Population mobility at regional level in the context of the COVID-19 pandemic

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Using data from Facebook's "Data for Good" initiative, it is possible to obtain information on population mobility from a regional perspective. The results have highlighted that:

- In the first State of Emergency, it was confirmed a decrease in population mobility, with an increase following the implementation of the de-confinement measures. Recently, following the declaration of a new State of Calamity on 15 October, there has been a further overall reduction in average levels of mobility, which was accentuated by the declaration of a new State of Emergency on 9 November.

- All the NUTS 3 with 50% or more of the population living in municipalities at high risk of COVID-19 had, overall, lower levels of mobility than the other territories. Since 4 November - the date on which 121 high risk municipalities were identified - the set of NUTS 3 with all municipalities at high risk had the lowest levels of mobility on a daily basis. On the other hand, all NUTS 3 without municipalities at high risk tended to have the highest levels of mobility.

- On days with restricted movement between municipalities - Easter, Labour Day and All Saints' Day - there is a tendency for lower levels of mobility. This trend is particularly evident when comparing the days with mobility restrictions during Easter and Labour Day - when the country was also in a State of Emergency - with the same days in the beginning of March and the days after the start of the 2020/2021 school year.

As part of Statistics Portugal's **Statslab**, this press release deepens the analysis of population mobility based on data provided by Facebook's "**Data for Good**" initiative (see technical note at the end of the press release), including the recent framework of more restrictive measures declared for a number of municipalities and limitations on mobility between municipalities in force from 30 October to 3 November

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### Main events related to the COVID-19 pandemic in Portugal

- 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.

- On March 19th, the first period of the State of Emergency was declared in Portugal, which would be renewed on April 3 and April 18.

- Between 9 and 13 April (the Easter period) and 1 and 3 May (Labour Day), it was decreed that circulation between municipalities would be limited.

- On May 3rd, the State of Calamity was declared, which was followed by three phases of de-confinement.

- On July 1st, the State of Alert was declared for most of the country, the State of Contingency for the Metropolitan Area of Lisboa and the State of Calamity for 19 parishes of five municipalities in the Metropolitan Area of Lisboa.

- ·On August 1st the State of Alert for the whole country was maintained and the State of Contingency was declared for the whole territory of the Metropolitan Area of Lisboa.

- On September 15th it was declared a State of Contingency throughout the country, establishing specific rules for the organisation of work for the metropolitan areas of Lisboa and Porto.

- On October15th the State of Calamity was declared for the whole country.

- Between 30 October and 3 November, it was decreed the limitation of movement between municipalities.

- On October 23rd, special measures were declared for the municipalities of Lousada, Felgueiras and Paços de Ferreira of the sub-region Tâmega e Sousa.

- On November 4th, these special measures began to cover a set of 121 municipalities in Portugal's mainland, given their high risk situation of COVID-19, measured according to the criterion of the European Centre for Disease Prevention and Control - 240 new cases per 100,000 inhabitants in the last 14 days - and according to a territorial contiguity criterion which covers municipalities which, despite not meeting that threshold, correspond to territories bordering municipalities in high risk situation.

- On November 9th the state of emergency was declared for the entire national territory, and on November 16th a new list of municipalities at high risk of COVID-19 came into force, including 191 municipalities.

Population mobility at regional level in the context of the COVID-19 pandemic

The following figure shows the proportion of the population "staying put" between 1 March and 16 November, namely the minimum, average and maximum values calculated based on the NUTS 3 sub-regions. The proportion of population that "stayed put" is based on the number of Facebook users associated with a single reference grid of 600mx600m during 8 am and 8 pm on day x, requiring at least three occurrences during that time period. For a better contextualisation of the information, the figure includes the main key moments associated with the COVID-19 pandemic in Portugal.

It is possible to observe that on Sundays there is generally less mobility of the population than on other days of the week. It is also noteworthy that after the first confirmed cases of COVID-19 and following the declaration of the first State of Emergency, there is a decrease in the mobility of the population, followed by an increase in the levels of mobility after the implementation of the de-confinement measures, the first phase of which started on 4 May. More recently, following the declaration of a new State of Calamity on 15 October, the restriction of movement between municipalities declared between 30 October and 4 November and the declaration of a new State of Emergency on 9 November, there has been a further overall reduction in the average levels of mobility. Considering the moving average of the last 7 days for the daily indicator "staying put", this recent reversal of the trend towards a reduction in mobility has been taking place since mid-October.

