Mobility during the first two full weeks of the second lockdown in France

Report #24 [previous reports at: www.epicx-lab.com/covid-19.html]

Eugenio Valdano[1], Jonggul Lee[1], Stefania Rubrichi[2], Vittoria Colizza[1,*]

1 INSERM, Sorbonne Université, Pierre Louis Institute of Epidemiology and Public Health, Paris, France
2 Orange Labs, Sociology and Economics of Networks and Services (SENSE), Chatillon, France

**vittoria.colizza@inserm.fr*

18/11/2020 (DATA UP TO 15/11/2020)

RESUME

La France traverse un deuxième confinement afin d'arrêter la deuxième vague de la COVID-19. Les fermetures et restrictions ont un impact sur la mobilité à différentes échelles spatiales et temporelles. Ce rapport est une mise à jour du rapport n°22, publié le 12 novembre 2020. Nous réactualisons ici l'analyse en considérant les données sur la mobilité de la population française au cours de la deuxième semaine ouvrée du confinement actuel. Les résultats suivants n'incluent pas le 11 novembre, car il s'agit d'un jour férié (Armistice du 1918), sauf explicitement précisé. Nous constatons peu de changement par rapport à la semaine précédente dans la mobilité moyenne nationale (2ème semaine du confinement actuel: 32% en dessous des niveaux pré-pandémiques; 1ère semaine: 33% en dessous des niveaux pré-pandémiques), soit une réduction nettement inférieure par rapport au première confinement (67% en dessous des niveaux pré-pandémiques). L'analyse de la mobilité par classe d'âge, heure et région a montré à peu près les mêmes tendances que la semaine précédente. Nous notons, néanmoins, une légère baisse de la mobilité pendant les heures de pointe du matin par rapport à la semaine précédente (2ème semaine du confinement actuel: 23% en dessous des niveaux pré-pandémiques; 1ère semaine: 20% en dessous des niveaux pré-pandémiques). Mais tout en restant sensiblement plus élevée que lors du 1ère confinement (23% contre 73% en dessous des niveaux pré-pandémiques).
La mobilité mesurée lors du11 novembre (jour de fête nationale) est nettement inférieure à celle du reste de la semaine: 64 % en dessous des niveaux pré-pandémiques. La mobilité à longue distance (trajets de plus de 100 km) est au contraire, toujours pour le 11 novembre, plus élevée que le reste de la semaine: 19% en dessous des niveaux pré-pandémiques contre 26% en dessous des niveaux pré-pandémiques pour le reste de la semaine. Les deux représentent une nette augmentation de la mobilité par rapport à la première semaine du confinement actuel (35% en dessous des niveaux pré-pandémiques).

SUMMARY

France is on a second lockdown to stop the second wave of COVID-19. Closures and restrictions are impacting mobility at different spatial and temporal scales. This is an update of Report #22, published on November 12, 2020. We extend here the analysis by adding mobility data from the 2nd working week of the current LD. The following reported values do not include Nov 11 as it was a national holiday (Armistice du 1918), unless explicitly specified. We measured little change from the previous week in national average mobility (2nd week of current lockdown: 32% below pre-pandemic levels; 1st week: 33% below pre-pandemic levels), and markedly less reduction than the 1st LD (67% below pre-pandemic levels). Analyzing mobility by age class, by time of day, and by region showed roughly the same patterns as the previous week. We report a slight additional drop in mobility during morning rush hours (2nd week of current lockdown: 23% below pre-pandemic levels; 1st week: 20% below pre-pandemic levels), during which, however, mobility remained substantially higher than the 1st LD (23% v 73% below pre-pandemic levels). Measured mobility on Nov 11 (national holiday) was markedly lower than the rest of the week: 64% below pre-pandemic levels. Long-range mobility (trips longer than 100 km) on Nov 11 was instead higher than the rest of the week: 19% below pre-pandemic levels vs 26% below pre-pandemic levels on the rest of the week. Both represent a marked increase in mobility from the 1st week of the current LD (35% below pre-pandemic levels).

