24 April, 2020

COVID-19: a statistical view integrating territory and demography

Despite the progressive spread of the pandemic throughout the national territory, its impact continues to be characterised by high regional heterogeneity, particularly when taking into account, in addition to the absolute numbers of confirmed cases and deaths, relative indicators according to the size and population density per km^2 of the territorial units considered in this analysis. Taking the municipality as a reference unit and data available for April 22 (2 weeks more than in the previous press release on the same topic), it can be seen that:

- On April 22, 2020, in Portugal, for every 10,000 inhabitants there were 21.7 confirmed cases of COVID-19. The number of confirmed cases of COVID-19 disease per 10 thousand inhabitants was above the national value in 47 municipalities and of this group, 33 belonged to the Norte region.

- The analysis of the relationship between the number of confirmed cases per 10 thousand inhabitants and population density highlights a set of 32 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.

The results of overall mortality refer to deaths (all causes of death) that occurred in the national territory from March 1st up to April 12th. Information on deaths is obtained through the civil registry (death certificates) computed under the Integrated Civil Registration and Identification System (SIRIC). This information was collected on April 21st for, and refers to all deaths occurred from 1st March until April 12th, 2020. This time lag prevents the disclosed information from being subjected to considerable revisions. Even so, the information is preliminary and will be subject to further updates.

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 23 (data of the situation up to April 22).

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

General Perspective

Number of deaths between March 1st and April 12th, 2020 higher than in the same period in 2019 and 2018

The preliminary total number of deaths between March 1st and April 12th, 2020 is 1,222 higher than the number registered in the same period in 2019 and 343 cases higher than number of deaths registered in 2018. The positive variation in relation to 2019 is due mainly to the increase in the number of deaths of people aged 75 and over (+ 1,194).

The following figures allow the comparison of the cumulative number of deaths from the beginning of March to April 12th, 2020 with that observed in the same period in 2019 and 2018, for the total number of deaths registered, and for the age group 75 and over. Two lines were added in order to identify the moment values of cumulated deaths registered in 2020 surpass those registered in 2019 and 2018.

Figure 1 - Cumulative number of deaths in Portugal from March 1st to April 12th (2018-2020)

	Number of deaths			Number of deaths per 100 thousand inhabitants		
	2018	2019	2020	2018	2019	2020
Total	14,517	13,638	14,860	141.1	132.7	144.4
Males	7,257	6,783	7,403	149.1	139.8	152.5
Females	7,260	6,855	7,457	133.9	126.4	137.1
Under 64 years	1,960	1,921	1,922	24.3	23.9	24.0
65 to 69 years	872	866	886	140.7	140.1	142.3
70 to 74 years	1,166	1,196	1,204	223.6	222.1	219.2
75 to 79 years	1,687	1,567	1,729	396.9	367.7	400.9
80 to 84 years	2,542	2,387	2,542	727.6	679.7	721.3
85 years and over	6,289	5,699	6,576	2,113.7	1,836.8	2,022.8
65 years and over	12,556	11,715	12,937	567.3	522.0	567.2
75 years and over	10,518	9,653	10,847	981.3	887.5	978.3

Source: Statistics Portugal, Deaths; Statistics Portugal, Annual estimates of resident population

Notes:
b) 2020 data: preliminary data based on information registered by the Civil Register Offices and sent to Statistics Portugal until April 21st 2020.
a) The total number of deaths may not correspond to the sum of the partial figures due to the existence of records with unknown age.