Figure 1 - Proportion of the population "staying put" between 1 March and 16 November – minimum, average and maximum values of NUTS 3 sub-regions
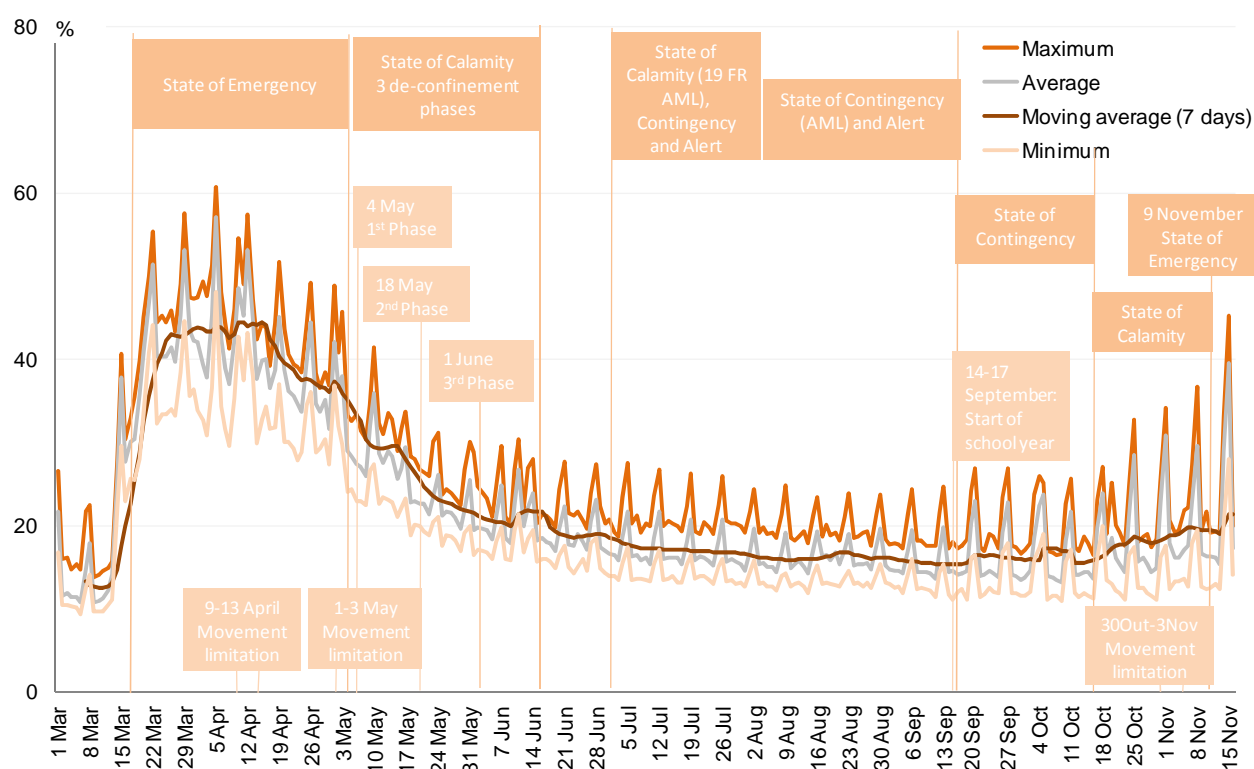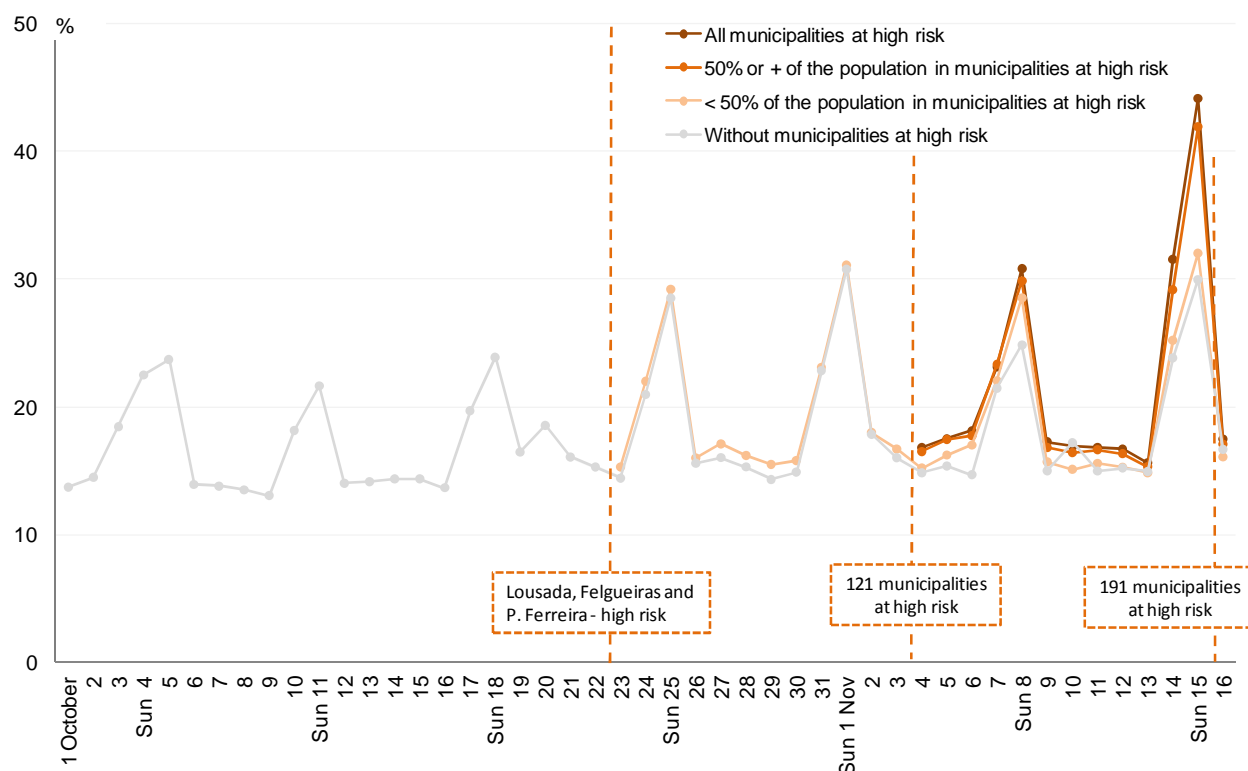

