + indice_ruralidad + puerto +
                  segunda_cuarentena + casos_con_sintomas + uci, data = data)
```

```
summary(fit2.4)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -2.955e-01  7.442e-01  1.114e-01 -2.652  0.00801 **
idse                3.177e+00  2.398e+01  1.205e+00  2.637  0.00837 **
hacinamiento       -4.138e-01  6.611e-01  2.583e-01 -1.602  0.10917
inmigrantes        -5.515e-05  9.999e-01  3.061e-05 -1.802  0.07161 .
capital_provincial -5.061e-01  6.028e-01  2.489e-01 -2.033  0.04202 *
indice_ruralidad    2.353e-02  1.024e+00  9.144e-03  2.573  0.01007 *
puerto             -5.410e-01  5.821e-01  3.846e-01 -1.407  0.15946
segunda_cuarentena  7.631e-01  2.145e+00  2.864e-01  2.664  0.00772 **
casos_con_sintomas -8.959e-02  9.143e-01  2.860e-02 -3.133  0.00173 **
uci                -2.516e-01  7.775e-01  4.248e-02 -5.923 3.16e-09 ***

fit2.5 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + hacinamiento +
                  inmigrantes + capital_provincial + indice_ruralidad + segunda_cuarentena +
                  casos_con_sintomas + uci, data = data)
summary(fit2.5)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -3.722e-01  6.892e-01  1.030e-01 -3.614 0.000302 ***
idse                3.203e+00  2.460e+01  1.215e+00  2.636 0.008386 **
hacinamiento       -4.387e-01  6.448e-01  2.607e-01 -1.683 0.092328 .
inmigrantes        -6.030e-05  9.999e-01  3.054e-05 -1.975 0.048303 *
capital_provincial -4.439e-01  6.415e-01  2.454e-01 -1.809 0.070474 .
indice_ruralidad    2.162e-02  1.022e+00  9.087e-03  2.379 0.017351 *
segunda_cuarentena  7.481e-01  2.113e+00  2.872e-01  2.605 0.009182 **
casos_con_sintomas -9.548e-02  9.089e-01  2.844e-02 -3.357 0.000789 ***
uci                -2.408e-01  7.860e-01  4.186e-02 -5.751 8.87e-09 ***

fit2.6 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + inmigrantes +
                  capital_provincial + indice_ruralidad + segunda_cuarentena + casos_con_sintomas +
                  uci, data = data)
summary(fit2.6)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -3.656e-01  6.938e-01  1.029e-01 -3.552 0.000382 ***
idse                3.327e+00  2.787e+01  1.219e+00  2.729 0.006349 **
inmigrantes        -5.051e-05  9.999e-01  3.002e-05 -1.683 0.092410 .
capital_provincial -4.059e-01  6.664e-01  2.438e-01 -1.665 0.095857 .
indice_ruralidad    2.483e-02  1.025e+00  8.806e-03  2.820 0.004800 **
segunda_cuarentena  6.515e-01  1.918e+00  2.805e-01  2.323 0.020193 *
casos_con_sintomas -8.299e-02  9.204e-01  2.648e-02 -3.134 0.001723 **
uci                -2.587e-01  7.720e-01  4.042e-02 -6.401 1.55e-10 ***

fit2.7 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + inmigrantes +
                  indice_ruralidad + segunda_cuarentena + casos_con_sintomas + uci, data = data)
summary(fit2.7)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -3.740e-01  6.880e-01  1.016e-01 -3.681 0.000233 ***
idse                3.041e+00  2.092e+01  1.207e+00  2.520 0.011741 *
inmigrantes        -4.960e-05  1.000e+00  2.991e-05 -1.658 0.097274 .
indice_ruralidad    2.365e-02  1.024e+00  8.820e-03  2.681 0.007336 **
segunda_cuarentena  7.031e-01  2.020e+00  2.780e-01  2.529 0.011448 *
casos_con_sintomas -8.374e-02  9.197e-01  2.581e-02 -3.244 0.001180 **
uci                -2.531e-01  7.764e-01  4.027e-02 -6.285 3.29e-10 ***

fit2.8 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + indice_ruralidad +
                  segunda_cuarentena + casos_con_sintomas + uci, data = data)
summary(fit2.8)
                        coef exp(coef)  se(coef)      z Pr(>|z|)
```

```
poblacion          -0.331445  0.717886  0.097285 -3.407 0.000657 ***
idse                2.133460  8.444029  1.080094  1.975 0.048239 *
indice_ruralidad    0.023079  1.023348  0.008751  2.637 0.008359 **
segunda_cuarentena  0.633768  1.884699  0.275212  2.303 0.021288 *
casos_con_sintomas -0.088696  0.915124  0.026239 -3.380 0.000724 ***
uci                -0.250914  0.778089  0.040164 -6.247 4.18e-10 ***

# ********************************************************************************** #
# casos_nuevos_con_sintomas + numero_cama_uci_r_prom + numero_pcr_r_prom

fit3.1 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas +
                  uci + pcr, data = data_fit3)
summary(fit3.1)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.466e-01  7.814e-01  1.203e-01 -2.050  0.04032 *
densidad_poblacional -9.617e-06  1.000e+00  3.745e-05 -0.257  0.79732
idse                  3.482e+00  3.251e+01  1.236e+00  2.817  0.00485 **
hacinamiento         -4.118e-01  6.625e-01  2.721e-01 -1.514  0.13015
inmigrantes          -4.745e-05  1.000e+00  3.306e-05 -1.435  0.15119
capital_regional     -4.968e-01  6.085e-01  4.348e-01 -1.143  0.25316
capital_provincial   -6.135e-01  5.415e-01  2.652e-01 -2.313  0.02070 *
indice_ruralidad      2.243e-02  1.023e+00  1.191e-02  1.884  0.05963 .
aeropuerto           -4.380e-03  9.956e-01  5.449e-01 -0.008  0.99359
puerto               -2.452e-01  7.826e-01  5.734e-01 -0.428  0.66899
segunda_cuarentena    7.096e-01  2.033e+00  2.990e-01  2.373  0.01764 *
casos_con_sintomas   -8.364e-02  9.198e-01  3.414e-02 -2.450  0.01428 *
uci                  -2.698e-01  7.635e-01  4.759e-02 -5.670 1.43e-08 ***
pcr                  -1.576e-04  9.998e-01  1.315e-03 -0.120  0.90465

fit3.2 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + puerto + segunda_cuarentena + casos_con_sintomas +  uci +
                  pcr, data = data_fit3)
summary(fit3.2)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.468e-01  7.813e-01  1.192e-01 -2.071  0.03836 *
densidad_poblacional -9.589e-06  1.000e+00  3.729e-05 -0.257  0.79704
idse                  3.482e+00  3.251e+01  1.236e+00  2.817  0.00485 **
hacinamiento         -4.121e-01  6.622e-01  2.682e-01 -1.537  0.12433
inmigrantes          -4.749e-05  1.000e+00  3.256e-05 -1.458  0.14472
capital_regional     -4.970e-01  6.084e-01  4.342e-01 -1.144  0.25243
capital_provincial   -6.135e-01  5.415e-01  2.652e-01 -2.314  0.02069 *
indice_ruralidad      2.242e-02  1.023e+00  1.189e-02  1.886  0.05934 .
puerto               -2.477e-01  7.806e-01  4.813e-01 -0.515  0.60683
segunda_cuarentena    7.097e-01  2.033e+00  2.990e-01  2.374  0.01760 *
casos_con_sintomas   -8.363e-02  9.198e-01  3.412e-02 -2.451  0.01424 *
uci                  -2.698e-01  7.635e-01  4.754e-02 -5.675 1.38e-08 ***
pcr                  -1.594e-04  9.998e-01  1.296e-03 -0.123  0.90209

fit3.3 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + hacinamiento +
                  inmigrantes + capital_regional + capital_provincial + indice_ruralidad +
                  puerto + segunda_cuarentena + casos_con_sintomas +  uci + pcr,
                  data = data_fit3)
summary(fit3.3)
                        coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -2.453e-01  7.824e-01  1.190e-01 -2.062  0.03918 *
```