INTRODUCTION

France entered a second lockdown since Friday, October 30, to control the second wave of COVID-19 epidemic. This updates Report #22 [1] to extend the analysis to the 2nd full week of the 2nd LD (up to Nov 15, 2020). Using mobile phone data [2] we measured the impact of the current closures and restrictions on population mobility patterns, at different spatial scales. We compared currently achieved mobility reductions with the ones registered in the first lockdown (March 17 to May 11, 2020). Current restrictions are less pervasive than the first lockdown: schools are open and presence at workplace is higher, as more productive sectors are allowed to continue functioning [3]. Report #22 reported that mobility went down 33% below pre-pandemic levels during the 1st full working week of the 2nd LD, compared to a drop of 67% observed at the start of the 1st LD.

This report includes mobility data from Jan 1, 2020, to November 15, 2020. It contains the following analyses:

- The status of mobility during the 2nd full working week of the current LD (Nov 9-13, 2020), breaking down the analysis by
    - space (regions, cities),
    - time of day,
    - age,
    - range (short-range vs. long-range mobility);
- Comparison of mobility during the 2nd full working week of the current LD to
    - The previous week (1st full working week of the current LD – Nov 2-6, 2020),

- The 1st full working week of the 1st LD (Mar 23-27, 2020);

Nov 11, 2020 is analyzed separately and not included in weekly statistics because it is a French national holiday (Armistice du 1918).

METHODS

Data. Mobility data were provided by the Orange Business Service Flux Vision in the form of displacement matrices, within the INSERM-Orange collaboration in the ANR research project EVALCOVID-19. The data contained travel flows among 1,436 geographic areas of mainland France (2018 EPCI, Établissements Publics de Coopération Intercommunale). For each pair of locations and any given day, data were provided stratified by age class, and time of day. More details are available in Ref. [2]. Internal mobility in a geographic area was defined as the number of trips starting and ending within that area. Outgoing mobility was defined as the number of trips starting inside the area, and ending outside that area, and within metropolitan France. We used the week Feb. 3-7, 2020 as a benchmark mobility in the pre-pandemic phase (chosen also to avoid school holidays and major transportation disruptions). The time periods analyzed are

- 1st full working week of the 1st LD: Mar 23-27, 2020;
- 1st full working week of the 2nd LD: Nov 2-6, 2020;
- 2nd working week of the 2nd LD: Nov 9, 10, 12, 13, 2020.
- Nov 11, 2020 is analyzed separately because it is a French national holiday (Armistice du 1918).

Demographic and economic data are from INSEE [4]. School calendar is obtained from the Ministry of Education [5].