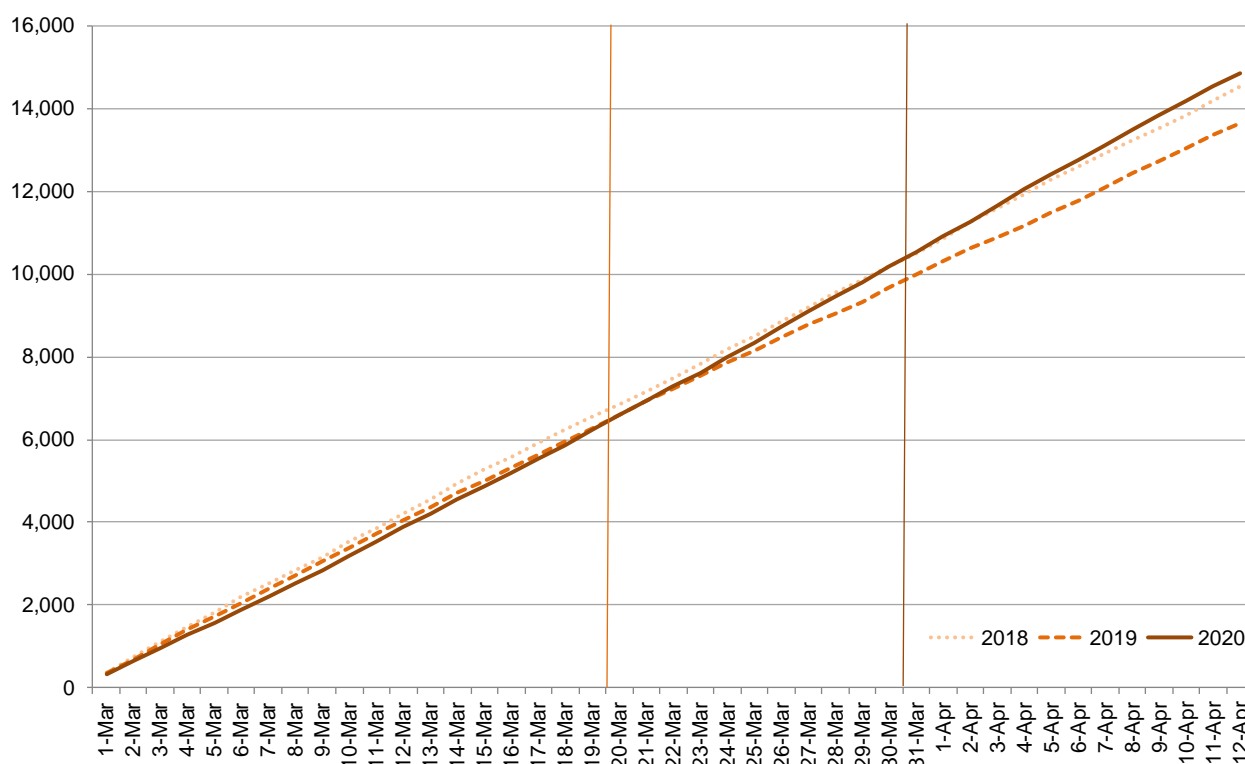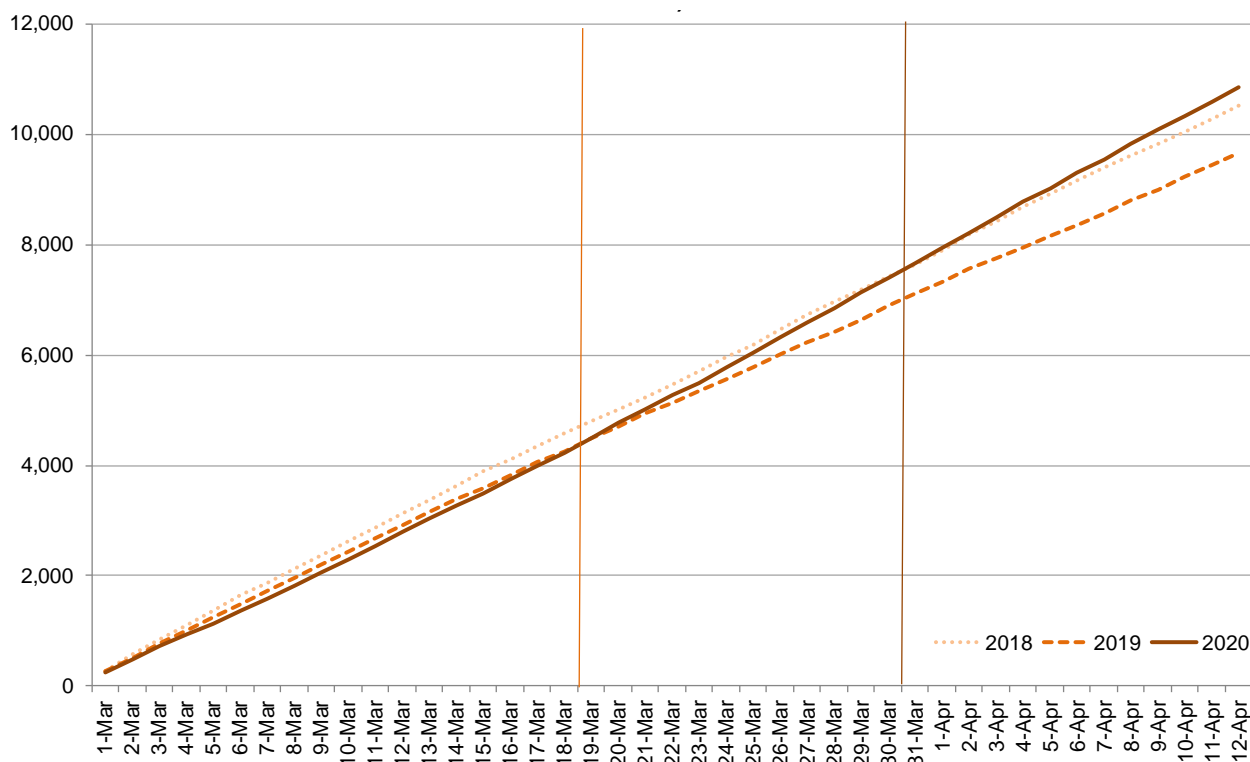**Figure 2 - Cumulative number of deaths, by day of death, March 1st to April 12th (2018-2020)**