Source: Facebook's "Data for Good" Initiative. Data provided by Carnegie Mellon University. Note: The dates marked on the graph axis correspond to Sundays.

Territories with 50% or more of the population living in municipalities at high risk of COVID-19 had, overall, lower levels of mobility

The following figure presents average values of population mobility based on NUTS 3 sub-regions since the beginning of October, differentiating the sub-regional territories based on the proportion of population living in municipalities considered as high risk due to the cumulative incidence of COVID-19 cases in the last 14 days - on October 23rd a first set of three high risk municipalities located in the sub-region of Tâmega e Sousa (Lousada, Felgueiras and Paços de Ferreira) was defined, on November 4 this set of municipalities accounted for a total of 121 municipalities and, as of November 16, a total of 191 municipalities.

The categories considered make it possible to distinguish: 1) sub-regions where all municipalities are at high risk; 2) sub-regions with 50% or more of the population living in municipalities at high risk; 3) sub-regions with less than 50% of the population living in municipalities at high risk; and 4) sub-regions without municipalities at high risk from COVID-19 disease. Therefore, a hierarchy of mobility levels can be observed according to the intensity of the proportion of the population living in municipalities at high risk of COVID-19 disease, i.e., sub-regions with 50% or more of the population living in municipalities at high risk scored, overall, lower levels of mobility. Since 4 November – the date on which 121 high risk municipalities were identified – the NUTS 3 sub-regions with all the municipalities at high risk showed the lowest levels of mobility on a daily basis. On the other hand, the NUTS 3 group without municipalities at high risk tended to have the highest levels of mobility.