RESULTS

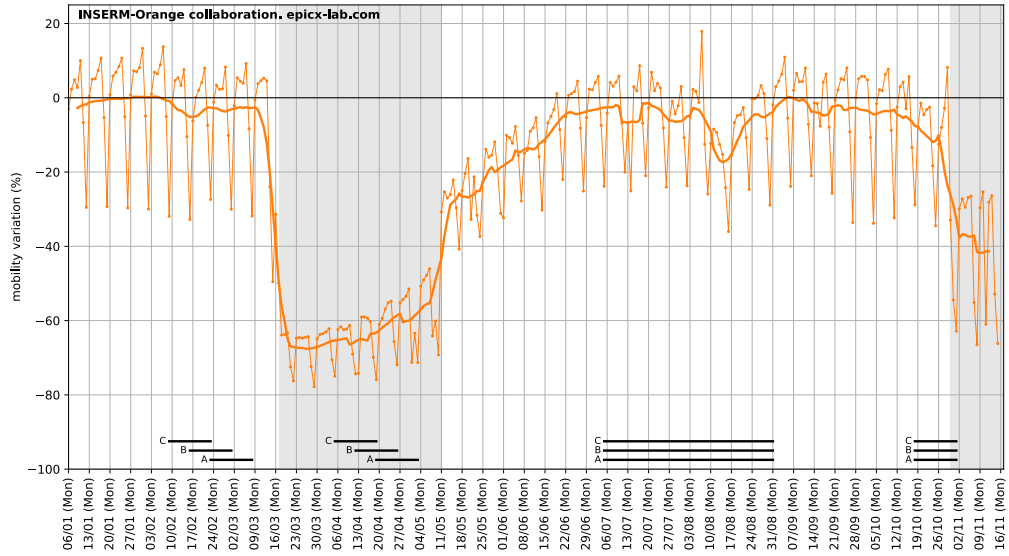

Figure 1. Mobility in France, in 2020. Daily mobility in France, from Jan 6, 2020, to Nov 15, 2020, defined as the relative variation in number of trips taken in mainland France, with respect to the average number of trips during the benchmark full week in the pre-pandemic phase (Feb 3-9, 2020). Dots and thin line indicate daily values, thick line indicates rolling average with a 7-day window. Positive values indicate higher mobility than during the benchmark week, negative values indicate lower mobility. Gray shaded areas indicate the 1st and the 2nd lockdown. Horizontal solid black lines mark school holidays in the three geographic areas (A,B,C) as defined by the Ministry of Education.

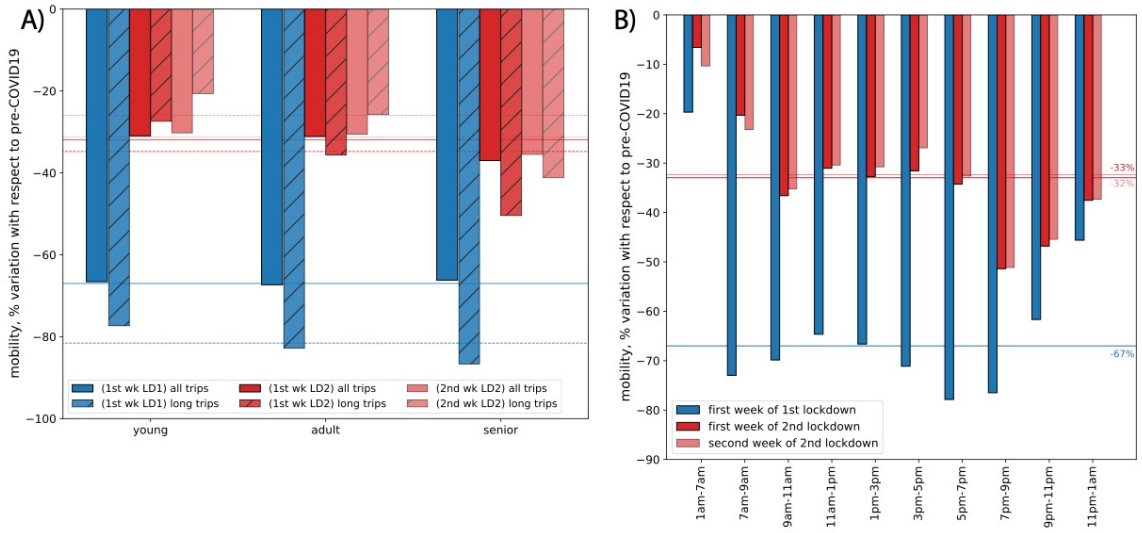

Figure 2. Comparing 1st and 2nd lockdown – national data. Mobility averaged over the 1st full working week of the 1st LD (blue) and of the 2nd LD (dark red – 1st week; light red - 2nd week). Mobility is defined as the relative variation in number of trips taken in mainland France, with respect to the average number of trips during the benchmark week in the pre-pandemic phase (working days only, Feb 3-7, 2020). Neither panel includes Wed 11, 2020, as it was a national holiday. A) breaks down mobility by age class (<18 years old for young, 18-64 for adult, >64 for senior) and trip distance (hatched bars for long trips - longer than 100 km in geodesic distance). The national averages are -67% for all trips (blue solid line) and -82% for long trips (blue dotted line) during the 1st LD; -33% for all trips (red solid line) and -35% for long trips (red dotted line) during the 1st week of 2nd LD; -31% for all trips (red solid line) and -26% for long trips (red dotted line) during the 1st week of 2nd LD. Panel (B) shows variation of mobility (all trips) broken down by time of day; national averages are shown as solid lines.

