9 April, 2020

Context indicators for the COVID-19 pandemic in Portugal

COVID-19: a statistical view integrating territory and demography

The current pandemic crisis COVID-19 has attracted unparalleled attention at a wide range of levels, media, academic communities, citizens in general and naturally public policy authorities. The information being disseminated by the Directorate-General of Health, in conditions never before experienced, has been fundamental in this context in Portugal. Statistics Portugal welcomes this public service.

Integrating this information with the data produced by Statistics Portugal on demographic dynamics, Statistics Portugal seeks to present in this press release an analytical perspective on the phenomenon by focusing on its spatial analysis.

Despite the progressive spread of the pandemic throughout the country, its impact has been particularly intense in relative terms (taking into account indicators of size and population density per km^2) in municipalities in the Metropolitan Area of Porto. Additionally, the following results stand out:

- The number of deaths in March 2020 was higher than the figure observed for the same period in 2019, but lower than in 2018. In this context, 27 municipalities that registered more than 150 deaths per 100 deaths in comparison to the same reference period (average number of deaths in March 2018 and 2019) should be highlighted.
- On April 7, 2020, in Portugal, for every 10,000 inhabitants there were 12.8 confirmed cases of COVID-19. The number of confirmed cases of COVID-19 disease per 10 thousand inhabitants was above the national value in 34 municipalities and of this group, 23 belonged to the Norte region.
- The analysis of the relationship between the number of confirmed cases per 10 thousand inhabitants and the proportion of the resident population aged 65 and over highlights a set of 13 municipalities with values above the national average in both indicators.

The first cases diagnosed with COVID-19 in Portugal were reported on March 2nd 2020 and the first death as a result of COVID-19 was recorded on March 16th 2020. The WHO (World Health Organization) declared the outbreak of COVID-19 as a pandemic on March 11th 2020.

This press release includes results for the national context on the general deaths (all causes of death) that have occurred in national territory since March 1, 2020. The incidence of the pandemic in the territory has not been homogeneous, which justifies the analysis of context indicators, when possible, at NUTS 3 (Metropolitan Areas and Intermunicipal Communities in Portugal mainland, and Autonomous Regions) and municipality level.

www.ine.pt | Communication Unit - Tel: +351 21.842.61.00 - sci@ine.pt

Data on deaths are based on compulsory civil registration information (death) collected under the *Sistema Integrado do Registo e Identificação Civil* (SIRIC). Data was collected for the entire last month of March, on April 6. The information is preliminary and will be subject to periodic updating.

The number of confirmed cases with COVID-19 is based on the information released for the entire country and by municipality in the 'Daily COVID-19 Status Report' edited by the Directorate-General of Health. This press release includes information available up to April 8 (data of the situation up to April 7).

Data on resident population are based on the preliminary results of the Annual estimates of resident population, referenced to December 31, 2019.

Statistics Portugal will also continue publishing monthly information on live births, deaths and marriages in the usual timetable and format, on its website.

General Perspective

Number of deaths in March 2020 higher than in the same period in 2019 but lower than in 2018

The preliminary total number of deaths occurred between 1 and 31 March 2020 is, so far, slightly higher (+ 233) than the number of deaths registered in the same period in 2019 and lower by 277 cases than the number registered in the same period in 2018.

Figure 1 - Number of deaths and number of deaths per 100 thousand inhabitants in March, Portugal, 2018-2020

	Number of deaths			Number of deaths per 100 thousand inhabitants		
	2018	2019	2020	2018	2019	2020
Total	10,501	9,991	10,224	102	97.2	99.3
Males	5,252	4,950	5,121	107.9	102	105.5
Females	5,249	5,041	5,103	96.8	92.9	93.8
Under 65 years	1,418	1,390	1,318	17.6	17.3	16.5
65 to 74 years	1,452	1,500	1,457	127.2	129.7	124.3
75 to 84 years	3,050	2,896	2,964	393.9	372.6	378.2
85 years and over	4,581	4,204	4,484	1,539.60	1,354.90	1,379.30

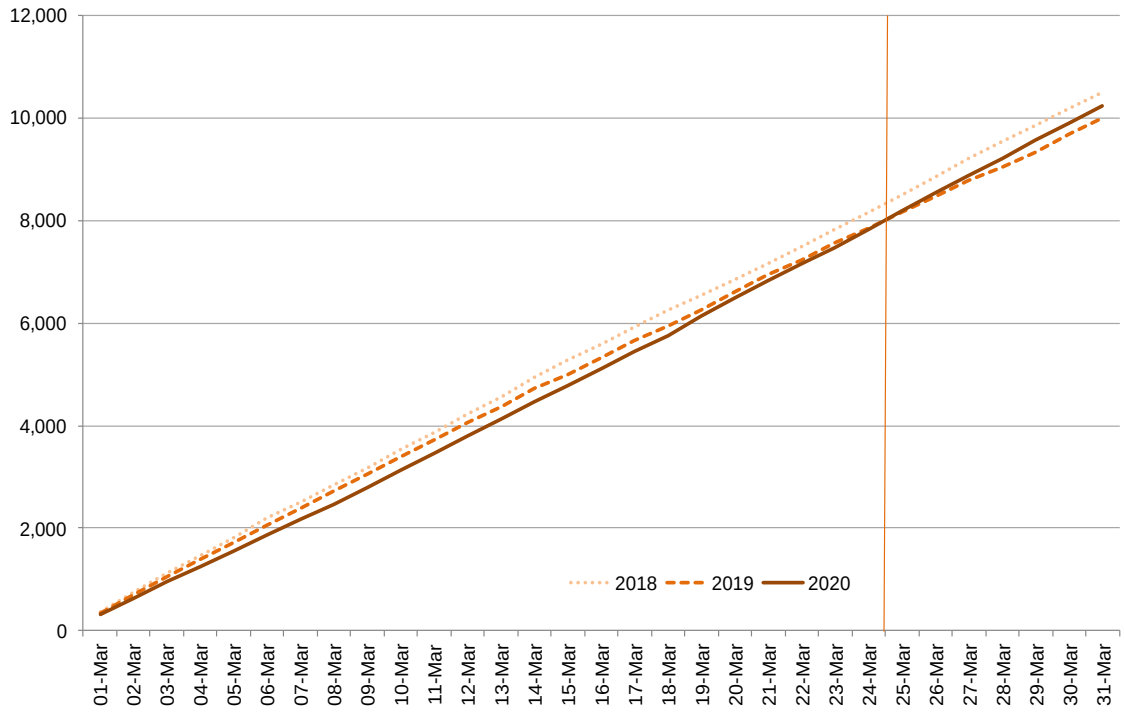
Source: INE, I.P., Statistics on Deaths (Preliminary (2020) and Final Results (2018 and 2019).

Note: The total number of deaths may not correspond to the sum of the partial figures due to the existence of records with unknown age.

The positive variation in relation to 2019 results from the increase of 171 deaths in the male population and 62 in the female. However, and for the same period, the results by age group show an **increase** in the number of deaths at older ages (+ 348 deaths in people aged 75 and over) and a **decrease** in the number of deaths in ages under 75 (- 115 deaths). Naturally, besides the pandemic's direct impact in terms of an increase in the number of deaths, its indirect impact, as a consequence of greater vulnerability associated with other diseases, and collateral impact, as a result of a lower propensity to make use of health services by people with at-risk diseases, it is possible that there will be an opposite signal impact, associated in particular with a decrease in accidents of various kinds, such as those resulting from road accidents. Final scrutiny can only take place when information on causes of death is available.

