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How can the Methods for Measuring the Spatial Inequalities of Access to General Practitioners be Improved?

Illustration in Ile-de-France

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Research on the spatial inequalities of access to primary healthcare, based on "floating density" type indicators, has made it possible to transcend the limits of the traditional indicators of density and distance. Local potential accessibility (LPA) –which takes into account the distances between municipalities by car, the availability of care, and the age structure of the population– is an adaptation of this type of method to the French context, which means that pre-established conclusions can be reconsidered.

To further improve the measurement, the indicator has been refined in various ways in this methodological study: by narrowing down the geographical observation scale —from the level of the municipality to a 200 x 200m grid—, by taking into account the social dimension of healthcare needs and differentiated mobility practices (car, public transport, etc.), and by including the systemic effect of the interactions between healthcare supply and demand on the regional level. This effect takes into account the fact that the probability of resorting to distant healthcare services is much lower when patients have access to local care.

The latter proposition is the one that has the greatest effect on the measurement by adjusting the spatial representation of the levels of accessibility. The change in geographical scale has highlighted situations that are sometimes very contrasting between the different districts in the same municipality. The inclusion of the social dimension in healthcare needs and the diversification of the means of transport and how it is used according to the types of areas have a more local impact on the results. However, for certain socially disadvantaged urban areas, the inclusion of these new dimensions highlights the local difficulties of accessibility to general practitioners.

In a context of reduced density of practitioners and the unequal distribution of human resources in the healthcare sector, one of the major public health issues in developed countries consists of ensuring that the population has equal access to healthcare services in their region. Even though the average medical density in France is now equivalent to that of all the countries in the Organisation for

Economic Cooperation and Development (OECD) (3.3 doctors per 1,000 inhabitants), the Directorate for Research, Studies, Assessments and Statistics (French Ministry of Health) [Direction de la Recherche, des Études, de l'Évaluation et des Statistiques, DREES] is predicting a gradual reduction in medical density until 2025. This specifically relates to private healthcare services and primarily general practitioners

(Bachelet et al., 2017). This drop in medical density is exacerbated by geographical disparities between, and above all, *within* French regions, which negatively affects accessibility to varying degrees—that is to say the possibility of having access to the nearest healthcare professionals.

Research into the spatial inequalities of accessibility to primary care uses "float-

ing density" type indicators, or the Two-Step Floating Catchment Area (2SFCA) (see "Sources and Method" inset on p.7) method used to complement the measurements obtained based solely on the calculation of density or distance. Created by the DREES and the Institute for Research and Information in Health Economics (IRDES) for the construction of a local potential accessibility (LPA) indicator for private general practitioners, this methodology then provided a basis, in 2017, for a regulatory framework that identified the areas lacking in general practitioners.

On the international level, the latest research work has addressed the various aspects of accessibility to further develop the concepts (in particular, Delamater, 2013; Mao and Nekorchuk, 2013; Luo, 2014; and Langford et al., 2016). The progress made and the availability of big data in France makes it possible to envisage new developments.

In this article, we have set forth various suggestions for improving the local potential accessibility (LPA) indicator on the basis of scenarios that make it possible to measure results' sensitivity to the new hypotheses tested. The first development involves taking into account a smaller geographical observation scale, which improves the measurement of the issue of infra-municipal accessibility and removes the limits linked to municipal boundaries in the analysis. The second involves taking into account the social dimension to assess the healthcare needs in order to take into account the poorest populations' more frequent consultations with a general practitioner, which is mainly due to their poor general state of health, as well as the types of healthcare use that are more directed at general practitioners than towards specialists, for financial (extra billings) or cultural reasons. The third development integrated differentiated mobility practices according to the types of area into the analysis, in particular to take into account public transport in urban areas. And the fourth development is a new approach to the spatial interactions between healthcare supply and demand (see Context, p.5), which assesses real behaviours in the spatial consultation of GPs, by taking into account the fact that if healthcare services are available within close proximity, patients tend to travel less further and inversely.