```
idse                3.520e+00  3.379e+01  1.225e+00  2.874  0.00405 **
hacinamiento       -3.962e-01  6.729e-01  2.607e-01 -1.520  0.12862
inmigrantes        -4.996e-05  1.000e+00  3.114e-05 -1.604  0.10868
capital_regional   -4.840e-01  6.163e-01  4.317e-01 -1.121  0.26223
capital_provincial -5.980e-01  5.499e-01  2.584e-01 -2.314  0.02066 *
indice_ruralidad    2.434e-02  1.025e+00  9.266e-03  2.626  0.00863 **
puerto             -2.344e-01  7.910e-01  4.787e-01 -0.490  0.62433
segunda_cuarentena  7.261e-01  2.067e+00  2.919e-01  2.488  0.01285 *
casos_con_sintomas -8.291e-02  9.204e-01  3.397e-02 -2.441  0.01465 *
uci                -2.718e-01  7.620e-01  4.690e-02 -5.795 6.84e-09 ***
pcr                -1.918e-04  9.998e-01  1.288e-03 -0.149  0.88160

fit3.4 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + hacinamiento +
                  inmigrantes + capital_regional + capital_provincial + indice_ruralidad +
                  segunda_cuarentena + casos_con_sintomas +  uci + pcr, data = data_fit3)
summary(fit3.4)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -2.513e-01  7.778e-01  1.190e-01 -2.112  0.03470 *
idse                3.561e+00  3.521e+01  1.222e+00  2.914  0.00357 **
hacinamiento       -4.021e-01  6.689e-01  2.605e-01 -1.543  0.12277
inmigrantes        -5.054e-05  9.999e-01  3.118e-05 -1.621  0.10506
capital_regional   -6.155e-01  5.404e-01  3.476e-01 -1.771  0.07664 .
capital_provincial -6.019e-01  5.478e-01  2.582e-01 -2.331  0.01974 *
indice_ruralidad    2.420e-02  1.024e+00  9.256e-03  2.614  0.00895 **
segunda_cuarentena  7.219e-01  2.058e+00  2.918e-01  2.474  0.01337 *
casos_con_sintomas -8.225e-02  9.210e-01  3.388e-02 -2.428  0.01519 *
uci                -2.729e-01  7.612e-01  4.694e-02 -5.814 6.09e-09 ***
pcr                -2.671e-04  9.997e-01  1.277e-03 -0.209  0.83438

fit3.5 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + inmigrantes +
                  capital_regional + capital_provincial + indice_ruralidad + segunda_cuarentena +
                  casos_con_sintomas +  uci + pcr, data = data_fit3)
summary(fit3.5)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -2.317e-01  7.932e-01  1.181e-01 -1.962  0.04974 *
idse                3.672e+00  3.933e+01  1.228e+00  2.990  0.00279 **
inmigrantes        -4.012e-05  1.000e+00  3.038e-05 -1.321  0.18666
capital_regional   -6.635e-01  5.150e-01  3.488e-01 -1.902  0.05714 .
capital_provincial -5.754e-01  5.625e-01  2.579e-01 -2.231  0.02571 *
indice_ruralidad    2.651e-02  1.027e+00  9.028e-03  2.936  0.00332 **
segunda_cuarentena  6.245e-01  1.867e+00  2.852e-01  2.190  0.02854 *
casos_con_sintomas -7.541e-02  9.274e-01  3.250e-02 -2.321  0.02030 *
uci                -2.875e-01  7.501e-01  4.598e-02 -6.253 4.03e-10 ***
pcr                 5.970e-05  1.000e+00  1.257e-03  0.048  0.96211

fit3.6 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + idse + capital_regional +
                  capital_provincial + indice_ruralidad + segunda_cuarentena + casos_con_sintomas +
                  uci + pcr, data = data_fit3)
summary(fit3.6)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion          -0.1823480  0.8333113  0.1108977 -1.644  0.10012
idse                2.9637207 19.3699078  1.1078791  2.675  0.00747 **
capital_regional   -0.7371134  0.4784932  0.3440502 -2.142  0.03216 *
capital_provincial -0.5791757  0.5603601  0.2573315 -2.251  0.02440 *
indice_ruralidad    0.0262131  1.0265597  0.0089790  2.919  0.00351 **
segunda_cuarentena  0.5627889  1.7555617  0.2827338  1.991  0.04653 *
casos_con_sintomas -0.0825658  0.9207509  0.0324222 -2.547  0.01088 *
uci                -0.2842263  0.7525963  0.0456883 -6.221 4.94e-10 ***
```

```
pcr                 0.0003248  1.0003248  0.0012375  0.262  0.79298

fit3.7 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ idse + capital_regional +
                  indice_ruralidad + segunda_cuarentena + casos_con_sintomas +
                  uci + pcr, data = data_fit3)
summary(fit3.7)
                         coef  exp(coef)   se(coef)      z Pr(>|z|)
idse                2.6795179 14.5780640  1.1024862  2.430 0.015081 *
capital_regional   -1.0230708  0.3594893  0.2936697 -3.484 0.000494 ***
capital_provincial -0.6819792  0.5056153  0.2491492 -2.737 0.006196 **
indice_ruralidad    0.0298464  1.0302963  0.0087528  3.410 0.000650 ***
segunda_cuarentena  0.5652700  1.7599228  0.2817631  2.006 0.044836 *
casos_con_sintomas -0.0842115  0.9192369  0.0328683 -2.562 0.010404 *
uci                -0.2829739  0.7535394  0.0450517 -6.281 3.36e-10 ***
pcr                 0.0005283  1.0005284  0.0012241  0.432 0.666048

# ******************************************************************************** #
# casos_nuevos_con_sintomas + numero_cama_uci_r_prom + numero_pcr_r_prom + casos_activos_c_prom

fit4.1 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas +
                  uci + pcr + casos_activos, data = data_fit4)
summary(fit4.1)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.621e-01  7.694e-01  1.242e-01  -2.109 0.034912 *
densidad_poblacional -8.495e-05  9.999e-01  4.017e-05  -2.115 0.034439 *
idse                 -5.148e-01  5.976e-01  1.223e+00  -0.421 0.673840
hacinamiento         -5.295e-01  5.889e-01  2.704e-01  -1.958 0.050201 .
inmigrantes           9.916e-06  1.000e+00  3.476e-05   0.285 0.775463
capital_regional     -1.834e-01  8.324e-01  4.549e-01  -0.403 0.686794
capital_provincial   -4.033e-01  6.681e-01  2.773e-01  -1.454 0.145814
indice_ruralidad     -5.385e-03  9.946e-01  1.313e-02  -0.410 0.681599
aeropuerto           -4.741e-01  6.225e-01  5.786e-01  -0.819 0.412559
puerto                1.448e-01  1.156e+00  5.927e-01   0.244 0.806959
segunda_cuarentena    8.744e-01  2.397e+00  3.143e-01   2.782 0.005403 **
casos_con_sintomas   -1.490e-02  9.852e-01  3.546e-02  -0.420 0.674439
uci                  -1.718e-01  8.421e-01  4.998e-02  -3.438 0.000587 ***
pcr                   5.168e-03  1.005e+00  1.381e-03   3.743 0.000182 ***
casos_activos        -3.111e-02  9.694e-01  2.881e-03 -10.795  < 2e-16 ***

fit4.2 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + segunda_cuarentena + casos_con_sintomas + uci +
                  pcr + casos_activos, data = data_fit4)
summary(fit4.2)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.628e-01  7.689e-01  1.242e-01  -2.116 0.034367 *
densidad_poblacional -8.554e-05  9.999e-01  4.010e-05  -2.133 0.032921 *
idse                 -5.161e-01  5.969e-01  1.223e+00  -0.422 0.673019
hacinamiento         -5.335e-01  5.866e-01  2.699e-01  -1.976 0.048104 *
inmigrantes           9.388e-06  1.000e+00  3.469e-05   0.271 0.786679
capital_regional     -1.368e-01  8.722e-01  4.090e-01  -0.334 0.738025
capital_provincial   -4.035e-01  6.680e-01  2.773e-01  -1.455 0.145674
indice_ruralidad     -5.542e-03  9.945e-01  1.312e-02  -0.422 0.672667
aeropuerto           -3.977e-01  6.719e-01  4.838e-01  -0.822 0.411046
segunda_cuarentena    8.745e-01  2.398e+00  3.140e-01   2.785 0.005360 **
casos_con_sintomas   -1.484e-02  9.853e-01  3.542e-02  -0.419 0.675123
```