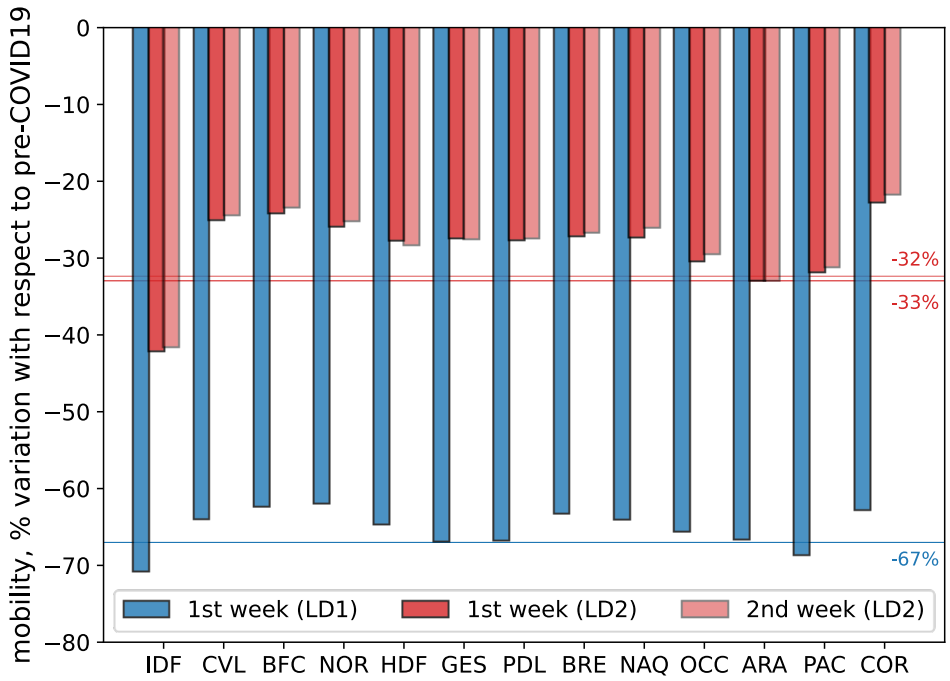

Figure 3. Comparing 1st and 2nd lockdown – regional data. Internal mobility in each of the 13 regions of mainland France, averaged over the 1st full working week of the 1st LD (blue) and of the 2nd LD (dark red – 1st week; light red - 2nd week). Wed 11, 2020 is not included in the 2nd week of the 2nd LD as it is a national holiday.