Figure 3 - Cumulative number of deaths aged 75 and over, by day of death, March 1st to April 12th (2018-2020)
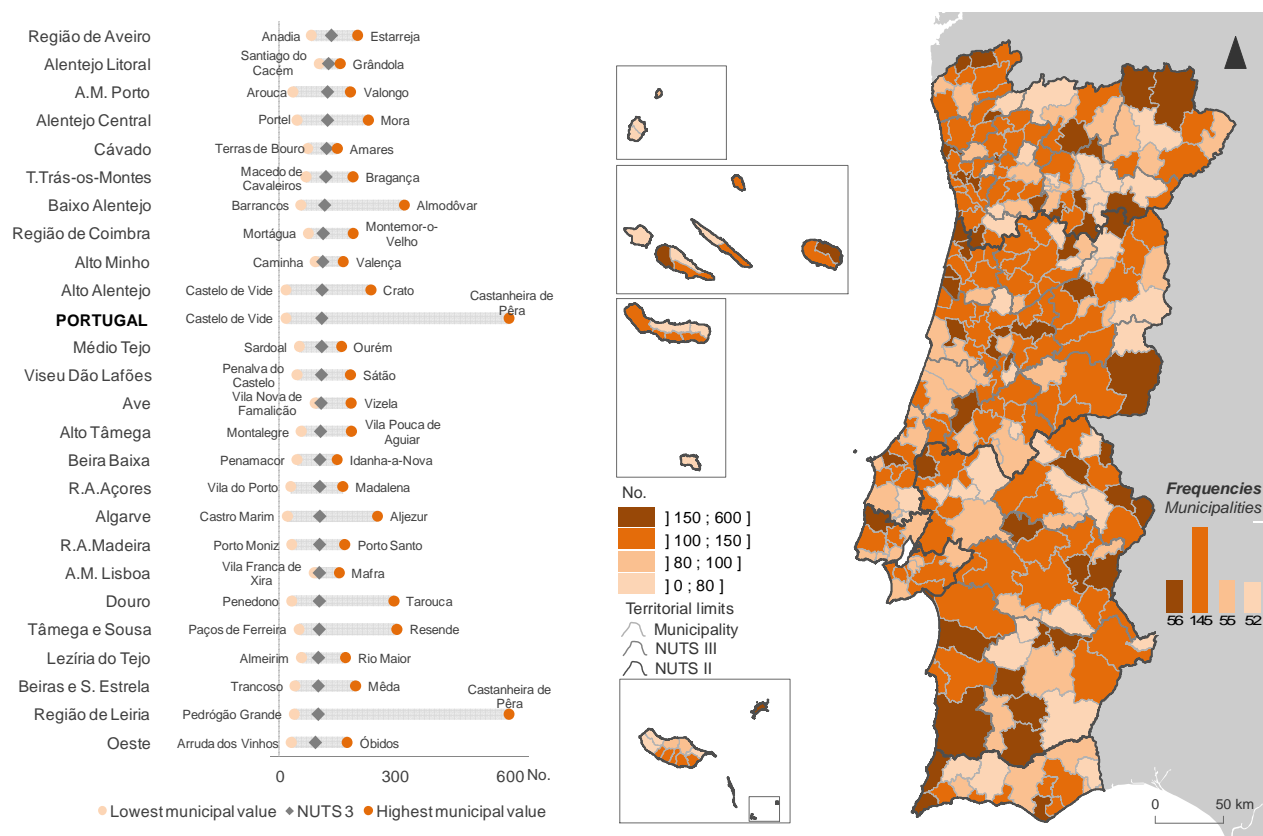
Territorial Perspective