```
uci                  -1.713e-01  8.426e-01  4.989e-02  -3.433 0.000596 ***
pcr                   5.157e-03  1.005e+00  1.380e-03   3.739 0.000185 ***
casos_activos        -3.104e-02  9.694e-01  2.867e-03 -10.827  < 2e-16 ***

fit4.3 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + capital_regional + capital_provincial + indice_ruralidad +
                  aeropuerto + segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos,
                  data = data_fit4)
summary(fit4.3)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.692e-01  7.640e-01  1.220e-01  -2.206 0.027385 *
densidad_poblacional -8.112e-05  9.999e-01  3.668e-05  -2.212 0.026984 *
idse                 -3.612e-01  6.968e-01  1.081e+00  -0.334 0.738257
hacinamiento         -5.401e-01  5.827e-01  2.693e-01  -2.006 0.044885 *
capital_regional     -1.242e-01  8.832e-01  4.060e-01  -0.306 0.759586
capital_provincial   -3.981e-01  6.716e-01  2.766e-01  -1.439 0.150111
indice_ruralidad     -4.695e-03  9.953e-01  1.274e-02  -0.368 0.712556
aeropuerto           -3.737e-01  6.882e-01  4.752e-01  -0.786 0.431656
segunda_cuarentena    8.878e-01  2.430e+00  3.098e-01   2.866 0.004154 **
casos_con_sintomas   -1.354e-02  9.865e-01  3.505e-02  -0.386 0.699254
uci                  -1.725e-01  8.416e-01  4.982e-02  -3.462 0.000535 ***
pcr                   5.077e-03  1.005e+00  1.346e-03   3.771 0.000163 ***
casos_activos        -3.100e-02  9.695e-01  2.863e-03 -10.828  < 2e-16 ***

fit4.4 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + capital_provincial + indice_ruralidad + aeropuerto +
                  segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos,
                  data = data_fit4)
summary(fit4.4)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.855e-01  7.516e-01  1.109e-01  -2.574 0.010057 *
densidad_poblacional -8.011e-05  9.999e-01  3.651e-05  -2.194 0.028212 *
idse                 -3.701e-01  6.907e-01  1.082e+00  -0.342 0.732279
hacinamiento         -5.345e-01  5.860e-01  2.689e-01  -1.987 0.046886 *
capital_provincial   -3.695e-01  6.911e-01  2.607e-01  -1.417 0.156351
indice_ruralidad     -4.516e-03  9.955e-01  1.276e-02  -0.354 0.723420
aeropuerto           -4.336e-01  6.482e-01  4.330e-01  -1.001 0.316660
segunda_cuarentena    8.861e-01  2.426e+00  3.097e-01   2.861 0.004223 **
casos_con_sintomas   -1.373e-02  9.864e-01  3.501e-02  -0.392 0.694964
uci                  -1.688e-01  8.447e-01  4.824e-02  -3.499 0.000466 ***
pcr                   5.089e-03  1.005e+00  1.346e-03   3.780 0.000157 ***
casos_activos        -3.106e-02  9.694e-01  2.857e-03 -10.870  < 2e-16 ***

fit4.5 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + indice_ruralidad + aeropuerto +
                  segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos,
                  data = data_fit4)
summary(fit4.5)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.932e-01  7.459e-01  1.087e-01  -2.696 0.007010 **
densidad_poblacional -7.968e-05  9.999e-01  3.653e-05  -2.182 0.029146 *
hacinamiento         -5.165e-01  5.966e-01  2.636e-01  -1.959 0.050090 .
capital_provincial   -3.704e-01  6.904e-01  2.607e-01  -1.421 0.155311
indice_ruralidad     -2.814e-03  9.972e-01  1.179e-02  -0.239 0.811333
aeropuerto           -4.425e-01  6.424e-01  4.317e-01  -1.025 0.305417
segunda_cuarentena    8.618e-01  2.367e+00  3.024e-01   2.850 0.004367 **
casos_con_sintomas   -1.002e-02  9.900e-01  3.279e-02  -0.305 0.760028
uci                  -1.731e-01  8.410e-01  4.638e-02  -3.733 0.000189 ***
```

```
pcr                  5.005e-03  1.005e+00  1.317e-03   3.801 0.000144 ***
casos_activos       -3.086e-02  9.696e-01  2.791e-03 -11.058  < 2e-16 ***

fit4.6 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + aeropuerto + segunda_cuarentena +
                  casos_con_sintomas + uci + pcr + casos_activos, data = data_fit4)
summary(fit4.6)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -2.819e-01  7.543e-01  9.749e-02  -2.892 0.003833 **
densidad_poblacional -7.374e-05  9.999e-01  2.672e-05  -2.760 0.005779 **
hacinamiento        -5.052e-01  6.034e-01  2.591e-01  -1.950 0.051171 .
capital_provincial  -3.621e-01  6.962e-01  2.586e-01  -1.400 0.161413
aeropuerto          -4.445e-01  6.412e-01  4.320e-01  -1.029 0.303538
segunda_cuarentena   8.736e-01  2.395e+00  2.985e-01   2.926 0.003431 **
casos_con_sintomas  -1.063e-02  9.894e-01  3.276e-02  -0.324 0.745623
uci                 -1.727e-01  8.414e-01  4.625e-02  -3.733 0.000189 ***
pcr                  4.964e-03  1.005e+00  1.305e-03   3.803 0.000143 ***
casos_activos       -3.080e-02  9.697e-01  2.776e-03 -11.092  < 2e-16 ***

fit4.7 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + aeropuerto + segunda_cuarentena + uci +
                  pcr + casos_activos, data = data_fit4)
summary(fit4.7)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -2.815e-01  7.547e-01  9.745e-02  -2.888  0.00387 **
densidad_poblacional -7.312e-05  9.999e-01  2.663e-05  -2.746  0.00603 **
hacinamiento        -4.935e-01  6.105e-01  2.565e-01  -1.924  0.05433 .
capital_provincial  -3.538e-01  7.020e-01  2.574e-01  -1.374  0.16932
aeropuerto          -4.364e-01  6.464e-01  4.314e-01  -1.012  0.31177
segunda_cuarentena   8.779e-01  2.406e+00  2.980e-01   2.946  0.00322 **
uci                 -1.773e-01  8.375e-01  4.394e-02  -4.036 5.44e-05 ***
pcr                  4.760e-03  1.005e+00  1.145e-03   4.156 3.24e-05 ***
casos_activos       -3.093e-02  9.695e-01  2.745e-03 -11.269  < 2e-16 ***

fit4.8 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + segunda_cuarentena + uci + pcr +
                  casos_activos, data = data_fit4)
summary(fit4.8)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -3.217e-01  7.249e-01  9.166e-02  -3.509 0.000449 ***
densidad_poblacional -6.638e-05  9.999e-01  2.577e-05  -2.575 0.010015 *
hacinamiento        -5.195e-01  5.948e-01  2.557e-01  -2.032 0.042184 *
capital_provincial  -3.180e-01  7.276e-01  2.551e-01  -1.246 0.212650
segunda_cuarentena   8.600e-01  2.363e+00  2.982e-01   2.884 0.003932 **
uci                 -1.736e-01  8.406e-01  4.372e-02  -3.971 7.16e-05 ***
pcr                  4.564e-03  1.005e+00  1.134e-03   4.025 5.70e-05 ***
casos_activos       -3.104e-02  9.694e-01  2.742e-03 -11.320  < 2e-16 ***

fit4.9 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + segunda_cuarentena + uci + pcr + casos_activos, data = data_fit4)
summary(fit4.9)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -3.415e-01  7.107e-01  9.100e-02  -3.753 0.000175 ***
densidad_poblacional -6.015e-05  9.999e-01  2.515e-05  -2.392 0.016764 *
hacinamiento        -5.113e-01  5.997e-01  2.566e-01  -1.992 0.046340 *
segunda_cuarentena   8.607e-01  2.365e+00  2.978e-01   2.890 0.003857 **
uci                 -1.708e-01  8.430e-01  4.354e-02  -3.924 8.71e-05 ***
pcr                  4.659e-03  1.005e+00  1.124e-03   4.145 3.40e-05 ***
```