This article focuses on the Ile-de-France area, in order to take into account the specificities of a region that is multi-polarised and diverse on the social and morphological levels. Indeed, this region's conurbations are exceptionally dense and have a very well-serviced public transport network. At the same time, it has a significant surface area of peri-urban and rural areas in the outer suburbs, in which the issues of healthcare access are entirely different. This study outlines the main results of this methodological work, which were published in their entirety in a working document. (Lucas-Gabrielli, Mangeney, 2019).

Changing the geographical observation scale from the municipality to the grid

Consultations with general practitioners were related to proximity: 60% of the consultations with a general practitioner required a journey of less than 5 minutes by car from the patient's municipality (Barlet et al., 2012). The recent availability of socio-demographic data on the scale of 200 x 200 metre grids provided by the INSEE, on the one hand, and the obtention —after the project's validation by the French Data Protection Authority (CNIL)— of data provided by the French National Health Insurance (Assurance Maladie) concerning the location of healthcare professionals at the same geographic level, on the other hand, made it possible to assess local potential accessibility (LPA) on the infra-municipal level.

The shift from a municipal indicator —and the conventional hypothesis of a negligible access time for all the consultations in the patient's municipality of residence— to an indicator measured on an infra-municipal scale, which comprised access times that are more realistic for these consultations, mechanically modified the measurement by globally reducing the average levels of accessibility indicators on the regional level and by exacerbating the indicators of "poor" accessibility to care in all the *départements* of the Ile-de-France region—even more so in the dense *départements* of Paris and its suburbs (the *petite couronne*). Hence, it is not possible to directly compare the levels of accessi-

bility measured by municipal local potential accessibility (LPA) with the indicators calculated in this study, which were measured on an infra-municipal level. But, this change of scale does highlight infra-municipal inequalities in terms of access to general practitioners.

A re-examination of the quantification of healthcare provision and demand

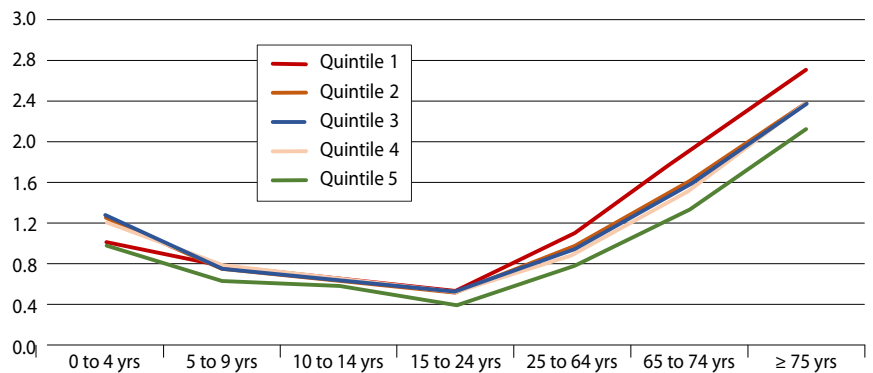
Healthcare provision is defined in terms of medical activity rather than on the number of doctors. Hence, it is not about overlooking the effect of mixed practices—situations in which doctors practise in various practices, or even the choice of practitioners, who may decide to allocate their working hours to different activities (for example, between a private practice and a salaried activity in a hospital or in Maternal and Child Protection Services (PMI)) or mediate between professional and personal activities. This amounts to considering that the reduced activities do not constitute unused healthcare that could be exploited, as the reduced activities of GPs were deliberate rather than imposed (Samson, 2011). We will not therefore apply the hypothesis of national local potential accessibility (LPA), which conventionally considers that the minimum activity of a GP is 3,600 medical acts, because this hypothesis does not seem to be suitable for the Ile-de-France region, where there are significant disparities in organisation and practice between different areas (for example, only 71% of exclusively private doctors with only one practice in the Seine-et-Marne *département*, but 87% in the Yvelines *département*). Healthcare provision is also deliberately "underestimated", because neither the doctors aged over 65 nor the proportion of the activity that exceeds 6,000 annual medical acts per doctor are taken into account. Indeed, the accessibility measured should not be dependent on the "overactivity" of general practitioners, who tend to compensate for the access difficulties in their area by extending their daily working hours or working after the age of retirement. Nevertheless, the activity of the health facilities or of some doctors with specific activities has been integrated into the model.