Figure 2 - Proportion of the population "staying put" between 1 October and 16 November by NUTS 3 classification category based on the proportion of population living in high-risk municipalities
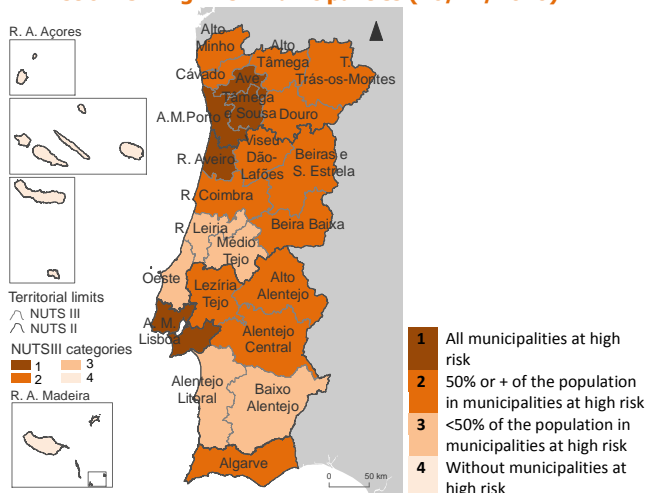

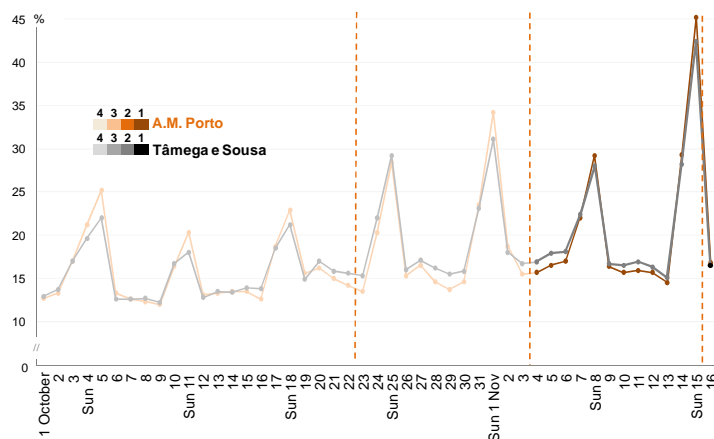Source: Facebook's "Data for Good" Initiative. Data provided by Carnegie Mellon University.

The figure below presents the same indicator for sub-regions with 50% or more of the population living in municipalities at high risk of COVID-19. The graphical representation also differentiates the situation of these sub-regions for 23 October (three municipalities) and 4 November (121 municipalities) - the intensity of the line colours for each NUTS 3 varies according to the intensity of the population living in high risk municipalities.

Figure 3 - Proportion of population "staying put" between 1 October and 16 November for NUTS 3 with 50% or more of the population living in high risk municipalities
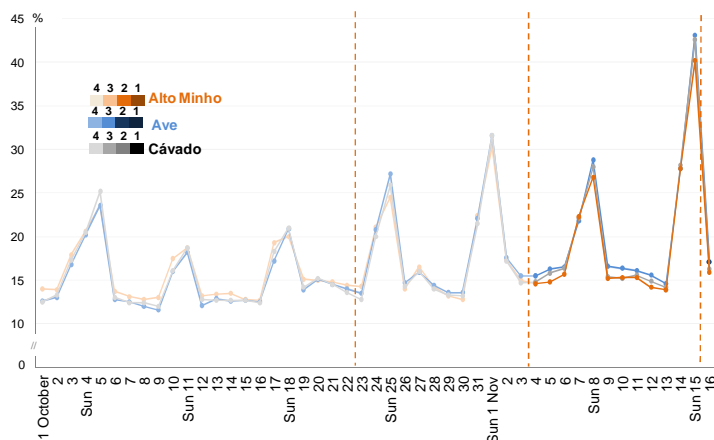
25 NUTS 3 according to the classification categories based on the list of 191 high risk municipalities (16/11/2020)
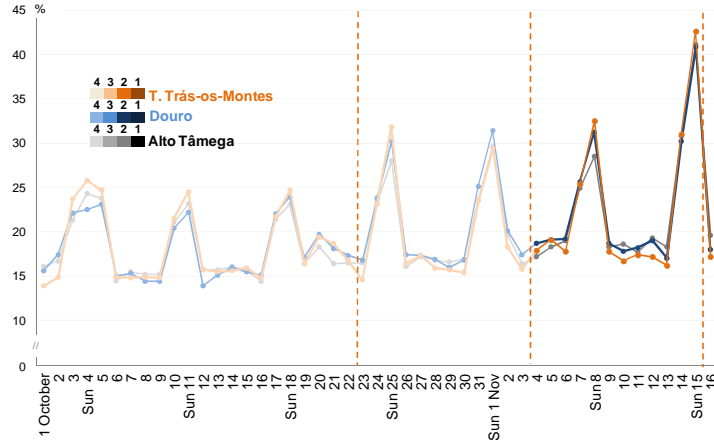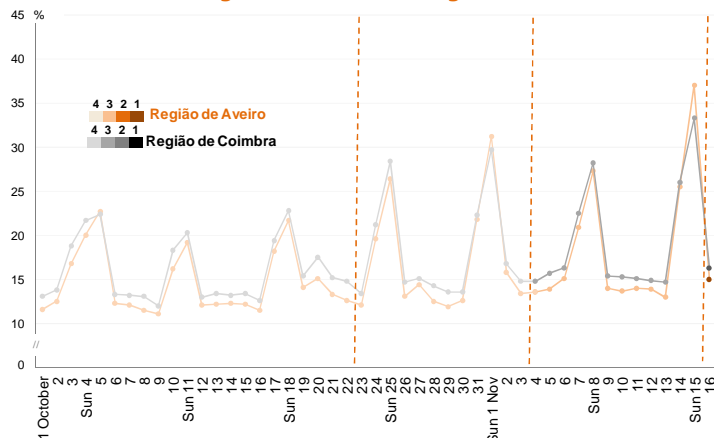