```
casos_activos        -3.085e-02  9.696e-01  2.729e-03 -11.306  < 2e-16 ***

# ******************************************************************************* #
# casos_nuevos_con_sintomas + numero_cama_uci_r_prom + numero_pcr_r_prom + casos_activos_c_prom +
# casos_nuevos_sin_sintomas_r_prom

fit5.1 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas +
                  uci + pcr + casos_activos + casos_sin_sintomas, data = data_fit5)
summary(fit5.1)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.539e-01  7.758e-01  1.311e-01  -1.937 0.052751 .
densidad_poblacional -5.360e-05  9.999e-01  4.333e-05  -1.237 0.216121
idse                 -5.545e-01  5.744e-01  1.335e+00  -0.415 0.677868
hacinamiento         -5.371e-01  5.845e-01  2.862e-01  -1.876 0.060616 .
inmigrantes           6.704e-07  1.000e+00  3.648e-05   0.018 0.985336
capital_regional      9.602e-02  1.101e+00  4.850e-01   0.198 0.843063
capital_provincial   -2.531e-01  7.764e-01  2.851e-01  -0.888 0.374598
indice_ruralidad      4.837e-03  1.005e+00  1.436e-02   0.337 0.736271
aeropuerto           -4.507e-01  6.372e-01  5.866e-01  -0.768 0.442338
puerto               -2.649e-02  9.739e-01  6.109e-01  -0.043 0.965414
segunda_cuarentena    9.142e-01  2.495e+00  3.200e-01   2.857 0.004277 **
casos_con_sintomas    1.305e-02  1.013e+00  3.692e-02   0.353 0.723829
uci                  -1.629e-01  8.496e-01  5.394e-02  -3.020 0.002524 **
pcr                   6.451e-03  1.006e+00  1.803e-03   3.579 0.000345 ***
casos_activos        -3.010e-02  9.703e-01  2.922e-03 -10.301  < 2e-16 ***
casos_sin_sintomas   -8.506e-02  9.185e-01  7.434e-02  -1.144 0.252525

fit5.2 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + capital_regional + capital_provincial + indice_ruralidad +
                  aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas + uci + pcr +
                  casos_activos + casos_sin_sintomas, data = data_fit5)
summary(fit5.2)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.544e-01  7.754e-01  1.278e-01  -1.990  0.04657 *
densidad_poblacional -5.329e-05  9.999e-01  3.993e-05  -1.334  0.18204
idse                 -5.453e-01  5.797e-01  1.238e+00  -0.440  0.65958
hacinamiento         -5.379e-01  5.840e-01  2.827e-01  -1.903  0.05707 .
capital_regional      9.738e-02  1.102e+00  4.793e-01   0.203  0.83901
capital_provincial   -2.526e-01  7.768e-01  2.836e-01  -0.891  0.37306
indice_ruralidad      4.891e-03  1.005e+00  1.406e-02   0.348  0.72796
aeropuerto           -4.484e-01  6.387e-01  5.734e-01  -0.782  0.43424
puerto               -2.739e-02  9.730e-01  6.090e-01  -0.045  0.96413
segunda_cuarentena    9.153e-01  2.498e+00  3.142e-01   2.913  0.00358 **
casos_con_sintomas    1.311e-02  1.013e+00  3.674e-02   0.357  0.72120
uci                  -1.629e-01  8.496e-01  5.395e-02  -3.020  0.00252 **
pcr                   6.446e-03  1.006e+00  1.774e-03   3.633  0.00028 ***
casos_activos        -3.010e-02  9.704e-01  2.915e-03 -10.323  < 2e-16 ***
casos_sin_sintomas   -8.503e-02  9.185e-01  7.431e-02  -1.144  0.25254

fit5.3 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + capital_regional + capital_provincial + indice_ruralidad +
                  aeropuerto + segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos +
                  casos_sin_sintomas, data = data_fit5)
summary(fit5.3)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.544e-01  7.754e-01  1.278e-01  -1.990 0.046598 *
```

```
densidad_poblacional -5.316e-05  9.999e-01  3.983e-05  -1.335 0.182006
idse                 -5.428e-01  5.811e-01  1.237e+00  -0.439 0.660753
hacinamiento         -5.373e-01  5.843e-01  2.824e-01  -1.903 0.057062 .
capital_regional      8.778e-02  1.092e+00  4.299e-01   0.204 0.838204
capital_provincial   -2.525e-01  7.769e-01  2.836e-01  -0.890 0.373268
indice_ruralidad      4.908e-03  1.005e+00  1.406e-02   0.349 0.726990
aeropuerto           -4.620e-01  6.300e-01  4.870e-01  -0.949 0.342742
segunda_cuarentena    9.153e-01  2.498e+00  3.142e-01   2.913 0.003581 **
casos_con_sintomas    1.307e-02  1.013e+00  3.675e-02   0.356 0.722101
uci                  -1.631e-01  8.495e-01  5.388e-02  -3.027 0.002473 **
pcr                   6.441e-03  1.006e+00  1.772e-03   3.636 0.000277 ***
casos_activos        -3.011e-02  9.703e-01  2.908e-03 -10.353  < 2e-16 ***
casos_sin_sintomas   -8.471e-02  9.188e-01  7.398e-02  -1.145 0.252195

fit5.4 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                 hacinamiento + capital_provincial + indice_ruralidad + aeropuerto +
                 segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos +
                 casos_sin_sintomas, data = data_fit5)
summary(fit5.4)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.432e-01  7.841e-01  1.146e-01  -2.122 0.033826 *
densidad_poblacional -5.406e-05  9.999e-01  3.960e-05  -1.365 0.172232
idse                 -5.220e-01  5.934e-01  1.233e+00  -0.423 0.672056
hacinamiento         -5.417e-01  5.818e-01  2.813e-01  -1.926 0.054127 .
capital_provincial   -2.725e-01  7.614e-01  2.658e-01  -1.025 0.305138
indice_ruralidad      4.663e-03  1.005e+00  1.400e-02   0.333 0.739026
aeropuerto           -4.196e-01  6.573e-01  4.403e-01  -0.953 0.340600
segunda_cuarentena    9.145e-01  2.495e+00  3.142e-01   2.910 0.003610 **
casos_con_sintomas    1.291e-02  1.013e+00  3.682e-02   0.351 0.725881
uci                  -1.660e-01  8.470e-01  5.199e-02  -3.193 0.001408 **
pcr                   6.399e-03  1.006e+00  1.760e-03   3.636 0.000276 ***
casos_activos        -3.007e-02  9.704e-01  2.901e-03 -10.362  < 2e-16 ***
casos_sin_sintomas   -8.292e-02  9.204e-01  7.352e-02  -1.128 0.259374

fit5.5 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                 hacinamiento + capital_provincial + aeropuerto + segunda_cuarentena +
                 casos_con_sintomas + uci + pcr + casos_activos + casos_sin_sintomas,
                 data = data_fit5)
summary(fit5.5)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.549e-01  7.750e-01  1.097e-01  -2.323 0.020170 *
densidad_poblacional -6.288e-05  9.999e-01  2.950e-05  -2.132 0.033034 *
idse                 -6.898e-01  5.017e-01  1.131e+00  -0.610 0.541924
hacinamiento         -5.682e-01  5.666e-01  2.702e-01  -2.103 0.035508 *
capital_provincial   -2.789e-01  7.566e-01  2.646e-01  -1.054 0.291959
aeropuerto           -4.115e-01  6.627e-01  4.392e-01  -0.937 0.348793
segunda_cuarentena    9.087e-01  2.481e+00  3.133e-01   2.900 0.003729 **
casos_con_sintomas    9.913e-03  1.010e+00  3.629e-02   0.273 0.784764
uci                  -1.637e-01  8.490e-01  5.168e-02  -3.168 0.001537 **
pcr                   6.317e-03  1.006e+00  1.741e-03   3.628 0.000285 ***
casos_activos        -3.014e-02  9.703e-01  2.894e-03 -10.417  < 2e-16 ***
casos_sin_sintomas   -7.347e-02  9.292e-01  6.776e-02  -1.084 0.278218

fit5.6 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                 hacinamiento + capital_provincial + aeropuerto + segunda_cuarentena +
                 uci + pcr + casos_activos + casos_sin_sintomas, data = data_fit5)
summary(fit5.6)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
```