The following figures show the cumulative number of deaths from the beginning to the end of March in 2020 with the number observed in the corresponding month in 2019 and 2018, for total registered deaths, by gender and age groups. When applicable, a timeline to help identify when the line corresponding to 2020 exceeds the 2019 line is included.

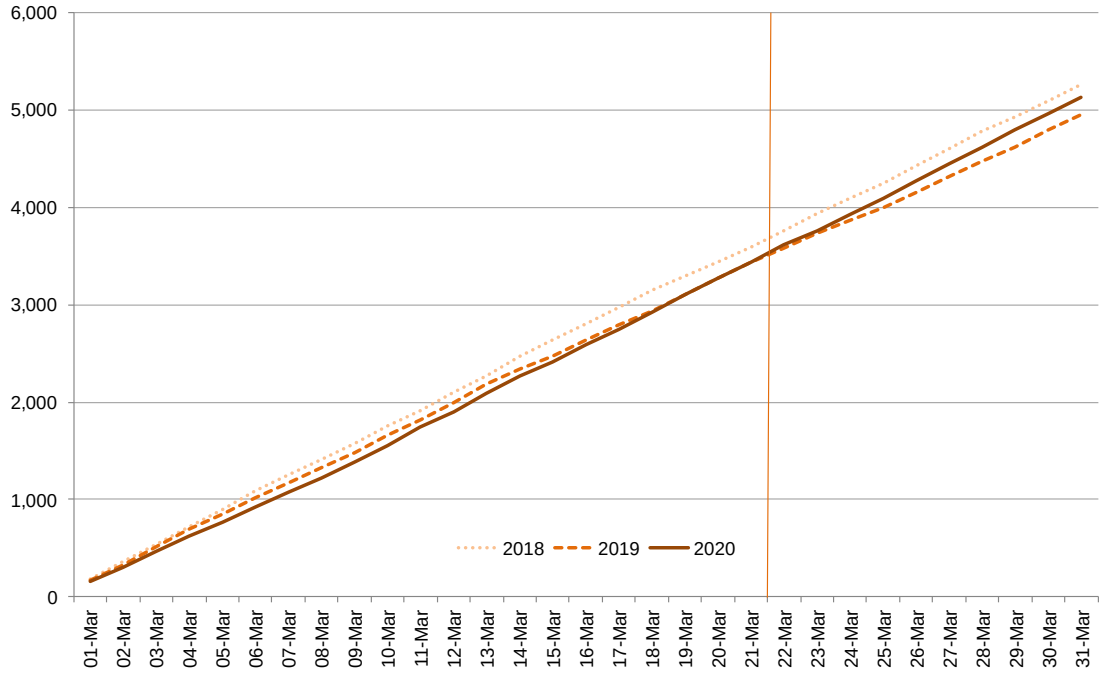
Figure 2 - Cumulative number of deaths in March by day of death, Portugal, 2018-2020



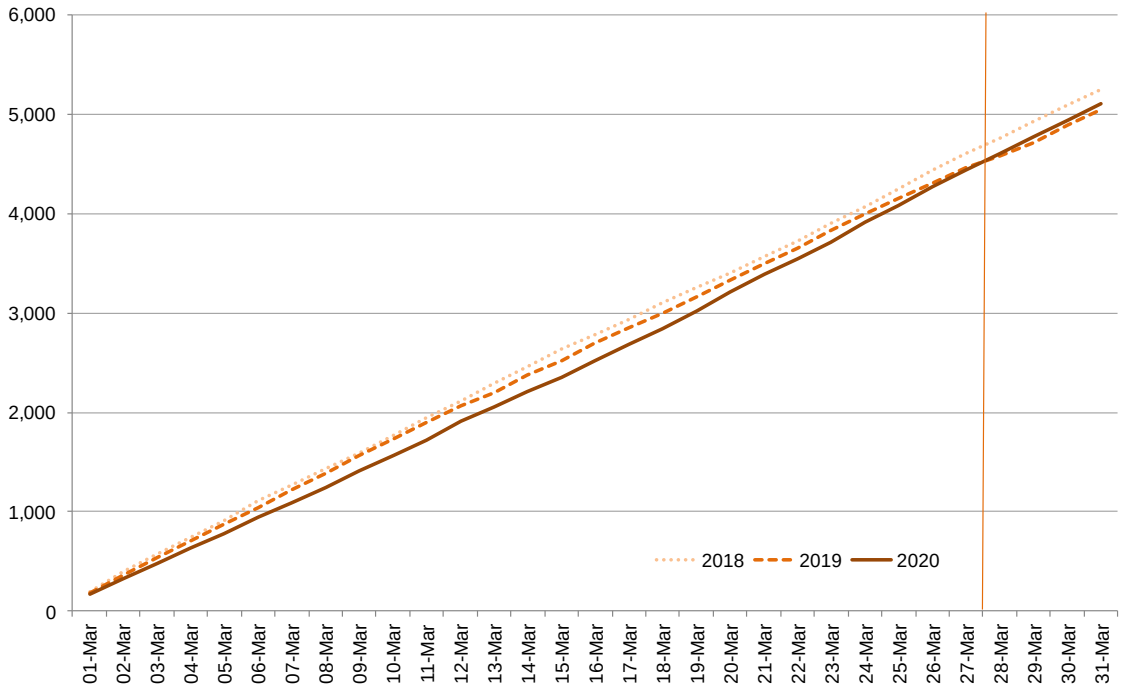
Source: INE, I.P., Statistics on Deaths (Preliminary (2020) and Final Results (2018 and 2019)).

Figure 3 - Cumulative number of deaths in March by day of death and sex, Portugal, 2018-2020