Norte - A.M. Porto and Tâmega e Sousa
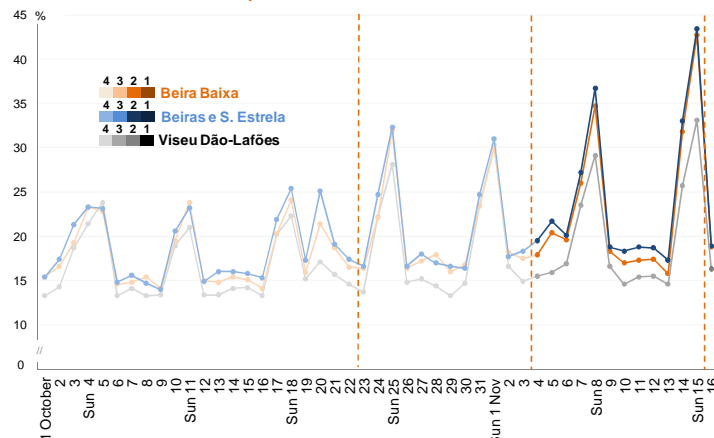

Norte - Alto Minho, Ave and Cávado

Norte – T. Trás-os-Montes, Douro and Alto Tâmega
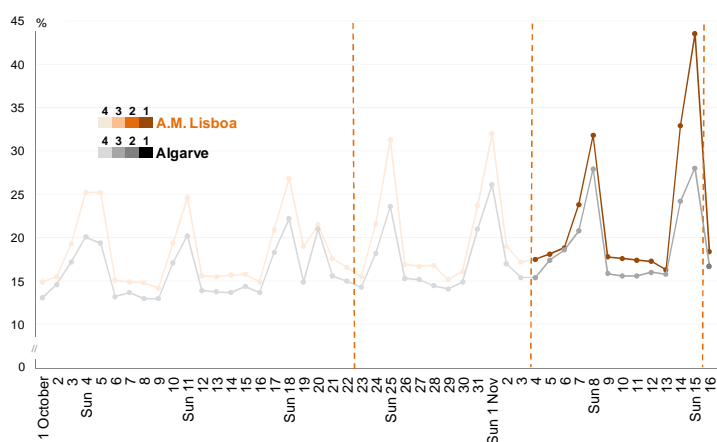

Centro – Região de Aveiro and Região de Coimbra

Centro – Beira Baixa, Beiras e S. Estrela and Viseu Dão-Lafões
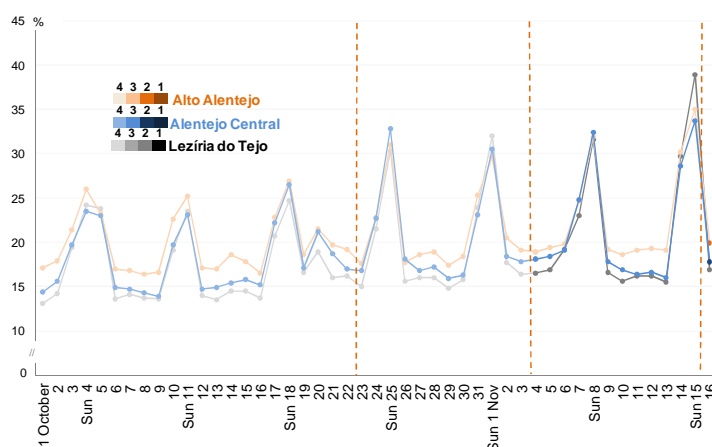