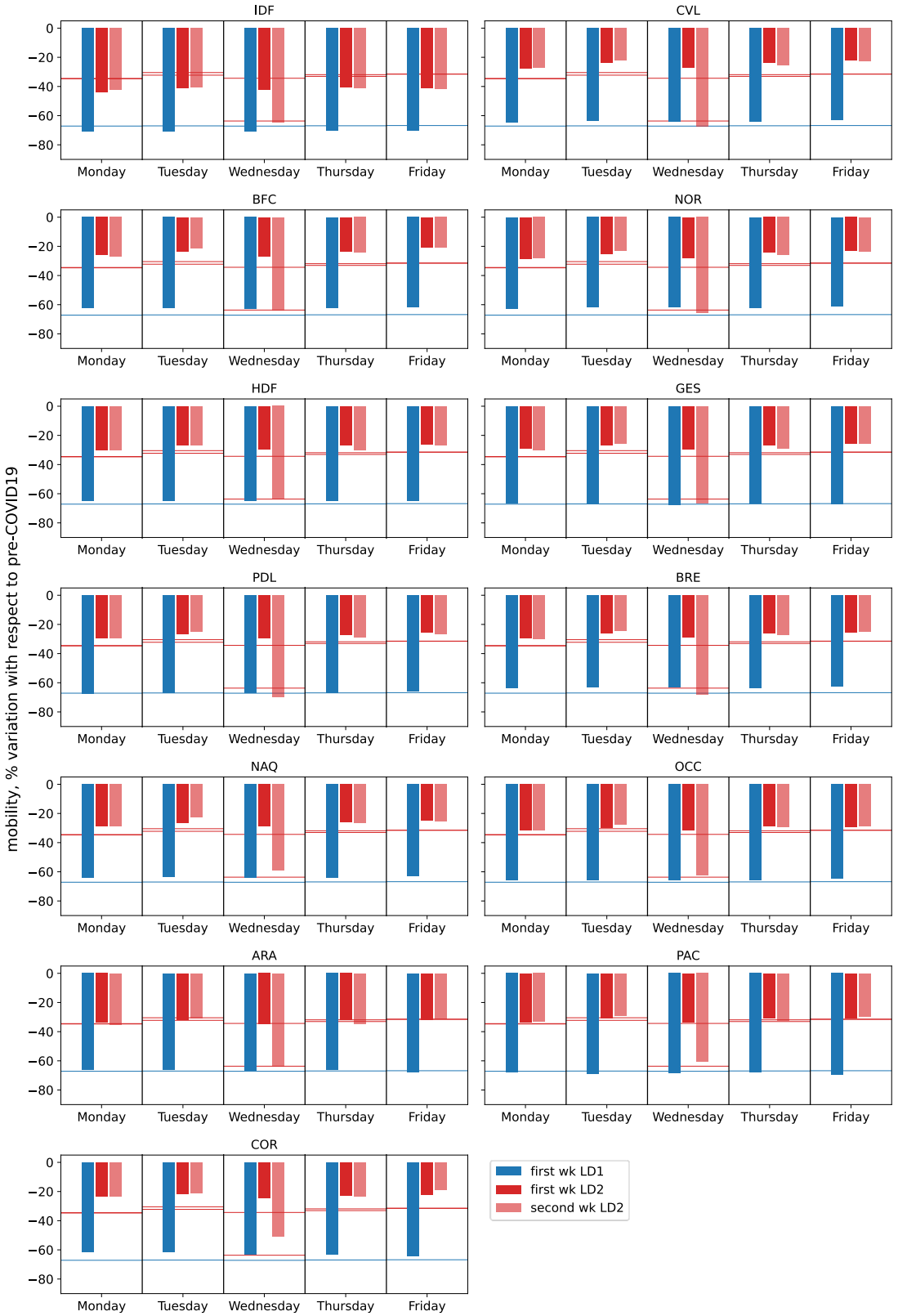

Figure 4. Regional daily variation of internal mobility on each of the days considered: 1st full working week of the 1st LD (blue - Mon 23 to Fri 27 Mar, 2020); 1st full working week of the 2nd LD (dark red - Mon 2 to Fri 6 Nov, 2020); 2nd full working week of the 2nd LD (light red –

Mon 9 to Fri 13, 2020). Lines represent national averages. National averages of the 2nd week of the current LD include Nov 11, 2020 (holiday) in this figure.