Males



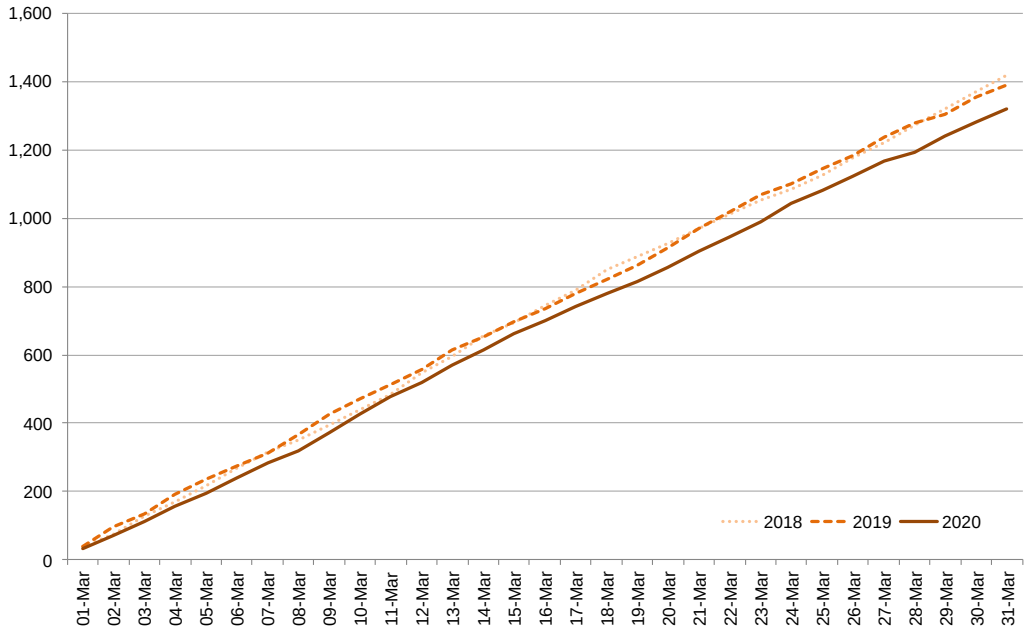
Females



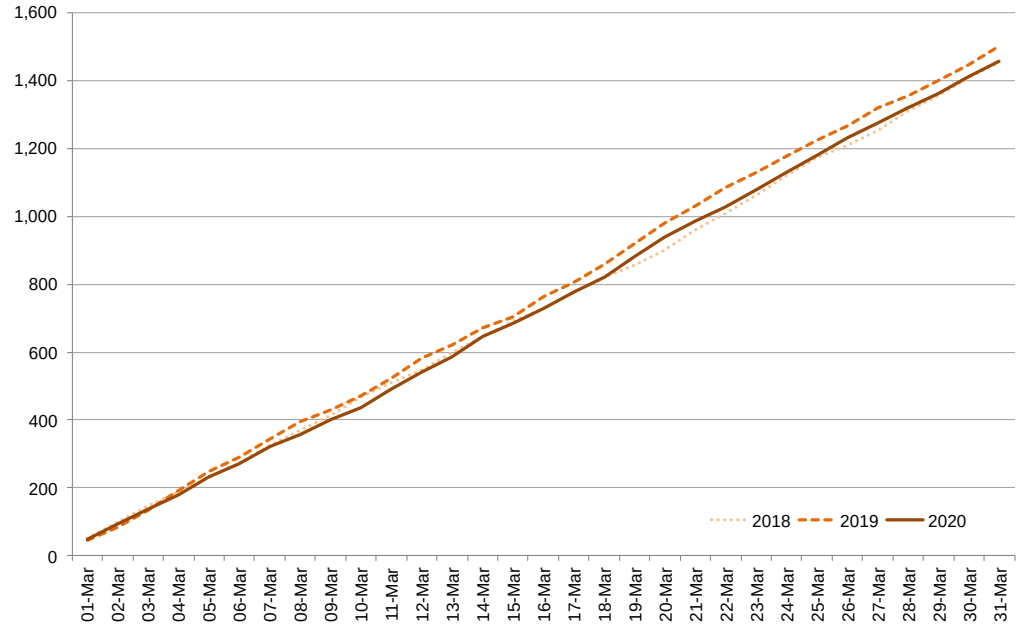
Source: INE, I.P., Statistics on Deaths (Preliminary (2020) and Final Results (2018 and 2019)).

Figure 4 - Cumulative number of deaths in March by day of death and age group, Portugal, 2018-2020