```
poblacion            -2.514e-01  7.777e-01  1.088e-01  -2.310 0.020892 *
densidad_poblacional -6.279e-05  9.999e-01  2.953e-05  -2.127 0.033458 *
idse                 -7.817e-01  4.576e-01  1.084e+00  -0.721 0.471014
hacinamiento         -5.793e-01  5.603e-01  2.669e-01  -2.171 0.029942 *
capital_provincial   -2.790e-01  7.566e-01  2.645e-01  -1.055 0.291576
aeropuerto           -4.146e-01  6.606e-01  4.390e-01  -0.944 0.344917
segunda_cuarentena    9.117e-01  2.488e+00  3.133e-01   2.910 0.003619 **
uci                  -1.585e-01  8.534e-01  4.788e-02  -3.310 0.000932 ***
pcr                   6.341e-03  1.006e+00  1.738e-03   3.649 0.000263 ***
casos_activos        -3.002e-02  9.704e-01  2.857e-03 -10.506  < 2e-16 ***
casos_sin_sintomas   -6.631e-02  9.358e-01  6.227e-02  -1.065 0.286971

fit5.7 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + aeropuerto + segunda_cuarentena +
                  uci + pcr + casos_activos + casos_sin_sintomas, data = data_fit5)
summary(fit5.7)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -2.771e-01  7.580e-01  1.030e-01  -2.691 0.007129 **
densidad_poblacional -6.834e-05  9.999e-01  2.842e-05  -2.405 0.016174 *
hacinamiento         -5.579e-01  5.724e-01  2.654e-01  -2.102 0.035543 *
capital_provincial   -3.017e-01  7.396e-01  2.624e-01  -1.150 0.250350
aeropuerto           -4.396e-01  6.443e-01  4.359e-01  -1.008 0.313294
segunda_cuarentena    8.397e-01  2.316e+00  2.981e-01   2.816 0.004858 **
uci                  -1.682e-01  8.452e-01  4.565e-02  -3.685 0.000229 ***
pcr                   6.268e-03  1.006e+00  1.731e-03   3.621 0.000294 ***
casos_activos        -2.968e-02  9.708e-01  2.804e-03 -10.585  < 2e-16 ***
casos_sin_sintomas   -6.274e-02  9.392e-01  6.193e-02  -1.013 0.310976

fit5.8 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + segunda_cuarentena + uci + pcr +
                  casos_activos + casos_sin_sintomas, data = data_fit5)
summary(fit5.8)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -3.202e-01  7.260e-01  9.670e-02  -3.311 0.000930 ***
densidad_poblacional -6.153e-05  9.999e-01  2.758e-05  -2.231 0.025674 *
hacinamiento         -5.862e-01  5.564e-01  2.643e-01  -2.218 0.026527 *
capital_provincial   -2.645e-01  7.676e-01  2.602e-01  -1.016 0.309459
segunda_cuarentena    8.268e-01  2.286e+00  2.987e-01   2.768 0.005634 **
uci                  -1.646e-01  8.482e-01  4.541e-02  -3.626 0.000288 ***
pcr                   6.002e-03  1.006e+00  1.695e-03   3.540 0.000400 ***
casos_activos        -2.977e-02  9.707e-01  2.796e-03 -10.646  < 2e-16 ***
casos_sin_sintomas   -6.045e-02  9.413e-01  6.114e-02  -0.989 0.322764

fit5.9 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + segunda_cuarentena + uci + pcr + casos_activos +
                  casos_sin_sintomas, data = data_fit5)
summary(fit5.9)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -3.345e-01  7.157e-01  9.631e-02  -3.473 0.000515 ***
densidad_poblacional -5.649e-05  9.999e-01  2.699e-05  -2.093 0.036305 *
hacinamiento         -5.797e-01  5.601e-01  2.649e-01  -2.188 0.028652 *
segunda_cuarentena    8.248e-01  2.281e+00  2.983e-01   2.765 0.005689 **
uci                  -1.622e-01  8.502e-01  4.517e-02  -3.592 0.000328 ***
pcr                   5.889e-03  1.006e+00  1.691e-03   3.483 0.000496 ***
casos_activos        -2.952e-02  9.709e-01  2.769e-03 -10.661  < 2e-16 ***
casos_sin_sintomas   -5.123e-02  9.501e-01  6.049e-02  -0.847 0.397044

# ********************************************************************************** #
```

```
# casos_nuevos_con_sintomas + numero_cama_uci_r_prom + numero_pcr_r_prom + casos_activos_c_prom +
# casos_nuevos_sin_sintomas_r_prom + casos_fallecidos_c_prom

fit6.1 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas +
                  uci + pcr + casos_activos + casos_sin_sintomas + fallecidos, data = data_fit6)
summary(fit6.1)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.233e-01  7.999e-01  1.465e-01 -1.525 0.127337
densidad_poblacional -7.686e-05  9.999e-01  5.188e-05 -1.482 0.138449
idse                 -4.404e-01  6.438e-01  1.447e+00 -0.304 0.760846
hacinamiento         -7.086e-01  4.923e-01  3.084e-01 -2.298 0.021569 *
inmigrantes          -1.549e-05  1.000e+00  4.027e-05 -0.385 0.700393
capital_regional      1.112e-01  1.118e+00  5.311e-01  0.209 0.834142
capital_provincial   -3.295e-01  7.193e-01  3.050e-01 -1.080 0.280043
indice_ruralidad      9.773e-03  1.010e+00  1.517e-02  0.644 0.519487
aeropuerto           -8.284e-01  4.367e-01  6.519e-01 -1.271 0.203789
puerto               -2.630e-02  9.740e-01  6.722e-01 -0.039 0.968786
segunda_cuarentena    1.060e+00  2.885e+00  3.339e-01  3.173 0.001507 **
casos_con_sintomas    3.668e-02  1.037e+00  4.373e-02  0.839 0.401581
uci                  -1.506e-01  8.602e-01  5.976e-02 -2.520 0.011752 *
pcr                   7.061e-03  1.007e+00  1.879e-03  3.758 0.000172 ***
casos_activos        -3.031e-02  9.701e-01  3.099e-03 -9.780  < 2e-16 ***
casos_sin_sintomas   -5.733e-02  9.443e-01  7.990e-02 -0.718 0.473042
fallecidos            5.578e-03  1.006e+00  4.342e-03  1.285 0.198904

fit6.2 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_regional + capital_provincial +
                  indice_ruralidad + aeropuerto + segunda_cuarentena + casos_con_sintomas +
                  uci + pcr + casos_activos + casos_sin_sintomas + fallecidos, data = data_fit6)
summary(fit6.2)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.231e-01  8.000e-01  1.464e-01 -1.524 0.127418
densidad_poblacional -7.686e-05  9.999e-01  5.188e-05 -1.482 0.138471
idse                 -4.383e-01  6.452e-01  1.446e+00 -0.303 0.761832
hacinamiento         -7.080e-01  4.926e-01  3.080e-01 -2.299 0.021508 *
inmigrantes          -1.536e-05  1.000e+00  4.010e-05 -0.383 0.701806
capital_regional      1.014e-01  1.107e+00  4.693e-01  0.216 0.828906
capital_provincial   -3.296e-01  7.192e-01  3.050e-01 -1.080 0.279927
indice_ruralidad      9.781e-03  1.010e+00  1.517e-02  0.645 0.519142
aeropuerto           -8.411e-01  4.312e-01  5.652e-01 -1.488 0.136733
segunda_cuarentena    1.059e+00  2.884e+00  3.338e-01  3.173 0.001508 **
casos_con_sintomas    3.669e-02  1.037e+00  4.375e-02  0.839 0.401714
uci                  -1.508e-01  8.600e-01  5.951e-02 -2.534 0.011279 *
pcr                   7.057e-03  1.007e+00  1.876e-03  3.762 0.000169 ***
casos_activos        -3.032e-02  9.701e-01  3.093e-03 -9.801  < 2e-16 ***
casos_sin_sintomas   -5.700e-02  9.446e-01  7.946e-02 -0.717 0.473161
fallecidos            5.593e-03  1.006e+00  4.324e-03  1.294 0.195782

fit6.3 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional + idse +
                  hacinamiento + inmigrantes + capital_provincial + indice_ruralidad + aeropuerto +
                  segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos +
                  casos_sin_sintomas + fallecidos, data = data_fit6)
summary(fit6.3)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion            -2.111e-01  8.097e-01  1.343e-01 -1.571 0.116150
densidad_poblacional -7.782e-05  9.999e-01  5.172e-05 -1.505 0.132390
```