These different choices clearly influence the quantification of the healthcare provision. In Paris, for example, taking into account the observed private activity, limited by the greater frequency of mixed activities, very significantly restricts the available healthcare provision. In Seine-Saint-Denis, the inclusion of the health facilities significantly increases the available healthcare services compared with other *départements*.

The inclusion of the social dimension of needs has a local impact on the level of accessibility

As far as demand is concerned, healthcare needs were studied by taking into account age — which is a major determinant in the consultation of a general practitioner—, as well as the social dimension. Indeed, in France, literature has shown that with a comparable age and health, the poorest individuals consulted general practitioners more frequently than the richest (Devaux,

G Consumption of healthcare provided by general practitioners according to age and the median income quintile per consumption unit of the municipality of residence in Ile-de-France (relative weight*)

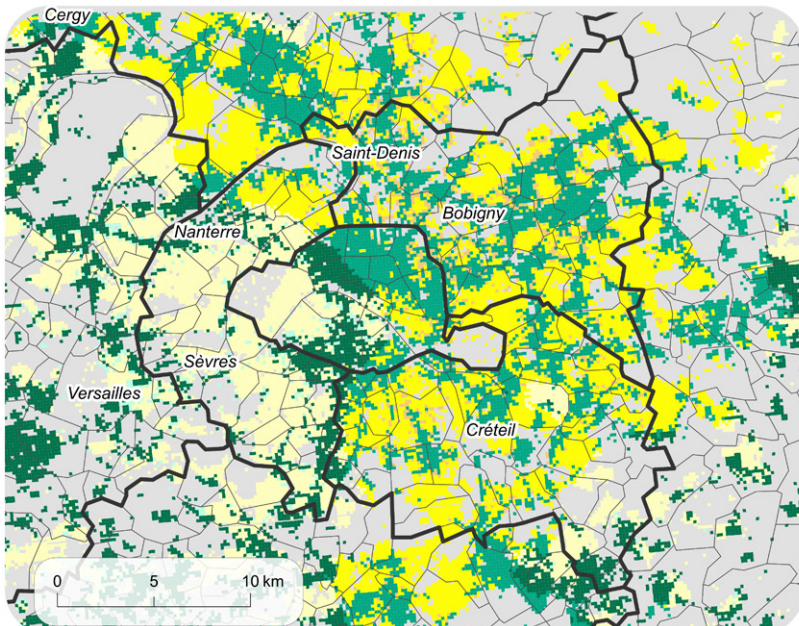


* The applied weight corresponds to the relative consumption of each age group and income quintile compared with the total regional average.
Reading: The graph illustrates a higher consumption of treatment by general practitioners for each age in the poorest Ile-de-France municipalities (quintile 1) and lower consumption in the wealthiest municipalities (quintile 5).
Sources: SNDS, all schemes, 2015 – INSEE - Produced by IRDES/ORS. [Download the data](#)

2013). The exploitation of medical and administrative databases in the *départements* of the Ile-de-France region confirm that the annual consumption of healthcare provided by general practitioners is generally greater for each age category in the

poorest Ile-de-France municipalities, and lower in the wealthiest municipalities— differences that are particularly marked at extreme ages (see Graph). Hence, persons aged 75 or over consult a general practitioner —measured by the number

M1 Comparison of the levels of accessibility with or without social weighting (means of transport: by car)



Median: 2.51 consultations and visits per inhabitant

IM-LPA lower than the median. Accessibility ...