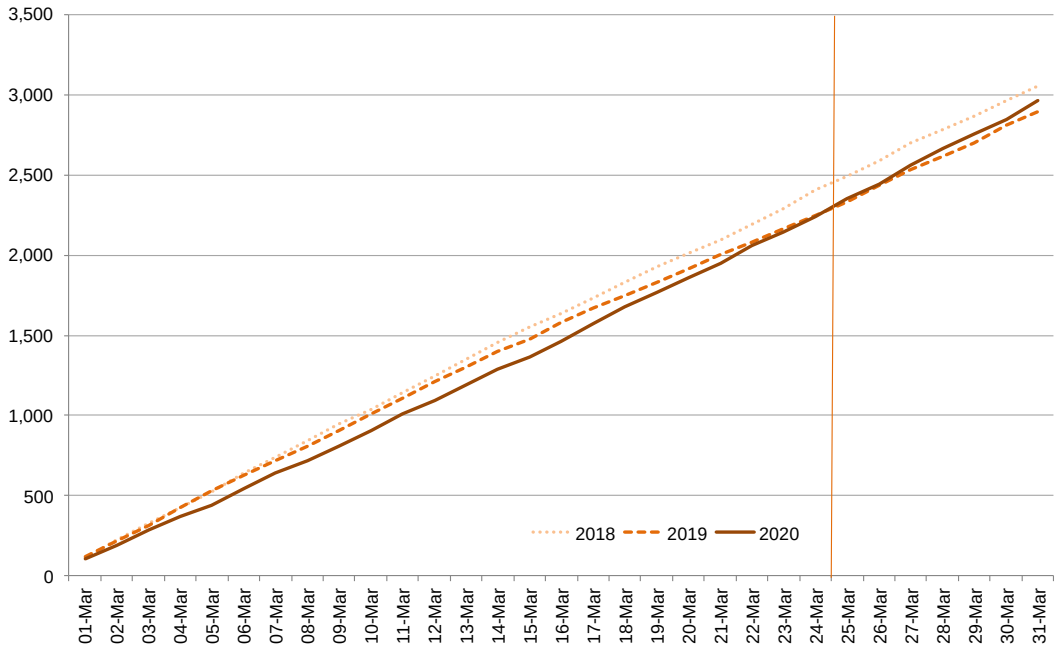
Under 65 years



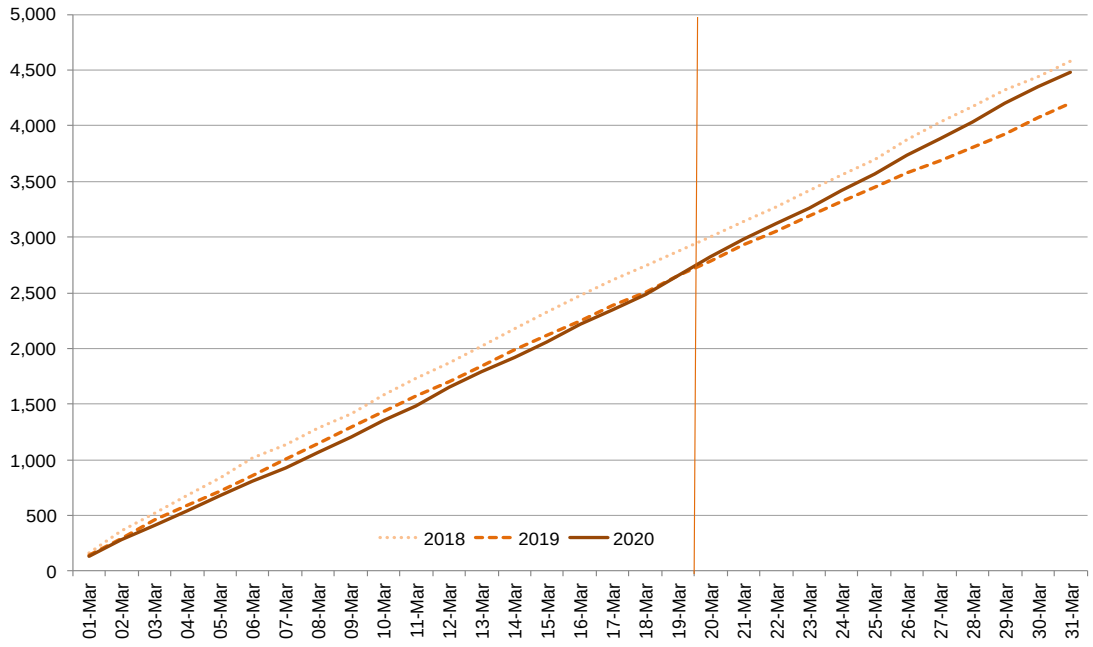
65 to 74 years



75 to 84 years



85 years and over

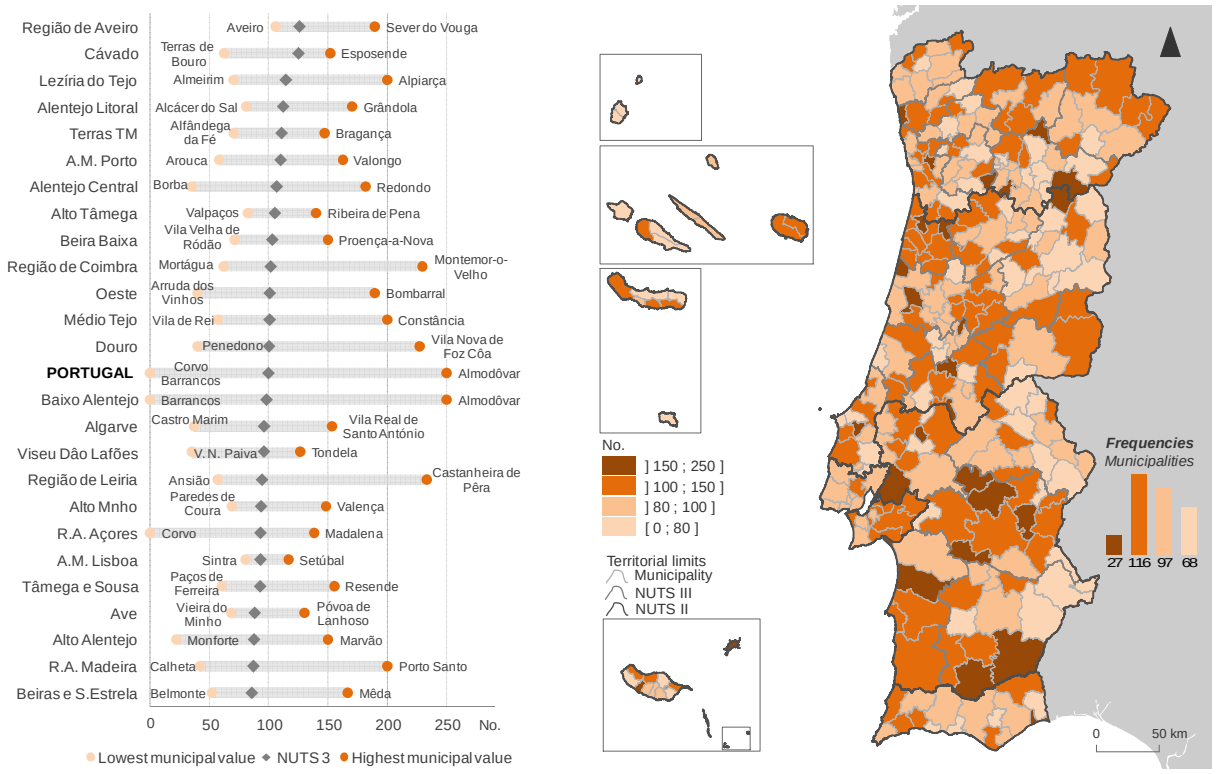


Source: INE, I.P., Statistics on Deaths (Preliminary (2020) and Final Results (2018 and 2019)).

Territorial Perspective

Another viewpoint of analysis of the information is to try to characterize the situation from a territorial perspective. In 143 out of the 308 Portuguese municipalities the number of deaths registered in the month of March 2020 was higher than the corresponding reference value (average number of deaths in March 2018 and 2019). Of this total, 27 municipalities stand out for registering more than 150 deaths per 100 deaths in the same reference period. For the remaining 165 municipalities (54% of the total number of municipalities) the number of deaths registered in the month of March 2020 was lower than the number observed in the reference period [Figure 5].

Figure 5 - Number of deaths in March 2020 per 100 deaths in the same period of reference, Portugal, NUTS 3 and municipality



Source: INE, I.P., Statistics on Deaths (Preliminary (2020) and Final Results (2018 and 2019)).

Figure 6 - Number of confirmed cases per 10 thousand inhabitants on April 7, 2020 and Number of deaths in March 2020 per 100 deaths in the same period of reference, by NUTS 3

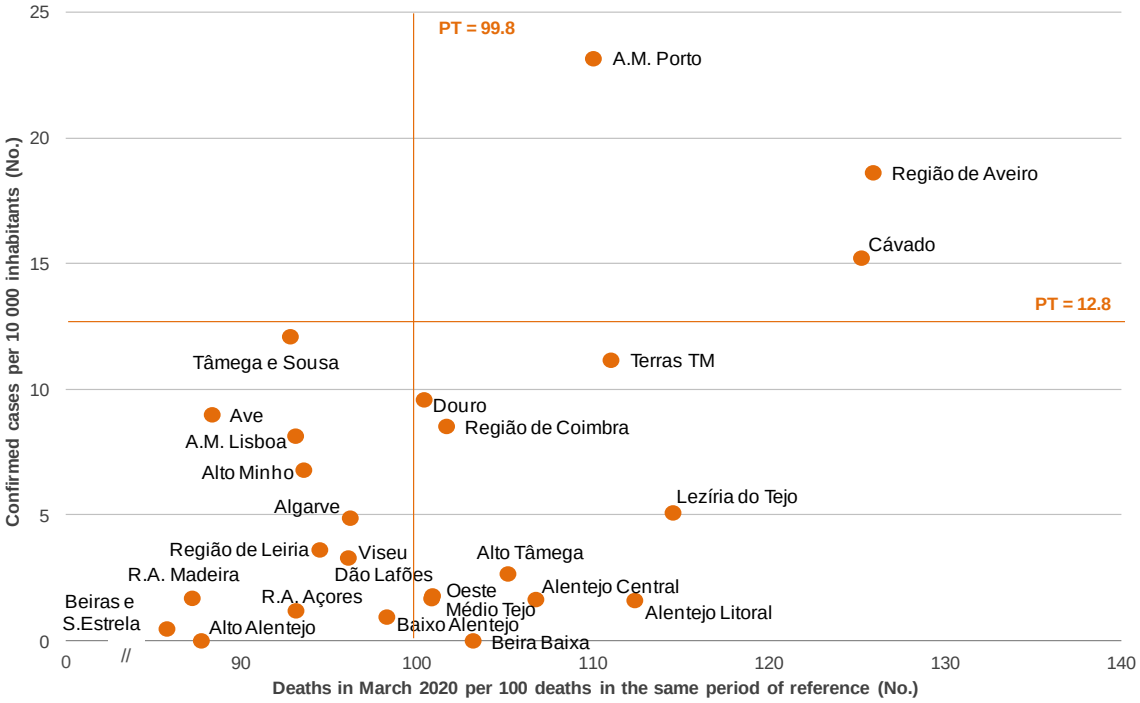
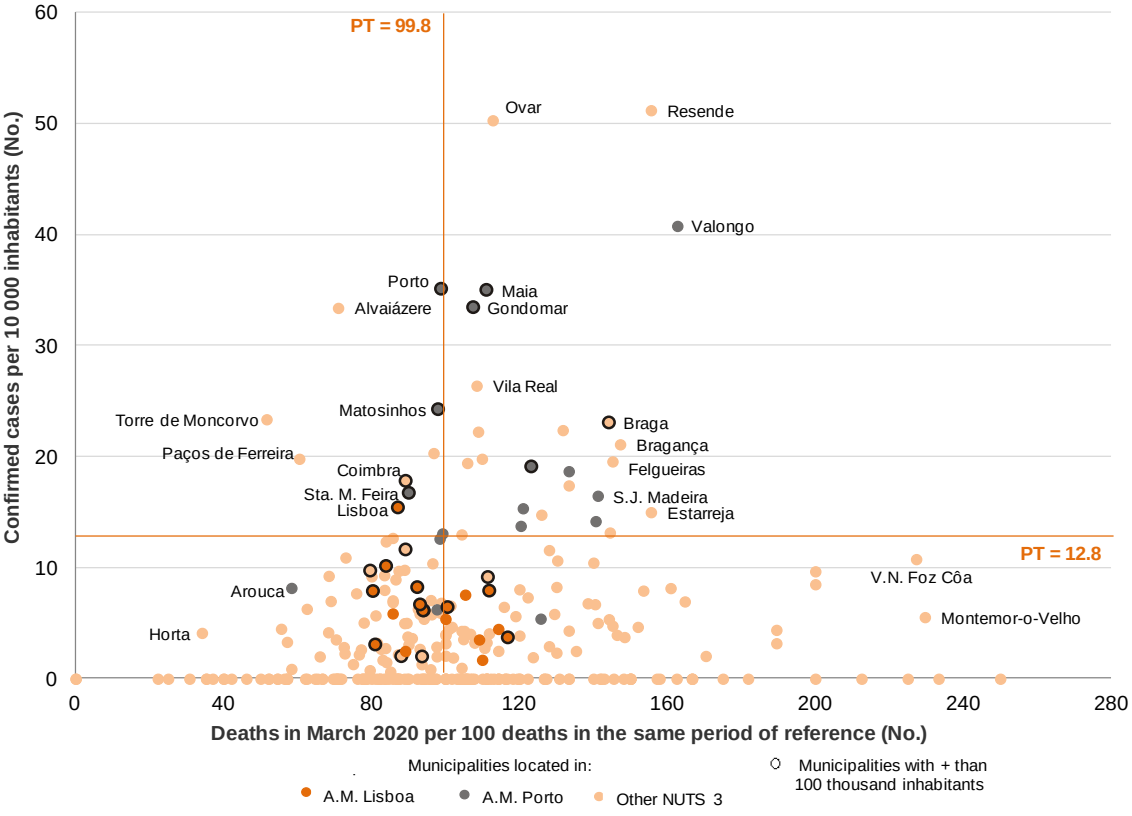