In 201 municipalities the number of deaths registered in the last four weeks (between 16 March and 12 April, 2020) was higher than the corresponding reference value

In 201 out of the 308 Portuguese municipalities the number of deaths registered in the last four weeks (between 16 March and 12 April, 2020) was higher than the corresponding reference value (<u>average number of deaths in the same period in 2018 and 2019</u>). Of this total, 56 municipalities stand out for registering more than 150 deaths per 100 deaths in the same reference period. For the remaining 107 municipalities (35% of the total number of municipalities) the number of deaths registered in the last four weeks was lower than the number observed in the reference period.

Figure 4 - Number of deaths in the last four weeks (16 March to 12 April) 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)).
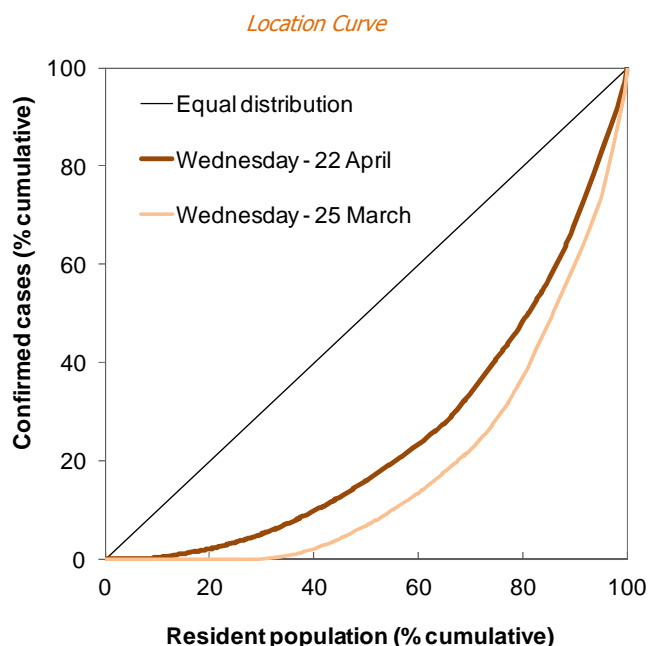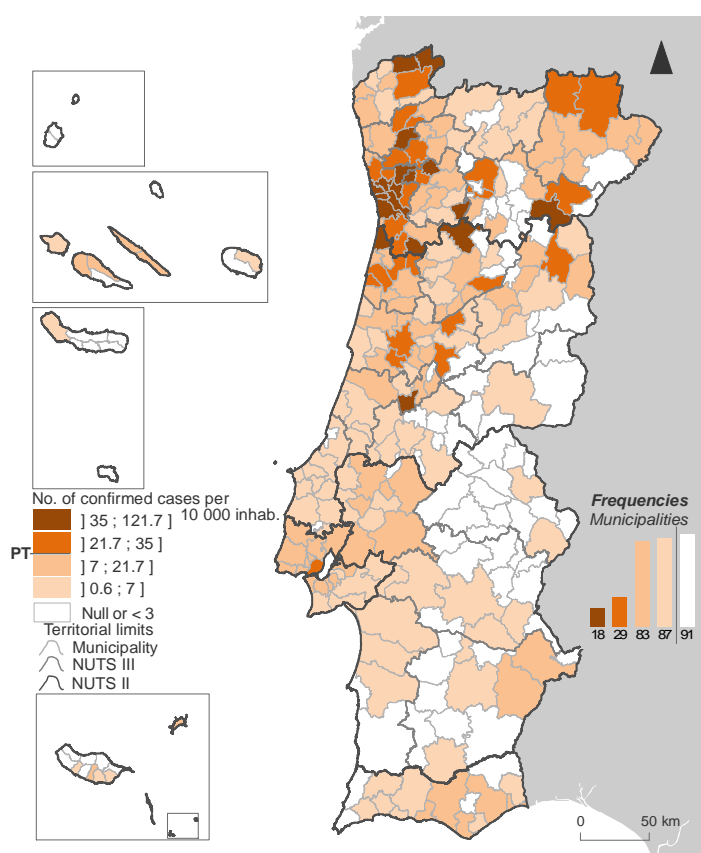
47 municipalities with confirmed cases of COVID-19 disease per 10 thousand inhabitants above the national value

On April 22, 2020, in Portugal, for every 10 thousand inhabitants there were 21.7 confirmed cases of COVID-19. The number of confirmed cases of COVID-19 disease per 10 thousand inhabitants was above the national value in 47 municipalities. In the Norte region, 33 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 35 confirmed cases per 10 thousand inhabitants Valongo, Maia, Gondomar, Matosinhos, Porto, Santo Tirso e Vila Nova de Gaia. Some municipalities in the Centro (13) and Metropolitan Area of Lisboa (the municipality of Lisboa) also scored values above the national value [Figure 5].

Despite this differentiation, the estimated location coefficient[1] for March 25th and April 22nd suggests a decrease in territorial concentration of cases, i.e., a progressive spatial dissemination throughout the country. The location curves graphically reflect this trend by the approximation to the straight line of equal distribution between the number of confirmed cases and the resident population in the municipalities [Figure 6].

Figure 5 - Number of confirmed cases of COVID-19 disease per 10 thousand inhabitants until April 22, 2020, by municipality

Figure 6 - Territorial concentration of COVID-19 confirmed cases until March 25 and until April 22 in relation to the resident population, based on the distribution by municipality