(to be continued)

A.M. Lisboa and Algarve

Alentejo – Alto Alentejo, Alentejo Central and Lezíria do Tejo

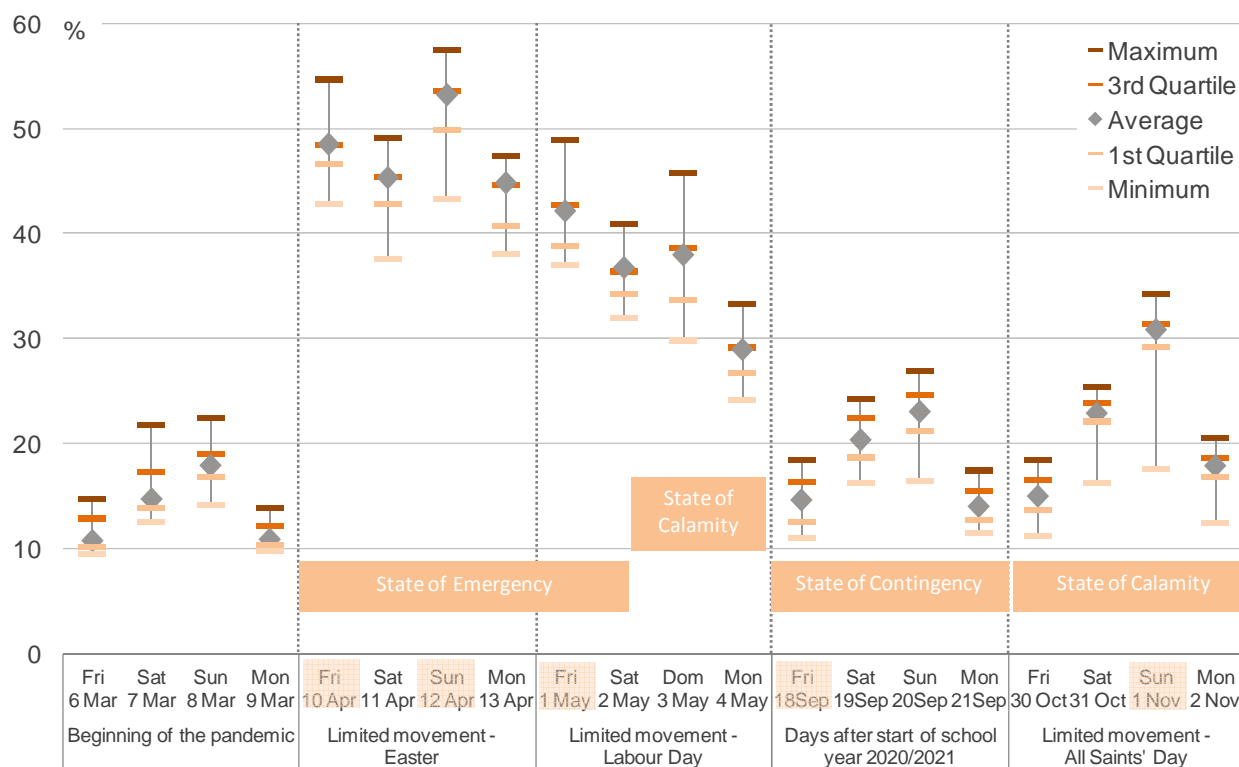Source: Facebook's "Data for Good" Initiative. Data provided by Carnegie Mellon University.
Note: Classification according to the proportion of population living in high risk municipalities: 1 – All municipalities at high risk; 2 – 50% or more of the population living in municipalities at high risk; 3) Less than 50% of the population living in municipalities at high risk; 4) Without municipalities at high risk.

Lower levels of mobility on days of limited movement between municipalities, compared to other reference moments

The following figure shows the level of mobility of the population for four days of the week (Friday, Saturday, Sunday and Monday) referring to the three moments in which there has been limited movement between municipalities since the beginning of the COVID-19 pandemic - in the Easter period (10 to 13 April), on Labour Day (1 to 4 May), and on All Saints Day (30 October to 2 November) - and for two other moments of comparison - the same days of the week at the beginning of the pandemic in Portugal and after the start of the 2020/2021 school year.