Figure 7 - Number of confirmed cases per 10 thousand inhabitants on April 7, 2020 and Number of deaths in March 2020 per 100 deaths in the same period of reference, by municipality



Source: Directorate-General of Health, Daily COVID-19 Status Report (released on April 8); INE, I.P., Statistics on Deaths (Preliminary (2020) and Final Results (2018 and 2019)).
Note: The year-on-year reference value corresponds to the average number of deaths in March for the years 2018 and 2019 (final results)..

34 municipalities with confirmed cases of COVID-19 disease per 10 thousand inhabitants above the national value

On April 7, 2020, in Portugal, for every 10 thousand inhabitants there were 12.8 confirmed cases of COVID-19. The number of confirmed cases of COVID-19 disease per 10 thousand inhabitants was above the national value in 34 municipalities. In the Norte region, 23 municipalities registered a value above the national average, and a set of contiguous municipalities in the Metropolitan Area of Porto stood out, with more than 25 confirmed cases per 10 thousand inhabitants: Valongo, Porto, Maia and Gondomar. Some municipalities in the Centro (10) and in the Metropolitan Area of Lisboa (the municipality of Lisboa) also scored values above the national value [Figure 8].

Despite this differentiation, the estimated location coefficient[1] for March 25th and 31st and April 7th suggests a trend of decrease in territorial concentration of cases, i.e., a progressive spatial dissemination throughout the country, especially between March 25th and 31st. The localization curves graphically reflect this trend by the progressive approximation to the straight line of equal distribution between the number of confirmed cases and the resident population in the municipalities [Figure 9].

Figure 8 - Number of confirmed cases of COVID-19 disease per 10 thousand inhabitants until April 7 2020, by municipality

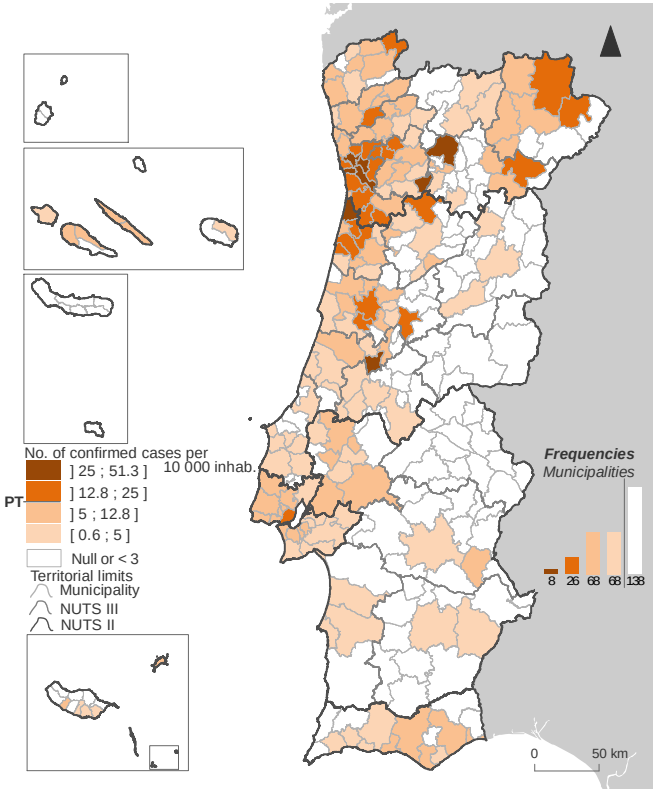
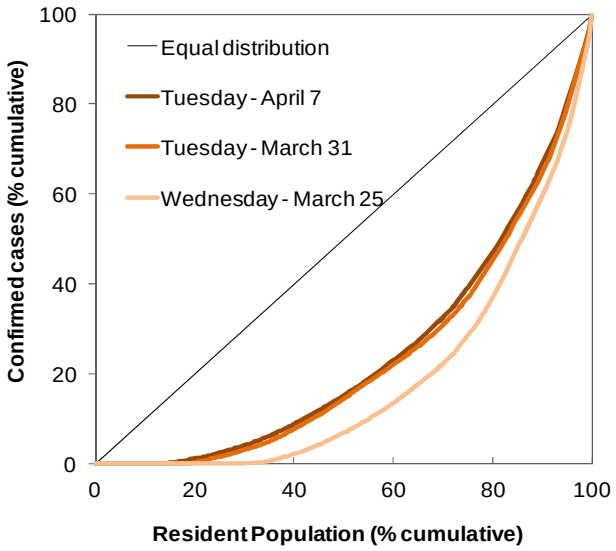


Figure 9 - Territorial concentration of COVID-19 confirmed cases until March 25, until March 31 and until April 7 in relation to the resident population, based on the distribution by municipality