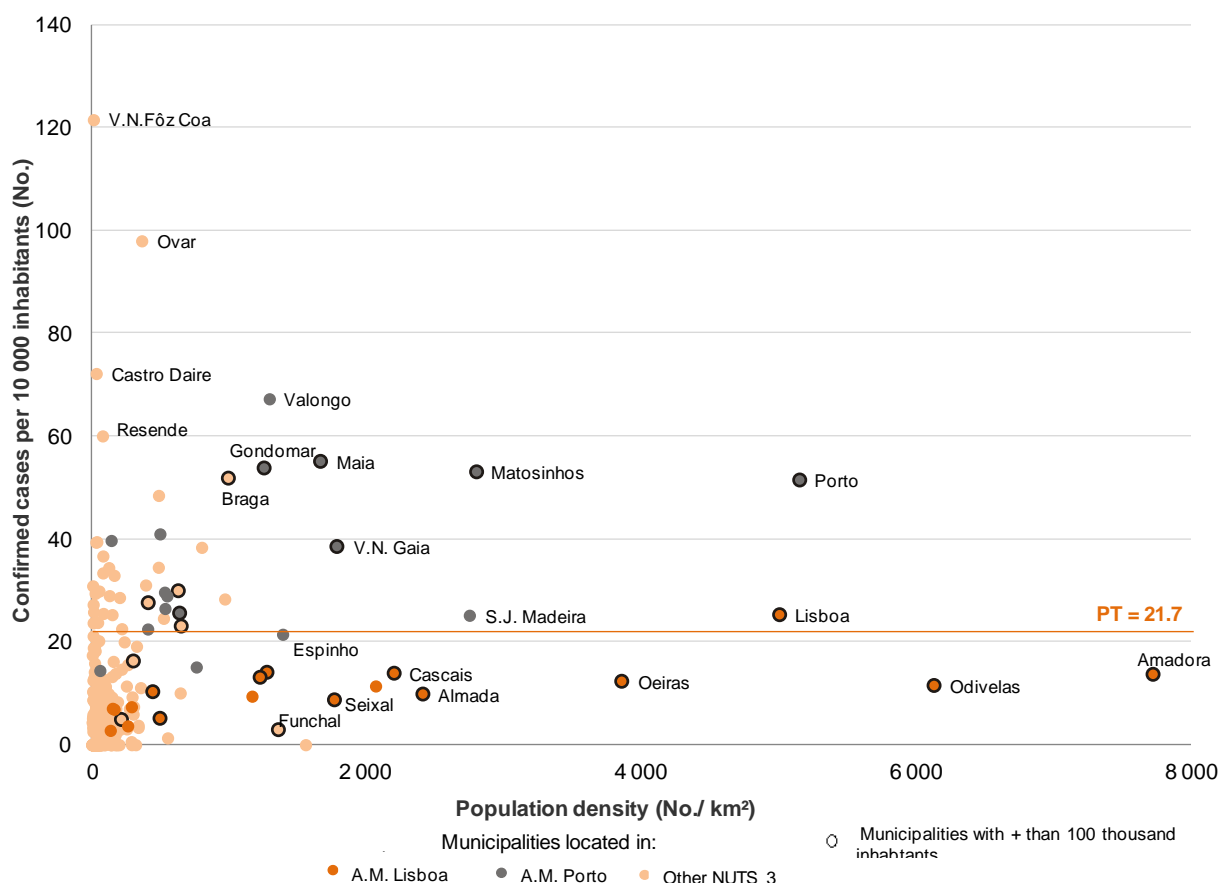| Location coefficient	
Wednesday - April 22	37.3
Wednesday - March 25	47.7

Source: Directorate-General of Health, Daily COVID-19 Status Report (released on April 23); 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).

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[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.

32 municipalities registered both a number of confirmed cases per 10 thousand inhabitants and population density values above the national reference

The following figure illustrates the relationship between population density and the number of confirmed cases per 10 thousand inhabitants for the country's municipalities. Of the 47 municipalities with a number of confirmed cases per 10 thousand inhabitants above the value for Portugal, 32 also had population density values above the national average. From this set of 32 municipalities, the municipalities of Ovar (98.1) in Região de Aveiro, the municipalities of Valongo (67.3), Maia (55.1), Gondomar (53.8), Matosinhos (53.1) and Porto (51.5), in the Metropolitan Area of Porto, and the municipality of Braga (51.9) in Cávado stood out with more than 50 confirmed cases per 10 thousand inhabitants. It should also be noted that 181 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 7 - Number of confirmed cases per 10 thousand inhabitants on April 22, 2020 and Population density, by municipality

Source: Directorate-General of Health, Daily COVID-19 Status Report (released on April 23); 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 –April 22 – data by municipality corresponded, respectively, to 83% 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.

Disseminated Indicators

Number of total deaths, by sex or age group

Number of deaths in the last 4 weeks per 100 deaths in the same reference period

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:

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

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).