- Bright yellow:** decreases further when the social dimension of needs is taken into account
- Light yellow:** increases but remains lower than the median
- Light green:** increases and becomes higher than or equal to the median

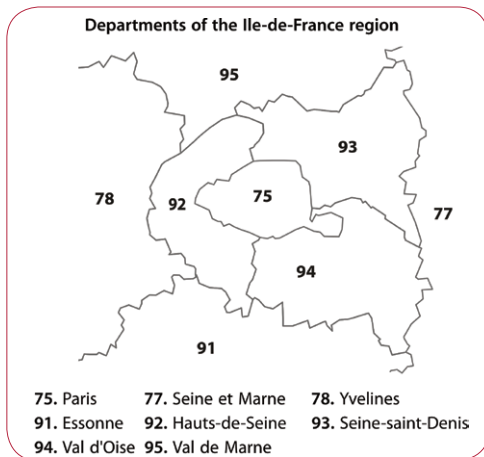
IM-LPA higher than or equal to the median. Accessibility...

- Dark green:** increases further when the social dimension of needs is taken into account
- Medium green:** decreases but remains higher than or equal to the median
- Orange:** decreases and becomes less than the median
- Grey:** Uninhabited grids

Reading: The comparison of the infra-municipal LPA (IM-LPA) between the two scenarios was carried out by differentiating the grids according to the IM-LPA, without taking into account whether the social dimension of needs is lower or higher than the regional median (2.5 consultations and annual visits). The regional median was measured at the grid level by adopting the scenarios of the national LPA (weighting of needs according to age and private car as the means of transport), but by reducing the minimal threshold of annual medical acts to 250. It served as a benchmark for all the comparisons.

The grids in bright yellow have accessibility to the general practitioner lower than the regional median and this accessibility is further reduced when the social dimension is taken into account. They are located mainly to the north and east of Paris.

Sources: INSEE, SNIIRAM 2015, CNAM, (Distance calculation) IRDES/French Biomedicine Agency – Produced by: IRDES, ORS IDF.



of annual consultations— 27% more frequently in the poorest municipalities (first income quintile) compared with the wealthiest municipalities (fifth quintile).

The inclusion of this social dimension of needs in the modelling reduced the levels of accessibility in a certain number of socially deprived grids in Seine-Saint-Denis, for example, while it increased them in the wealthier areas in and to the west of Paris (see Map 1). Nevertheless, there was little change in the equilibrium between the grids. There were situations of relatively low accessibility to GPs in the wealthier areas of the Hauts-de-Seine, for example, while more favourable situations

existed in a number of municipalities in Seine-Saint-Denis.

The hypothesis according to which the consultation of a GP depends on the distance that needs to be travelled, as well as on other general practitioners who are available at a closer distance, has the greatest impact on the results