Location Curve



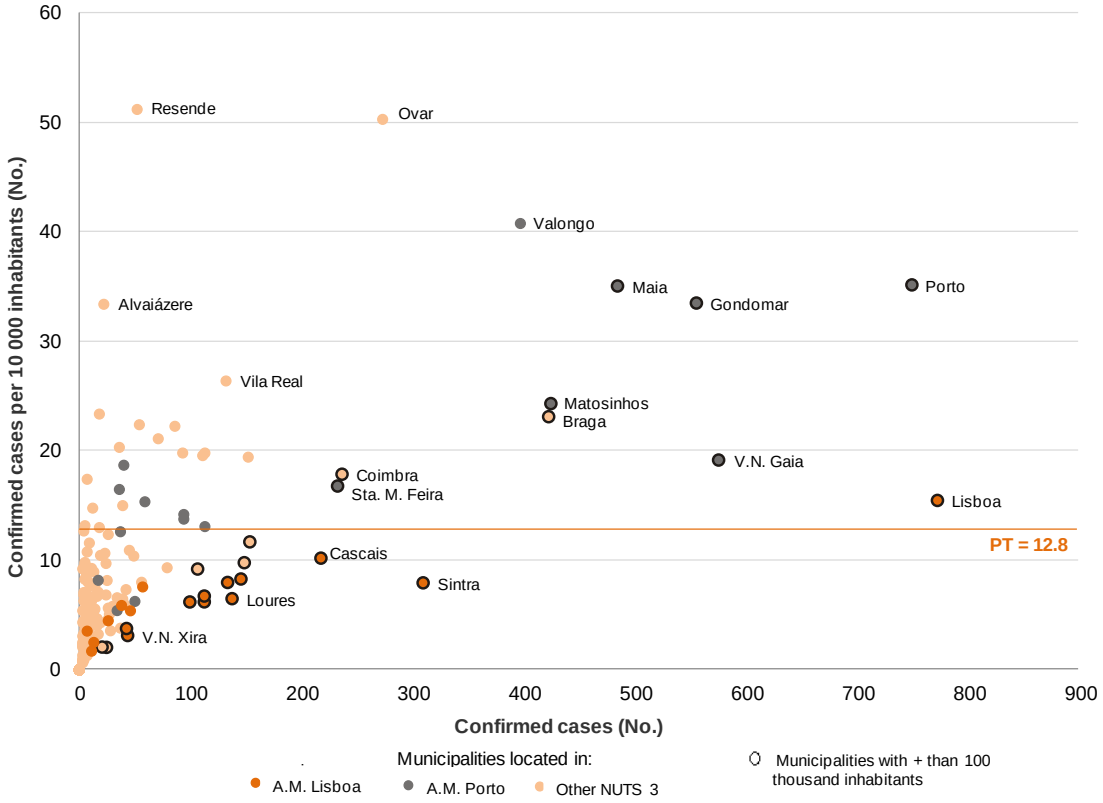
Location coefficient	
Tuesday - April 7	37.7
Tuesday- March 31	39.2
Wednesday - March 25	47.7

Source: Directorate-General of Health, Daily COVID-19 Status Report (released on April 8); INE, I.P., Annual estimates of resident population, 31 December 2019 (Preliminary Results).
Note: For the calculation of the location coefficients zero cases were considered for the municipalities with no value in the Directorate-General of Health report (null or less than 3 cases).

[1] The Location coefficient varies between 0 and 100, with values closer to 100 reflecting greater inequality in the distribution of confirmed cases of COVID-19 against the total resident population.

The following figure presents the 308 Portuguese municipalities in relation to the number of confirmed cases and the number of confirmed cases per 10 thousand inhabitants and highlights the more relative serious situation of a set of four contiguous municipalities in the Metropolitan Area of Porto (Valongo, Porto, Maia and Gondomar), with more than 30 confirmed cases per 10 thousand inhabitants. Two municipalities, Ovar and Resende, with more than 50 cases per 10,000 inhabitants, are also noteworthy.

Figure 10 - Number of confirmed cases per 10 thousand inhabitants and number of confirmed cases on April 7, 2020, by municipality



Source: Directorate-General of Health, Daily COVID-19 Status Report (released on April 8); INE, I.P., Annual estimates of resident population, 31 December 2019 (Preliminary Results).

The following figures illustrate the relationship between population density and the number of confirmed cases per 10 thousand inhabitants for the country's 25 NUTS 3 sub-regions and municipalities. In terms of NUTS 3 sub-regions, the Metropolitan Area of Porto (23.2 confirmed cases per 10 thousand inhabitants), Região de Aveiro (18.6) and Cávado (15.2) stand out as they register both a number of confirmed cases per 10 thousand inhabitants and population density values above the national reference. The most common pattern of cross representation of these indicators shows 16 NUTS 3 sub-regions with a number of confirmed cases per 10 thousand inhabitants and population densities below the national reference. The two metropolitan areas are both characterized by high and close levels of urbanisation intensity, but have, on the other hand, a differentiated incidence of confirmed cases - the Metropolitan Area of Porto with 23.2 confirmed cases per 10 thousand inhabitants and the Metropolitan Area of Lisboa with only 8.1 confirmed cases.

The analysis at municipal level showed that of the 34 municipalities with a number of confirmed cases per 10 thousand inhabitants above the value for Portugal, 26 also had population density values above the national average. From this set of 26 municipalities, the municipalities of Ovar (50.3) in Região de Aveiro and the municipalities of Valongo (40.8), Porto

(35.1), Maia (35.0) and Gondomar (33.5) in the Metropolitan Area of Porto stood out with more than 30 confirmed cases per 10 thousand inhabitants. It should also be noted that 188 of the 308 municipalities in the country had a number of confirmed cases per 10 thousand inhabitants and population density values below the national reference.

Figure 11 - Number of confirmed cases per 10 thousand inhabitants on April 7, 2020 and Population density, by NUTS 3