```
idse                -4.173e-01  6.588e-01  1.445e+00 -0.289 0.772702
hacinamiento        -7.098e-01  4.917e-01  3.074e-01 -2.309 0.020921 *
inmigrantes         -1.465e-05  1.000e+00  3.993e-05 -0.367 0.713619
capital_provincial  -3.515e-01  7.037e-01  2.875e-01 -1.223 0.221459
indice_ruralidad     9.442e-03  1.009e+00  1.507e-02  0.626 0.531051
aeropuerto          -7.941e-01  4.520e-01  5.211e-01 -1.524 0.127577
segunda_cuarentena   1.058e+00  2.879e+00  3.336e-01  3.170 0.001525 **
casos_con_sintomas   3.669e-02  1.037e+00  4.384e-02  0.837 0.402630
uci                 -1.547e-01  8.567e-01  5.692e-02 -2.717 0.006583 **
pcr                  7.005e-03  1.007e+00  1.861e-03  3.765 0.000167 ***
casos_activos       -3.027e-02  9.702e-01  3.087e-03 -9.808  < 2e-16 ***
casos_sin_sintomas  -5.491e-02  9.466e-01  7.893e-02 -0.696 0.486671
fallecidos           5.555e-03  1.006e+00  4.323e-03  1.285 0.198777

fit6.4 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + inmigrantes + capital_provincial + indice_ruralidad +
                  aeropuerto + segunda_cuarentena + casos_con_sintomas + uci + pcr +
                  casos_activos + casos_sin_sintomas + fallecidos, data = data_fit6)
summary(fit6.4)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -2.171e-01  8.049e-01  1.328e-01 -1.635 0.102033
densidad_poblacional -7.491e-05  9.999e-01  5.081e-05 -1.474 0.140371
hacinamiento        -6.956e-01  4.988e-01  3.035e-01 -2.292 0.021926 *
inmigrantes         -1.901e-05  1.000e+00  3.724e-05 -0.511 0.609589
capital_provincial  -3.561e-01  7.004e-01  2.870e-01 -1.241 0.214709
indice_ruralidad     1.144e-02  1.012e+00  1.340e-02  0.854 0.393064
aeropuerto          -7.880e-01  4.548e-01  5.205e-01 -1.514 0.130020
segunda_cuarentena   1.041e+00  2.832e+00  3.294e-01  3.160 0.001578 **
casos_con_sintomas   4.171e-02  1.043e+00  3.894e-02  1.071 0.284031
uci                 -1.621e-01  8.504e-01  5.087e-02 -3.186 0.001444 **
pcr                  6.949e-03  1.007e+00  1.850e-03  3.755 0.000173 ***
casos_activos       -3.014e-02  9.703e-01  3.047e-03 -9.889  < 2e-16 ***
casos_sin_sintomas  -5.908e-02  9.426e-01  7.726e-02 -0.765 0.444460
fallecidos           5.726e-03  1.006e+00  4.289e-03  1.335 0.181890

fit6.5 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + indice_ruralidad + aeropuerto +
                  segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos +
                  casos_sin_sintomas + fallecidos, data = data_fit6)
summary(fit6.5)
                          coef  exp(coef)   se(coef)      z Pr(>|z|)
poblacion           -2.014e-01  8.176e-01  1.288e-01 -1.563 0.118046
densidad_poblacional -8.375e-05  9.999e-01  4.779e-05 -1.752 0.079721 .
hacinamiento        -6.652e-01  5.142e-01  2.967e-01 -2.242 0.024966 *
capital_provincial  -3.752e-01  6.872e-01  2.852e-01 -1.315 0.188343
indice_ruralidad     1.144e-02  1.012e+00  1.340e-02  0.853 0.393517
aeropuerto          -8.625e-01  4.221e-01  5.002e-01 -1.724 0.084633 .
segunda_cuarentena   9.906e-01  2.693e+00  3.149e-01  3.146 0.001656 **
casos_con_sintomas   4.351e-02  1.044e+00  3.811e-02  1.142 0.253626
uci                 -1.665e-01  8.466e-01  4.999e-02 -3.330 0.000868 ***
pcr                  7.115e-03  1.007e+00  1.821e-03  3.907 9.34e-05 ***
casos_activos       -3.014e-02  9.703e-01  3.042e-03 -9.910  < 2e-16 ***
casos_sin_sintomas  -6.369e-02  9.383e-01  7.667e-02 -0.831 0.406161
fallecidos           6.224e-03  1.006e+00  4.174e-03  1.491 0.135899

fit6.6 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + capital_provincial + indice_ruralidad + aeropuerto +
                  segunda_cuarentena + casos_con_sintomas + uci + pcr + casos_activos +
```

```
                 fallecidos, data = data_fit6)
summary(fit6.6)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -2.139e-01  8.074e-01  1.284e-01  -1.666  0.09564 .
densidad_poblacional -9.477e-05  9.999e-01  4.601e-05  -2.060  0.03942 *
hacinamiento        -7.004e-01  4.964e-01  2.921e-01  -2.398  0.01649 *
capital_provincial  -3.657e-01  6.937e-01  2.846e-01  -1.285  0.19883
indice_ruralidad     7.834e-03  1.008e+00  1.282e-02   0.611  0.54118
aeropuerto          -8.673e-01  4.201e-01  4.992e-01  -1.737  0.08234 .
segunda_cuarentena   9.692e-01  2.636e+00  3.136e-01   3.090  0.00200 **
casos_con_sintomas   3.047e-02  1.031e+00  3.684e-02   0.827  0.40817
uci                 -1.615e-01  8.508e-01  4.941e-02  -3.269  0.00108 **
pcr                  6.099e-03  1.006e+00  1.340e-03   4.552 5.32e-06 ***
casos_activos       -2.964e-02  9.708e-01  2.959e-03 -10.015  < 2e-16 ***
fallecidos           6.460e-03  1.006e+00  4.151e-03   1.556  0.11964

fit6.7 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                 hacinamiento + capital_provincial + aeropuerto + segunda_cuarentena +
                 casos_con_sintomas + uci + pcr + casos_activos + fallecidos, data = data_fit6)
summary(fit6.7)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -2.461e-01  7.818e-01  1.180e-01  -2.085 0.037037 *
densidad_poblacional -1.097e-04  9.999e-01  3.909e-05  -2.807 0.004994 **
hacinamiento        -7.328e-01  4.806e-01  2.883e-01  -2.542 0.011037 *
capital_provincial  -3.857e-01  6.800e-01  2.819e-01  -1.368 0.171217
aeropuerto          -8.486e-01  4.280e-01  4.969e-01  -1.708 0.087695 .
segunda_cuarentena   9.331e-01  2.542e+00  3.073e-01   3.036 0.002395 **
casos_con_sintomas   3.006e-02  1.031e+00  3.684e-02   0.816 0.414484
uci                 -1.633e-01  8.494e-01  4.959e-02  -3.292 0.000995 ***
pcr                  6.173e-03  1.006e+00  1.340e-03   4.608 4.07e-06 ***
casos_activos       -2.983e-02  9.706e-01  2.944e-03 -10.131  < 2e-16 ***
fallecidos           6.234e-03  1.006e+00  4.137e-03   1.507 0.131801

fit6.8 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                 hacinamiento + capital_provincial + aeropuerto + segunda_cuarentena + uci +
                 pcr + casos_activos + fallecidos, data = data_fit6)
summary(fit6.8)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -2.498e-01  7.789e-01  1.177e-01  -2.122  0.03380 *
densidad_poblacional -1.079e-04  9.999e-01  3.876e-05  -2.784  0.00536 **
hacinamiento        -7.453e-01  4.746e-01  2.871e-01  -2.596  0.00943 **
capital_provincial  -3.934e-01  6.747e-01  2.817e-01  -1.396  0.16259
aeropuerto          -8.535e-01  4.259e-01  4.963e-01  -1.720  0.08551 .
segunda_cuarentena   9.251e-01  2.522e+00  3.069e-01   3.014  0.00258 **
uci                 -1.532e-01  8.580e-01  4.823e-02  -3.175  0.00150 **
pcr                  6.619e-03  1.007e+00  1.232e-03   5.374 7.69e-08 ***
casos_activos       -2.958e-02  9.709e-01  2.931e-03 -10.092  < 2e-16 ***
fallecidos           5.614e-03  1.006e+00  4.040e-03   1.390  0.16459

fit6.9 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                 hacinamiento + aeropuerto + segunda_cuarentena + uci + pcr + casos_activos +
                 fallecidos, data = data_fit6)
summary(fit6.9)
                          coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion           -2.931e-01  7.459e-01  1.158e-01  -2.531  0.01136 *
densidad_poblacional -9.128e-05  9.999e-01  3.673e-05  -2.485  0.01294 *
hacinamiento        -7.045e-01  4.943e-01  2.882e-01  -2.445  0.01450 *
aeropuerto          -7.537e-01  4.706e-01  4.904e-01  -1.537  0.12429
```