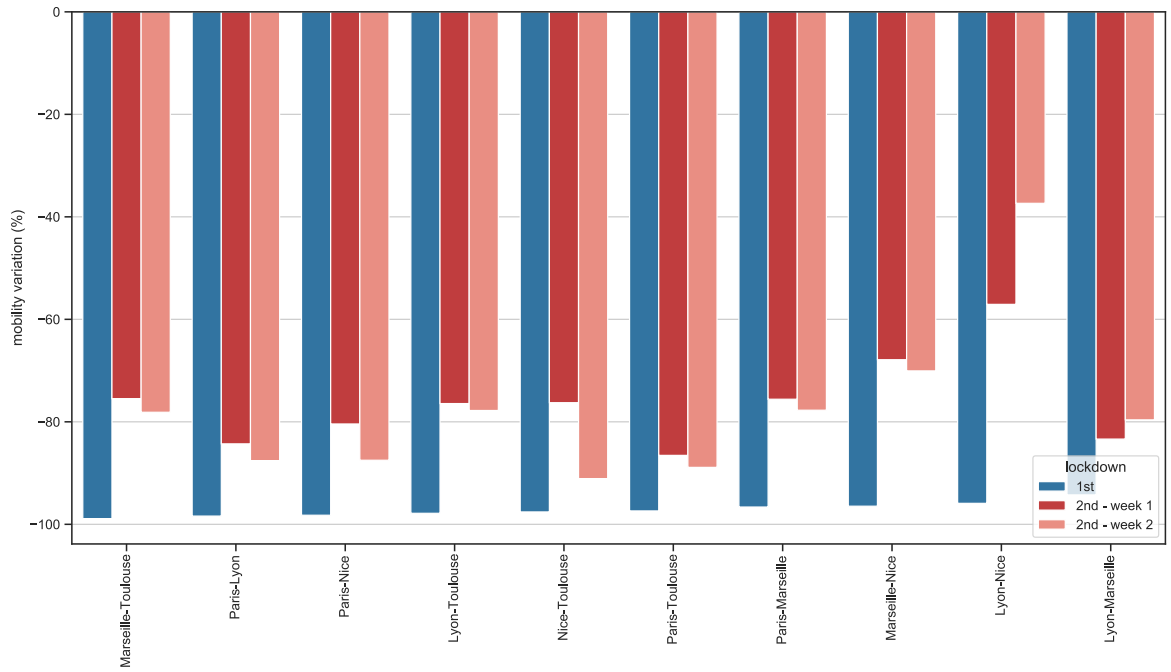

Figure 5. Traffic between main cities. Comparing variation of traffic during the first full working weeks of the 1st and 2nd LD, and the 2nd working week of the 2nd LD (excluding Armistice holiday on Nov 11), among the top 5 French cities by population: Paris, Marseille, Lyon, Toulouse, Nice. Traffic is considered in both directions, and sorted by increasing variation during the 1st LD. Wed 11, 2020 is not included in the 2nd week of the 2nd LD as it is a national holiday.

KEY FINDINGS

Overall mobility (Fig. 1, 2). Mobility was 32% below pre-pandemic levels during the working days of the 2nd full week of the current lockdown (Nov 9, 10, 12, 13). The value was 33% during the 1st week. **This means that the data show roughly no mobility variation from the previous working week** (Nov 2-6). Long-range mobility (trips longer than 100 km) was 26% below pre-pandemic levels. **This represented a marked 9-point increase of long-range mobility with respect to the previous week**, when it was down 35% below pre-pandemic levels. Measured reduction in short-range mobility during the 2nd week of the current LD was stronger than reduction in long-range mobility. This is the opposite of what observed during the 1st week, and during the 1st LD. These results exclude the national holiday of Nov 11 (Armistice du 1918). The anomalous increase in long-range mobility is concentrated on the eve of the holiday, and after the holiday. Long-range mobility on Nov 10 was 16% below pre-pandemic levels; on Nov 12 it was 25% below pre-pandemic levels. Long-range mobility at the beginning of the week – Nov 9 –was 35% below pre-pandemic levels, a value consistent with the 1st week of the current lockdown.

Mobility by age (Fig. 2). Age-stratified analysis of mobility reveals no change with respect to the 1st week of the current LD. Mobility variations within each age class follow global mobility variations between the two weeks. These results are obtained on working days only and exclude Nov 11.

Mobility by time of day (Fig. 2). Little difference from the 1st week of the current LD is visible. A slight mobility reduction is visible before 9am (3-point difference), and a slight mobility increase is visible in the afternoon between 3pm and 5pm (5-point difference). These results are obtained on working days only and exclude Nov 11.

Holiday of Nov 11 (Armistice du 1918, Fig. 4). Mobility on Nov 11, 2020 was markedly lower than in the rest of the week (62% below pre-pandemic levels v 32% of the rest of the week). Long-range mobility was instead higher than the rest of the week: 19% below pre-pandemic levels vs 26%. Low total mobility and high long-range mobility are compatible with the absence of workplace and school commuting - Nov 11 was a holiday. The increase in long-range mobility might be due to an increased number of trips related to the festivity.