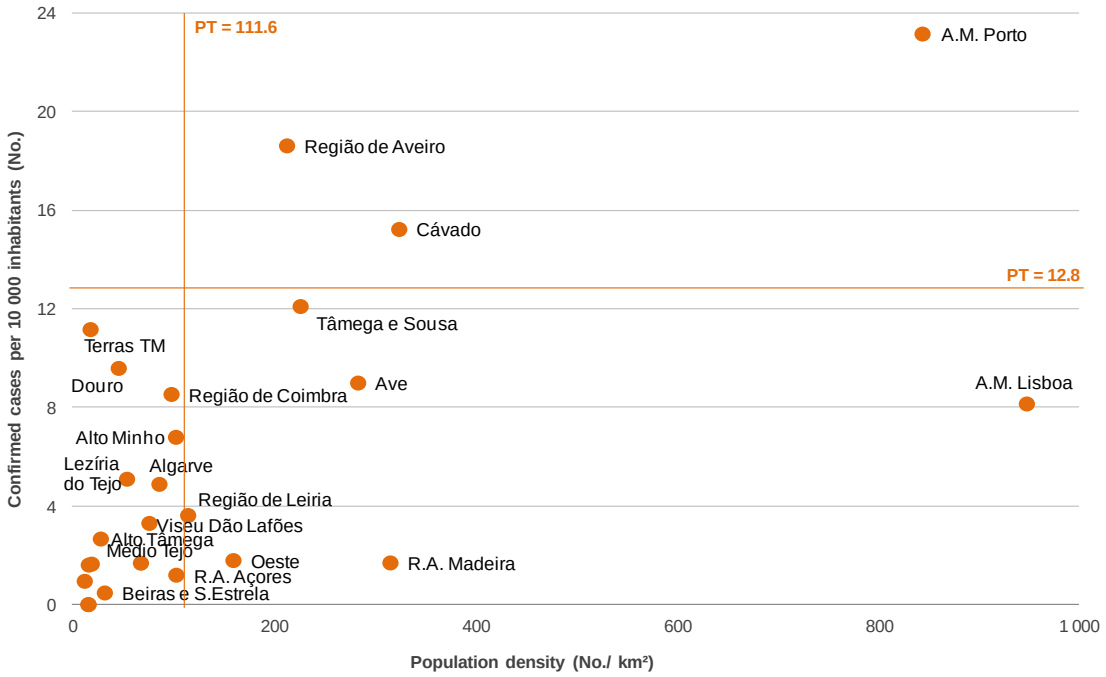
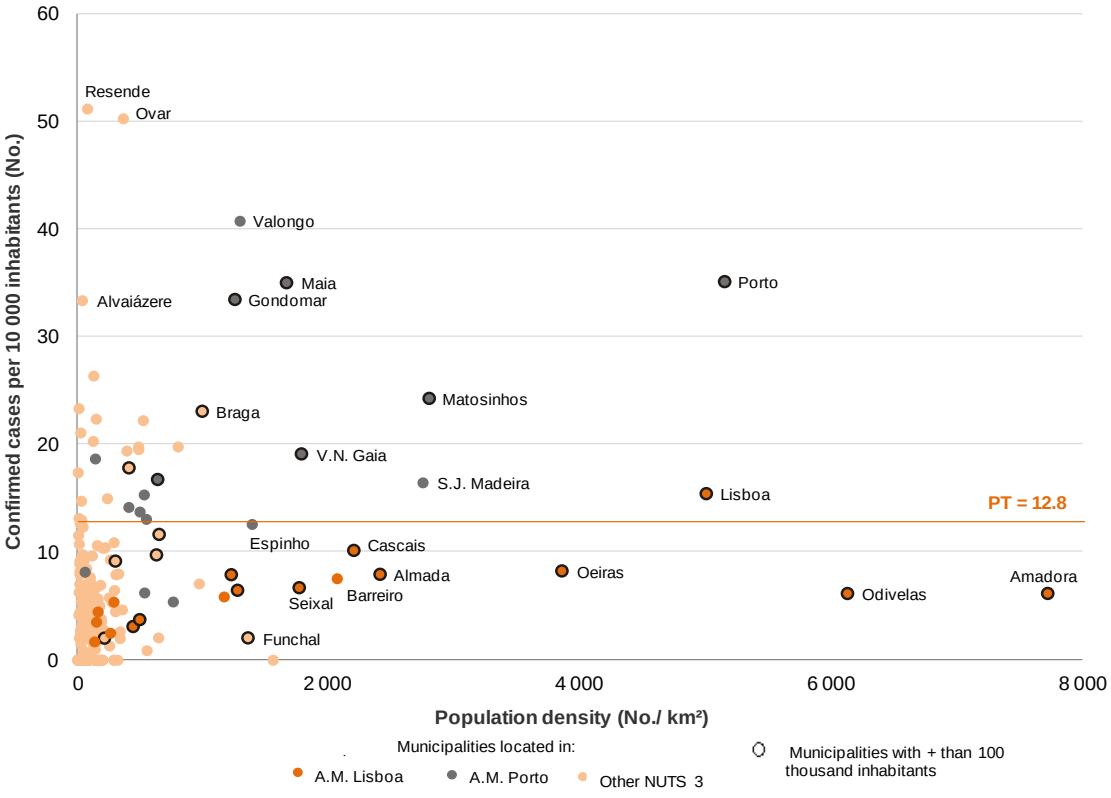


Figure 12 - Number of confirmed cases per 10 thousand inhabitants on April 7, 2020 and Population density, by municipality



Source: Directorate-General of Health, Daily COVID-19 Status Report (released on April 8); INE, I.P., Annual estimates of resident population, 31 December 2019 (Preliminary Results).

The following figures show the relationship between the number of confirmed cases per 10 thousand inhabitants and the proportion of the resident population aged 65 and over. Compared to the national average of 12.8 confirmed cases per 10 thousand inhabitants, the three sub-regions that registered a number of confirmed cases above that threshold - Área Metropolitana do Porto (23.2 cases per 10,000 inhabitants), Região de Aveiro (18.6) and Cávado (15.2) - also presented a less aged population compared to the national average (22.2% of the resident population in 2019 in Portugal was 65 and over). On the other hand, it should be noted that in 15 sub-regions the number of confirmed cases per 10 thousand inhabitants was lower than that recorded for the entire country, but the proportion of the resident population aged 65 and over was higher than the national average.

The analysis at municipality level makes it possible to identify a group of 13 municipalities with values above the national average in relation to the number of confirmed cases per 10 thousand inhabitants and the proportion of the population aged 65 and over. Of this set, the municipalities of Resende, Porto and Alvaiázere stand out for having values above 30 confirmed cases per 10 thousand inhabitants. With values also above the national average in relation to the number of confirmed cases per 10 thousand inhabitants, but with a population less aged compared to the country average, an additional set of 21 municipalities stood out, of which the municipalities of Ovar, Valongo, Maia and Gondomar also recorded values above 30 confirmed cases per 10 thousand inhabitants. The remaining 274 municipalities registered, on April 7, a number of confirmed cases per 10 thousand inhabitants lower than the one registered for the country, of which 190 presented a proportion of population with 65 and more years above the national average.

Figure 13 - Number of confirmed cases per 10 thousand inhabitants on April 7, 2020 and proportion of resident population with 65 or more years old, by NUTS 3