Overall, there are lower levels of population mobility on weekdays associated with periods of limited movement between municipalities compared to the other two reference moments considered, particularly at the time of Easter and Labour Day, when the country was in a State of Emergency, which was followed by a period of State of Calamity with three stages of de-confinement. In the most recent period of restriction of movement between municipalities, which took place from 30 October to 3 November, the lowest levels of mobility on Sunday 1 November, corresponding to the All Saints' Day, stand out in particular.

Figure 4 - Proportion of population "staying put" - position measures based on the NUTS 3 sub-regions - for Fridays, Saturdays, Sundays and Mondays associated to the periods of limited movement between municipalities and to two other reference periods in the context of the COVID-19 pandemic
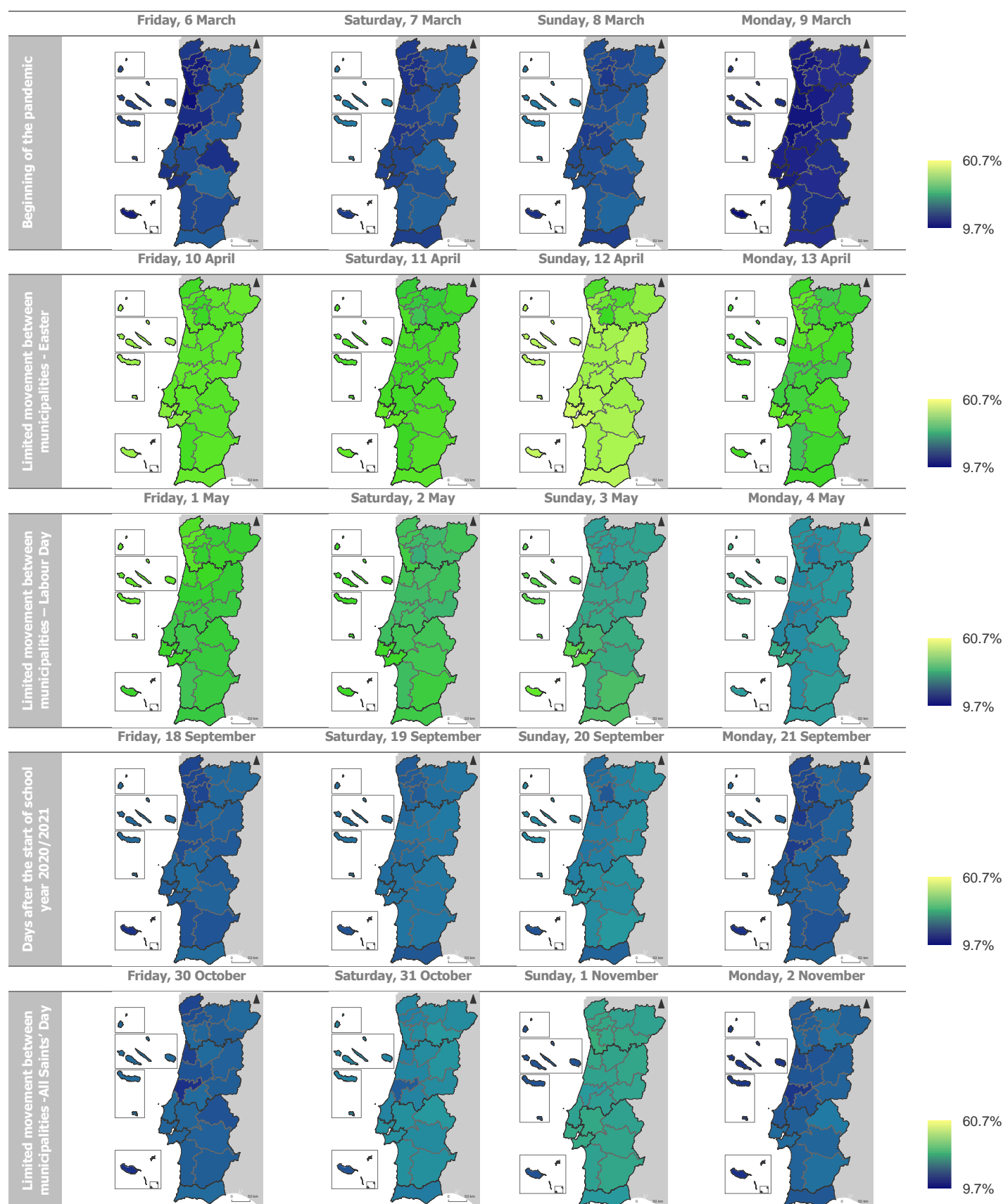

Source: Facebook's "Data for Good" Initiative. Data provided by Carnegie Mellon University.