Traffic among largest cities (Fig. 5). We analyzed the impact of LDs on traffic among the top 5 most populous (Paris, Marseille, Lyon, Toulouse, Nice). Measured mobility during the 2nd week remained consistently higher than 1st LD. It however decreased with respect to the 1st week of the 2nd LD in 8 out of 10 connections. The largest drop is between Nice and Toulouse (2nd week of current LD: 91% below pre-pandemic levels; 1st week: 76% below pre-pandemic levels). This is larger than the largest drop measured during the 1st week (Paris-Toulouse, 87% below pre-pandemic levels). Mobility increased between Lyon and Marseille (2nd week of current LD: 80% below pre-pandemic levels; 1st week: 83% below pre-pandemic levels), and Lyon and Nice (2nd week of current LD: 37% below pre-pandemic levels; 1st week: 57%; 1st LD: 96% below pre-pandemic levels). These results are obtained on working days only and exclude Nov 11.

LIMITATIONS

- Potential inaccuracy inherent to using mobile phone data to quantify mobility, such as population representativeness, geographical coverage, and heterogeneity in user activity. The data owner has adjusted the data to maximize spatial and temporal representativeness (more details in [2]), and mobile phone data have now a proven record of being a reliable proxy for population-level mobility, for COVID-19 [6], and in other epidemiological contexts [7,8].
- The data record the number of trips among geographic patches (EPCI). As such, it cannot provide information on mobility within this resolution scale.

ACKNOWLEDGMENTS

This study is partially funded by: ANR projects DATAREDUX (ANR-19-CE46-0008-03) and EVALCOVID-19 (ANR-20-COVI-0007); EU H2020 grants MOOD (H2020-874850) and RECOVER (H2020-101003589); REACTing COVID-19 modeling grant.

REFERENCES

[1] E Valdano, J Lee, S Rubrichi, V Colizza, Evaluating the impact of demographic factors, socioeconomic factors, and risk aversion on mobility during COVID-19 epidemic in France under lockdown: a population-based study, Epicx-lab Report #22, Nov 12 2020, https://www.epicx-lab.com/uploads/9/6/9/4/9694133/inserm_covid-19-lockdown2-mobility_20201112.pdf

[2] G Pullano, E Valdano, N Scarpa, S Rubrichi, V Colizza, Evaluating the impact of demographic factors, socioeconomic factors, and risk aversion on mobility during COVID-19 epidemic in France under lockdown: a population-based study, **The Lancet Digital Health,** 2020, https://doi.org/10.1016/S2589-7500(20)30243-0.

[3] French Government, Informations Coronavirus. Retrieved November 12, 2020, from https://www.gouvernement.fr/info-coronavirus

[4] Institut National de la Statistique et des Études Économiques. Retrieved November 12, 2020, from www.insee.fr

[5] Ministère de l'Éducation Nationale. Calendrier scolaire. Retrieved November 22, 2020, from https://www.education.gouv.fr/calendrier-scolaire-100148

[6] N Oliver, B Lepri, H Sterly, R Lambiotte, S Deletaille, M De Nadai, et al., Mobile phone data for informing public health actions across the COVID-19 pandemic life cycle. **Science Advances**, 2020; 6(23), http://doi.org/10.1126/sciadv.abc0764

[7] S Lai, A Farnham, NW Ruktanonchai, AJ Tatem, Measuring mobility, disease connectivity and individual risk: a review of using mobile phone data and mHealth for travel medicine. **Journal of Travel Medicine**, 2019; 26(3), https://doi.org/10.1093/jtm/taz019

[8] CM Peak, A Wesolowski, E zu Erbach-Schoenberg, AJ Tatem, E Wetter, X Lu, et al., Population mobility reductions associated with travel restrictions during the Ebola epidemic in Sierra Leone: use of mobile phone data, **International Journal of Epidemiology**, 2018; 47(5):1562–70, https://doi.org/10.1093/ije/dyy095