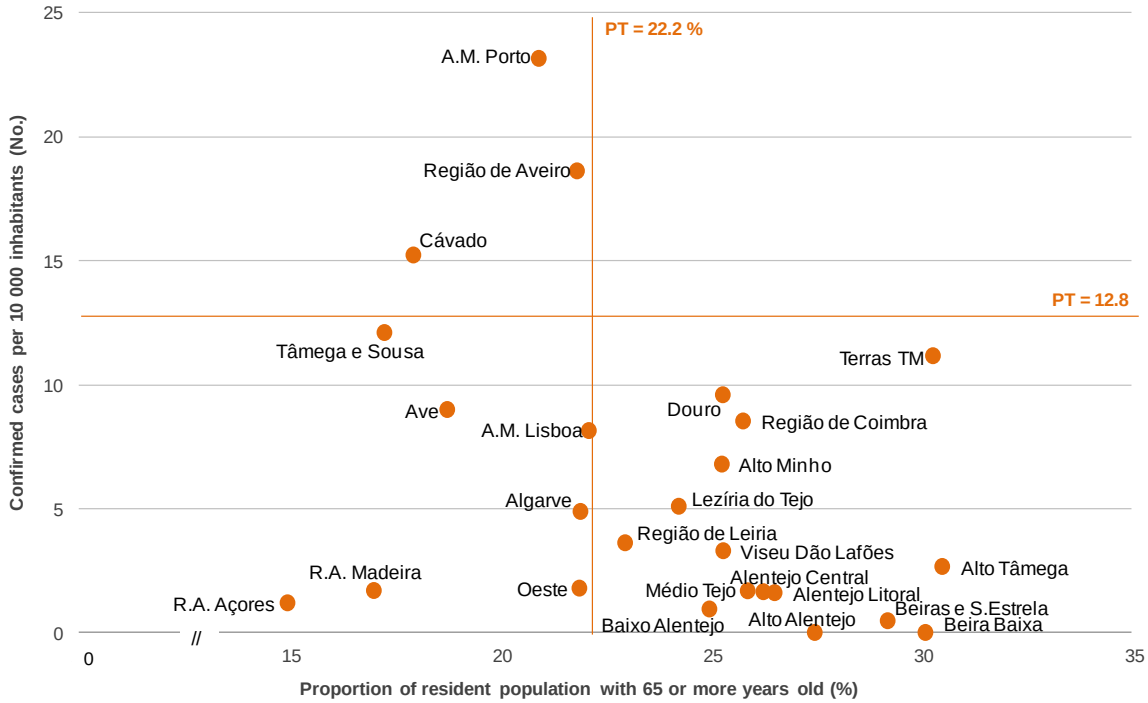
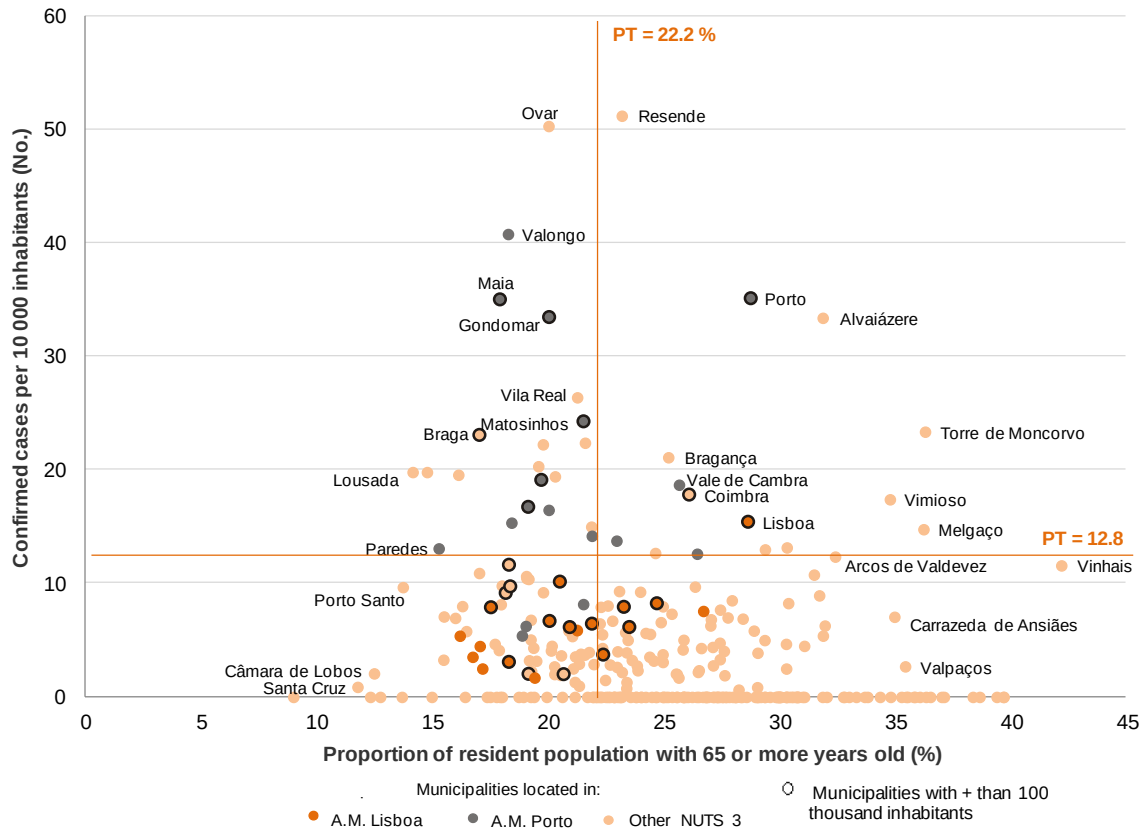


Figure 14 - Number of confirmed cases per 10 thousand inhabitants on April 7, 2020 and proportion of resident population with 65 or more years old, by municipality



Source: Directorate-General of Health, Daily COVID-19 Status Report (released on April 8); INE, I.P., Annual estimates of resident population, 31 December 2019 (Preliminary Results).

Technical note

Data sources

Data on **Deaths** correspond to general deaths (all causes of death) occurring in the national territory since March 1st, 2020 and until the Tuesday of the week prior to publication. The information is preliminary and is obtained from statistical operations of direct and exhaustive collection on deaths occurring in Portuguese territory using facts that are subject to compulsory civil registration (death) in the *Sistema Integrado do Registo e Identificação Civil* (SIRIC). In addition to administrative information obtained from Civil Register Offices, Statistics Portugal collects an additional set of variables identified as statistically relevant to the National Statistical System (NSS) and the European Statistical System (EES). Data are recorded and sent electronically, in compliance with the requirements set out by Statistics Portugal and laid down in liaison with the *Instituto de Registos e Notariado* (IRN) and the *Instituto de Gestão Financeira e Equipamentos da Justiça* (IGFEJ).

Data on the number of confirmed cases are based on those published daily in the **Directorate-General of Health COVID-19 Status Report** for the entire country and by municipality. The confirmed cases are referenced to the municipality of occurrence and correspond to the total of clinical notifications in the SINAVE (National System of Epidemiological Surveillance) system. When the confirmed cases by municipality are fewer than 3, for confidentiality reasons, data are not disclosed by the Directorate-General of Health. For the reference dates considered in this press release – March 25 and 31, and April 7 – data by municipality corresponded, respectively, to 69%, 77% and 77% of confirmed cases in the national territory. These proportions reflect data confidentiality by municipality, but also limitations in the process of spatial referencing of information.

The resident population data are preliminary estimates, not yet disseminated, and referenced to December 31, 2019.

Presented Indicators

Number of total deaths, by sex or age group

Number of deaths in March 2020 per 100 deaths in the same reference period

Number of confirmed cases of COVID-19 disease

Number of confirmed cases of COVID-19 disease per 10 thousand inhabitants

Population density

Proportion of resident population with 65 or more years old

Location coefficient

The location coefficient (LC) is obtained using the following formula:

$$LC = \left(\frac{1}{2} \sum_{j=1}^{n} \left| x_j - y_j \right| \right) \times 100$$ where:

x_j corresponds to the ratio of the number of confirmed cases of COVID-19 in each municipality *j* to the number of confirmed cases of COVID-19 for the total country;

y_j corresponds to the ratio between the resident population in each municipality *j* and the total resident population in the country.

The Location coefficient varies between 0 and 100, with values closer to 100 reflecting greater inequality in the distribution of confirmed cases of COVID-19 against the total resident population and, in this sense, indicates situations of greater territorial concentration.

The location curve (or Lorenz concentration curve) corresponds to a graphical representation that relates the cumulative distribution of two variables. This representation also includes the straight line of equal distribution, and the greater the distance from it, the greater is the concentration of the variable represented in the ordinate axis (in this analysis, the confirmed cases of COVID-19, by period of reference) versus the variable represented in the abscissa axis (in this analysis, the total resident population).