```
segunda_cuarentena    8.902e-01  2.436e+00  3.050e-01   2.919  0.00351 **
uci                  -1.479e-01  8.625e-01  4.783e-02  -3.093  0.00198 **
pcr                   6.547e-03  1.007e+00  1.225e-03   5.342 9.18e-08 ***
casos_activos        -2.933e-02  9.711e-01  2.903e-03 -10.101  < 2e-16 ***
fallecidos            4.228e-03  1.004e+00  3.957e-03   1.069  0.28529

fit6.10 <- coxph(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion + densidad_poblacional +
                  hacinamiento + segunda_cuarentena + uci + pcr + casos_activos + fallecidos,
                  data = data_fit6)
summary(fit6.10)
                           coef  exp(coef)   se(coef)       z Pr(>|z|)
poblacion            -3.554e-01  7.009e-01  1.138e-01  -3.124  0.00179 **
densidad_poblacional -7.747e-05  9.999e-01  3.529e-05  -2.195  0.02815 *
hacinamiento         -7.245e-01  4.846e-01  2.890e-01  -2.507  0.01218 *
segunda_cuarentena    8.703e-01  2.388e+00  3.058e-01   2.846  0.00443 **
uci                  -1.444e-01  8.655e-01  4.769e-02  -3.029  0.00245 **
pcr                   6.162e-03  1.006e+00  1.209e-03   5.097 3.45e-07 ***
casos_activos        -2.958e-02  9.709e-01  2.894e-03 -10.221  < 2e-16 ***
fallecidos            3.765e-03  1.004e+00  3.906e-03   0.964  0.33508
```

6.3 Weibull model with time-dependent covariates

```
# casos_nuevos_con_sintomas

fit_flex_1.1 <- flexsurvreg(Surv(tiempo1, tiempo2, fim_cuarentena) ~ poblacion +
                                  densidad_poblacional1 + inmigrantes1 + hacinamiento + idse +
                                  capital_regional + capital_provincial + indice_ruralidad +
                                  aeropuerto + puerto + segunda_cuarentena + casos_con_sintomas,
                                  data = data, dist = "weibull", method = "Nelder-Mead")
fit_flex_1.1$res; select_variable(fit_flex_1.1$res)

                              est          L95%          U95%           se
shape                  2.08178259  1.801081602  2.4062311924  0.153839299
scale                 18.35472451  4.815854351 69.9555856867 12.529891350
poblacion              0.10509754  0.008979772  0.2012153122  0.049040580
densidad_poblacional1  0.20164705 -0.514687747  0.9179818402  0.365483651
inmigrantes1           0.89097924  0.215198562  1.5667599099  0.344792394
hacinamiento           0.47283775  0.258068791  0.6876067054  0.109578012
idse                  -0.52376260 -1.526737248  0.4792120399  0.511731160
capital_regional       0.09976484 -0.383314907  0.5828445918  0.246473789
capital_provincial     0.08847039 -0.142874881  0.3198156703  0.118035473
indice_ruralidad      -0.01149228 -0.022824060 -0.0001605059  0.005781625
aeropuerto             0.14442508 -0.342003422  0.6308535763  0.248182366
puerto                 0.12434725 -0.449248514  0.6979430092  0.292656276
segunda_cuarentena    -0.43346911 -0.705801686 -0.1611365306  0.138947746
casos_con_sintomas     0.05911250  0.034318488  0.0839065042  0.012650237

[1] "densidad_poblacional1"
```

6.4 Joint model

```
joint_fit_uci <- mjoint(formLongFixed = log_uci ~ tiempo,
                      formLongRandom = ~ tiempo | id,
                      formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                      idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                      indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                      data = long_data, survData = short_data, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
               Value Std.Err z-value p-value
(Intercept)_1 1.6969  0.0641 26.4597 <0.0001
tiempo_1      0.1037  0.1457  0.7119  0.4765

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.2682  0.1215 -2.2076  0.0273
densidad_poblacional  0.0000  0.0000 -0.9435  0.3454
idse                  3.4846  1.3247  2.6306  0.0085
hacinamiento         -0.3409  0.2667 -1.2780  0.2012
inmigrantes          -0.0001  0.0000 -2.3787  0.0174
capital_regional     -0.4102  0.4605 -0.8907  0.3731
capital_provincial   -0.5669  0.3095 -1.8316  0.0670
indice_ruralidad      0.0229  0.0134  1.7134  0.0866
aeropuerto           -0.2780  0.7486 -0.3713  0.7104
puerto               -0.2723  0.7277 -0.3742  0.7083
segunda_cuarentena    0.6021  0.5504  1.0938  0.2740
gamma_1              -1.4187  0.2422 -5.8587 <0.0001
```

```
joint_fit_activos <- mjoint(formLongFixed = log_casos_activos ~ tiempo,
                      formLongRandom = ~ tiempo | id,
                      formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                      idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                      indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                      data = long, survData = short, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
                Value Std.Err z-value p-value
(Intercept)_1  5.1688  0.1499 34.4726 <0.0001
tiempo_1      -1.5093  0.2516 -5.9977 <0.0001

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.3394  0.1424 -2.3838  0.0171
densidad_poblacional  0.0000  0.0001 -0.8285  0.4074
idse                  1.3202  1.3650  0.9672  0.3335
hacinamiento         -0.9533  0.2981 -3.1981  0.0014
inmigrantes          -0.0001  0.0000 -1.7407  0.0817
capital_regional      0.5102  0.7719  0.6611  0.5086
capital_provincial   -0.2827  0.3415 -0.8279  0.4077
indice_ruralidad      0.0312  0.0196  1.5924  0.1113
aeropuerto           -0.2108  0.7740 -0.2723  0.7854
puerto               -0.5759  0.7418 -0.7764  0.4375
segunda_cuarentena    0.6480  0.4437  1.4605  0.1441
gamma_1              -0.9160  0.1343 -6.8213 <0.0001
```

```
joint_fit_fallecidos <- mjoint(formLongFixed = log_fallecidos ~ tiempo,
                      formLongRandom = ~ tiempo | id,
                      formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                      idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                      indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                      data = long, survData = short, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
               Value Std.Err z-value p-value
(Intercept)_1 1.7704  1.7254  1.0260  0.3049
tiempo_1      5.6961  4.0659  1.4009  0.1612

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.3821  0.1458 -2.6201  0.0088
densidad_poblacional  0.0000  0.0001 -0.3867  0.6990
idse                  1.0333  1.5246  0.6778  0.4979
hacinamiento         -0.7941  0.3494 -2.2730  0.0230
inmigrantes          -0.0001  0.0000 -2.8513  0.0044
capital_regional      0.7685  0.7215  1.0651  0.2868
capital_provincial   -0.3777  0.3281 -1.1511  0.2497
indice_ruralidad      0.0440  0.0195  2.2524  0.0243
aeropuerto           -0.5196  0.9067 -0.5731  0.5666
puerto               -0.8269  0.6790 -1.2179  0.2233
segunda_cuarentena    1.2969  0.4909  2.6416  0.0083
gamma_1               0.1047  0.0990  1.0578  0.2901
```

```
joint_fit_positivity <- mjoint(formLongFixed = log_positividad ~ tiempo,
                      formLongRandom = ~ tiempo | id,
                      formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                      idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                      indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                      data = long, survData = short, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
                Value Std.Err  z-value p-value
(Intercept)_1 -1.7167  0.0798 -21.5236 <0.0001
tiempo_1      -2.4098  0.1792 -13.4461 <0.0001

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.2143  0.1432 -1.4968  0.1344
densidad_poblacional  0.0000  0.0001 -0.1718  0.8636
idse                  1.4925  1.4622  1.0207  0.3074
hacinamiento         -0.4801  0.3182 -1.5089  0.1313
inmigrantes           0.0000  0.0000 -0.9844  0.3249
capital_regional      0.5767  0.7156  0.8059  0.4203
capital_provincial   -0.1855  0.3424 -0.5417  0.5881
indice_ruralidad      0.0295  0.0169  1.7423  0.0815
aeropuerto           -0.4073  0.7605 -0.5356  0.5923
puerto               -0.5569  0.7054 -0.7894  0.4299
segunda_cuarentena    0.6776  0.4525  1.4976  0.1342
gamma_1              -1.4922  0.2890 -5.1636 <0.0001
```