The figure below illustrates this analysis focused on the three periods of limitation of movement between municipalities, compared with two other reference moments, up to the level of NUTS 3 sub-regions.

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Figure 5 - Proportion of population "staying put" by NUTS 3 for Fridays, Saturdays, Sundays and Mondays associated with the periods of limited movement between municipalities and to two other reference periods in the context of the COVID-19 pandemic

Source: Facebook's "Data for Good" Initiative. Data provided by Carnegie Mellon University.

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Technical note

The mobility data from Facebook's "Data for Good" Initiative correspond to location updates collected from mobile devices of Facebook application users that have the "location history" option turned on. Only location accuracy (GPS) data of less than 200 meters is considered and if a user has multiple locations resulting from more than one associated mobile device, Facebook only considers the data with the highest location accuracy.

Obtaining results for the NUTS 3 level implies a minimum of 300 unique users per sub-region. The proportion of the population "staying put" is measured by the number of Facebook users associated with a single 600mx600m reference grid during 8 am and 8 pm on day x, requiring at least three occurrences during that time period. The reference grid, as a "residence" *proxy*, is measured daily based on the largest number of locations observed between 8 pm and midnight on day x-1 and between 0 am and 8 am on day x, requiring at least three occurrences during that time period. The information associated with the 600mx600m grids is allocated to the respective NUTS 3 sub-region. Since a grid cell can intercept more than one sub-region, 9 sample points are generated in each grid, assigning 1/9 of the grid population to each point in the sample.

The average figures presented for the total of Portugal and by NUTS 3 classification category according to the proportion of the population living in municipalities at high risk were calculated on the basis of the population weighted average (Statistics Portugal, Annual Estimates of Resident Population, 2019) in the respective NUTS 3 sub-region.

Facebook's "Data for Good" initiative aims to provide data for research on humanitarian issues and has allowed results to be published in scientific articles particularly in the United States. Obviously, Statistics Portugal's use of this data source in the Statslab domain is not motivated by any publicity motive, but by the public interest of the information. Statistics Portugal thanks researcher Miguel Godinho Matos[1] for his support in the analytical preparation of this information.

The edition of the press release "Indicators of demographic context and territorial expression of the COVID-19 pandemic in Portugal", every two weeks, has been benefiting from the information released weekly by the Directorate-General of Health (DGS) by municipality. The interruption in the weekly dissemination of information by municipality by DGS, between 19 October and 16 November, compromised the dissemination of the Statistics Portugal press release on 6 November.

The dissemination of information by municipality by DGS on 16 November was followed by a note identifying changes in the scope of the information provided by municipality: confirmed cases of SARS-CoV-2/COVID-19 infection notified in the National Epidemiological Surveillance System (SINAVE) began to consider, in addition to clinical notifications, laboratory notifications. The reference metric for the information by municipality has also changed: the *Number (total) of confirmed cases* is no longer available and the *14-day Cumulative Incidence* of Infection by SARS-CoV-2/COVID-19, obtained by the quotient of the number of new cases confirmed in the previous 14 days and the resident population estimated by INE for 2019, expressed per 100,000 inhabitants, is now disseminated. The note presented by the DGS does not mention the periodicity of the information availability, which was weekly, until the results released by the DGS on 19 October. The pattern of information availability has also changed from *1 day after the reference date of the information* to *6 days after the reference date*. The reference date of the last information published by DGS corresponds to a Tuesday when it was Sunday (last day of the standardised week used by Eurostat: ISO 8601). These changes do not allow Statistics Portugal, at least for the time being, to resume the usual analysis "The expression of the pandemic in municipalities".

For reference purposes, the data file attached to this press release shows a table with the 14-day cumulative incidence data (28/10/2020 to 10/11/2020) by municipality, as released by DGS on 16 November, and additionally the same metric for NUTS 3 sub-regions and the Number of new confirmed cases (28/10/2020 to 10/11/2020) by municipality and NUTS 3, estimated based on the data by municipality released by DGS and Statistics Portugal's Annual Estimates of Resident Population (2019).

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