```
joint_fit_uci_activos <- mjoint(formLongFixed = list("uci" = log_uci ~ tiempo,
                                              "casos_activos" = log_casos_activos ~ tiempo),
                        formLongRandom = list("uci" = ~ tiempo | id,
                                              "casos_activos" = ~ tiempo | id),
                        formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                        idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                        indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                        data = long, survData = short, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
                Value Std.Err z-value p-value
(Intercept)_1  1.7329  0.0737 23.5186 <0.0001
tiempo_1      -0.0483  0.1975 -0.2447  0.8067
(Intercept)_2  5.3207  0.1457 36.5082 <0.0001
tiempo_2      -2.8022  0.4317 -6.4908 <0.0001

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.3181  0.1616 -1.9679  0.0491
densidad_poblacional  0.0000  0.0001 -0.5436  0.5867
idse                  2.5705  1.4969  1.7172  0.0859
hacinamiento         -0.5534  0.3549 -1.5593  0.1189
inmigrantes          -0.0001  0.0000 -1.3001  0.1936
capital_regional     -0.1198  0.5585 -0.2144  0.8302
capital_provincial   -0.3903  0.3797 -1.0280  0.3040
indice_ruralidad      0.0270  0.0172  1.5721  0.1159
aeropuerto           -0.2620  0.8807 -0.2975  0.7661
puerto               -0.3832  0.7607 -0.5038  0.6144
segunda_cuarentena    0.7010  0.5721  1.2252  0.2205
gamma_1              -1.1469  0.3303 -3.4729  0.0005
gamma_2              -0.9376  0.2102 -4.4597 <0.0001
```

```
joint_fit_positividad_uci <- mjoint(formLongFixed = list("uci" = log_uci ~ tiempo,
                                             "positividad" = log_positividad ~ tiempo),
                        formLongRandom = list("uci" = ~ tiempo | id,
                                              "positividad" = ~ tiempo | id),
                        formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                        idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                        indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                        data = long, survData = short, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
                Value Std.Err  z-value p-value
(Intercept)_1  1.8143  0.0759  23.9123 <0.0001
tiempo_1      -0.2299  0.1983  -1.1595  0.2462
(Intercept)_2 -1.7416  0.0949 -18.3524 <0.0001
tiempo_2      -2.2260  0.2132 -10.4408 <0.0001

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.2168  0.1437 -1.5083  0.1315
densidad_poblacional  0.0000  0.0001 -0.0842  0.9329
idse                  2.0876  1.6572  1.2597  0.2078
hacinamiento         -0.3770  0.3569 -1.0563  0.2908
inmigrantes           0.0000  0.0000 -0.9588  0.3377
capital_regional      0.3000  0.6854  0.4377  0.6616
capital_provincial   -0.2741  0.3467 -0.7908  0.4291
indice_ruralidad      0.0293  0.0167  1.7572  0.0789
aeropuerto           -0.3950  0.7856 -0.5028  0.6151
puerto               -0.5032  0.7441 -0.6762  0.4989
segunda_cuarentena    0.7118  0.5070  1.4038  0.1604
gamma_1              -0.5586  0.5231 -1.0679  0.2856
gamma_2              -1.1476  0.4693 -2.4455  0.0145
```

```
joint_fit_positividad_activos <- mjoint(formLongFixed = list("casos_activos" = log_casos_activos ~
                                             tiempo, "positividad" = log_positividad ~ tiempo),
                        formLongRandom = list("casos_activos" = ~ tiempo | id,
                                              "positividad" = ~ tiempo | id),
                        formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                        idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                        indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                        data = long, survData = short, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
                Value Std.Err  z-value p-value
(Intercept)_1  5.3950  0.1463  36.8716 <0.0001
tiempo_1      -2.3582  0.2859  -8.2475 <0.0001
(Intercept)_2 -1.6976  0.0813 -20.8699 <0.0001
tiempo_2      -2.6421  0.1844 -14.3294 <0.0001

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.2142  0.1671 -1.2819  0.1999
densidad_poblacional  0.0000  0.0001  0.2131  0.8312
idse                  0.5149  1.7819  0.2889  0.7726
hacinamiento         -0.6914  0.3471 -1.9919  0.0464
inmigrantes           0.0000  0.0000 -0.5711  0.5680
capital_regional      0.6265  0.7323  0.8555  0.3923
capital_provincial   -0.1363  0.3795 -0.3591  0.7195
indice_ruralidad      0.0330  0.0193  1.7105  0.0872
aeropuerto           -0.3760  1.1364 -0.3309  0.7407
puerto               -0.6786  0.7092 -0.9569  0.3386
segunda_cuarentena    0.8124  0.5168  1.5720  0.1159
gamma_1              -0.7985  0.1798 -4.4424 <0.0001
gamma_2              -1.5145  0.3129 -4.8406 <0.0001
```

```
joint_fit_posi_activos_uci <- mjoint(formLongFixed = list("casos_activos" = log_casos_activos ~ tiempo,
                                            "uci" = log_uci ~ tiempo,
                                            "positividad" = log_positividad ~ tiempo),
                        formLongRandom = list("casos_activos" = ~ tiempo | id,
                                             "uci" = ~ tiempo | id,
                                             "positividad" = ~ tiempo | id),
                        formSurv = Surv(tiempo3, fim_cuarentena) ~ poblacion + densidad_poblacional +
                        idse + hacinamiento + inmigrantes + capital_regional + capital_provincial +
                        indice_ruralidad + aeropuerto + puerto + segunda_cuarentena,
                        data = long, survData = short, timeVar = "tiempo", verbose = F)

Longitudinal sub-model:
                Value Std.Err  z-value p-value
(Intercept)_1  5.3950  0.1463  36.8716 <0.0001
tiempo_1      -2.3582  0.2859  -8.2475 <0.0001
(Intercept)_2 -1.6976  0.0813 -20.8699 <0.0001
tiempo_2      -2.6421  0.1844 -14.3294 <0.0001

Time-to-event sub-model:
                       Value Std.Err z-value p-value
poblacion            -0.2142  0.1671 -1.2819  0.1999
densidad_poblacional  0.0000  0.0001  0.2131  0.8312
idse                  0.5149  1.7819  0.2889  0.7726
hacinamiento         -0.6914  0.3471 -1.9919  0.0464
inmigrantes           0.0000  0.0000 -0.5711  0.5680
capital_regional      0.6265  0.7323  0.8555  0.3923
capital_provincial   -0.1363  0.3795 -0.3591  0.7195
indice_ruralidad      0.0330  0.0193  1.7105  0.0872
aeropuerto           -0.3760  1.1364 -0.3309  0.7407
puerto               -0.6786  0.7092 -0.9569  0.3386
segunda_cuarentena    0.8124  0.5168  1.5720  0.1159
gamma_1              -0.7985  0.1798 -4.4424 <0.0001
gamma_2              -1.5145  0.3129 -4.8406 <0.0001

# Variable selection
# joint_fit_positividad_activos1 = joint_fit_positividad_activos - densidad_poblacional (p-value = 0.83)
# joint_fit_positividad_activos2 = joint_fit_positividad_activos1 - idse (p-value = 0.80)
# joint_fit_positividad_activos3 = joint_fit_positividad_activos2 - aeropuerto (p-value = 0.73)
# joint_fit_positividad_activos4 = joint_fit_positividad_activos3 - capital_provincial (p-value = 0.64)
# joint_fit_positividad_activos5 = joint_fit_positividad_activos4 - inmigrantes (p-value = 0.53)
# joint_fit_positividad_activos6 = joint_fit_positividad_activos5 - capital_regional (p-value = 0.37)
# joint_fit_positividad_activos7 = joint_fit_positividad_activos6 - puerto (p-value = 0.49)
# joint_fit_positividad_activos8 = joint_fit_positividad_activos7 - segunda_cuarentena (p-value = 0.11)
# joint_fit_positividad_activos9 = joint_fit_positividad_activos8 - poblacion (p-value = 0.12)
```

References

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