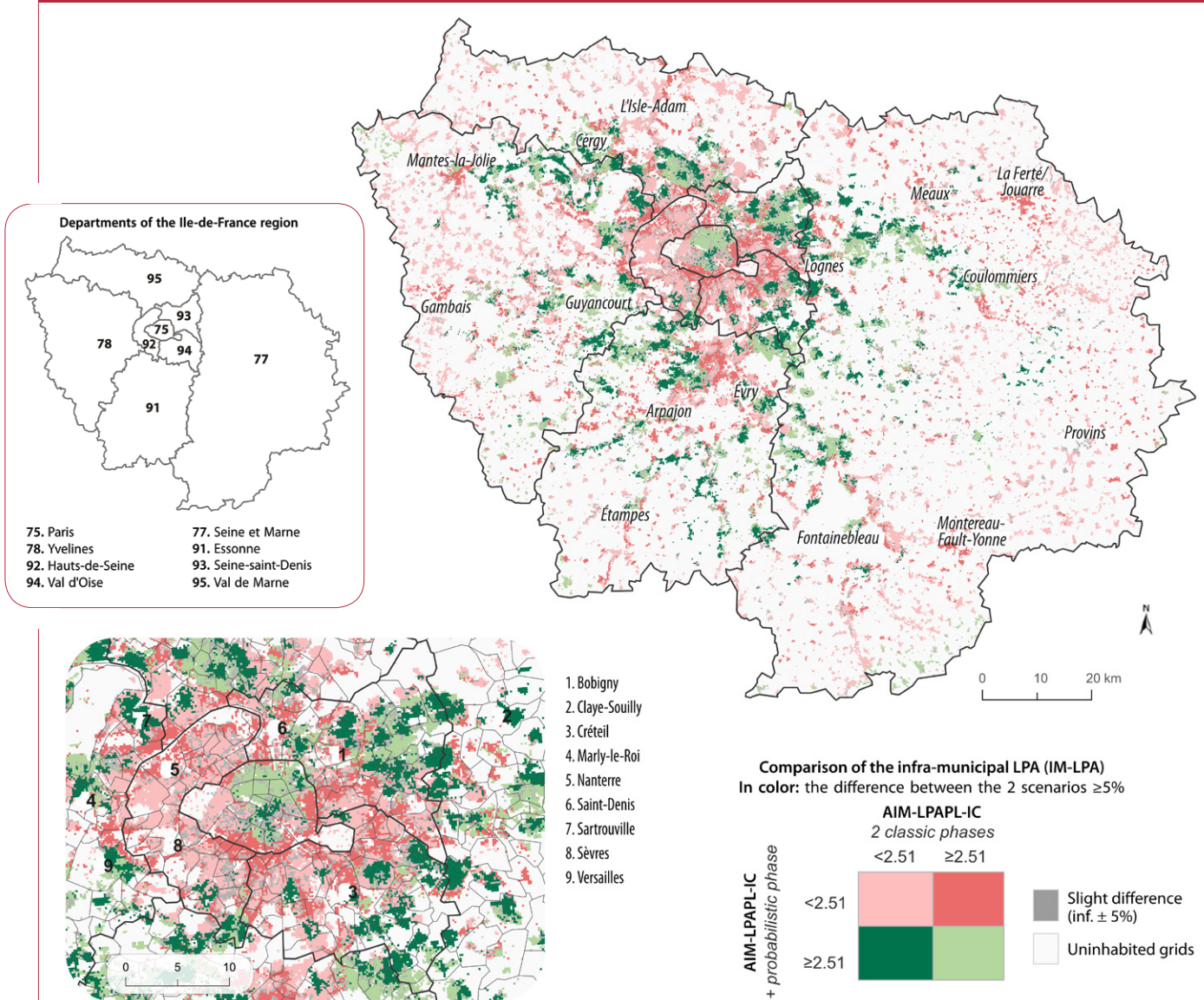
The inhabitants of an area will not all consult doctors located near their homes. They tend to use the various accessible and available healthcare services. To better assess the healthcare demand that locally con-

cerns general practitioners (Luo, 2014), it is essential to integrate an extra stage in the calculations to take into account the probability of the use of care, a probability that depends on the distance and availability of the healthcare services as well as the volume of the alternative accessible and available healthcare (for more details, see Lucas-Gabrielli and Mangeney, 2019).

The inclusion of this effect has a particular impact on certain areas, such as Mantes-la-Jolie, Gambais, Montereau-Fault-Yonne, La Ferté-sous-Jouarre, and l'Isle-Adam in the outer suburbs (in dark red), where this parameter takes accessibility to a level that is higher than or equal to the median to a lesser level (from "good" accessibility

M2

Integration of a differentiated probability of healthcare use according to the local context of the healthcare provision



Sources: INSEE, SNIIRAM 2015, CNAM, (Distance calculation) IRDES/French Biomedicine Agency – Produced by: IRDES, ORS IDF.

to "poor" accessibility). Indeed, in these generally rural areas where the healthcare provision is mainly concentrated in the town centre(s), the patients travel further and the demand converges on the town's doctors.

Inversely, certain grids (in dark green) shift from a lesser or equal level at this threshold ("poor" accessibility) to a higher level at the same threshold ("good" accessibility). This is true of Versailles, Marly-le-Roi, Claye-Souilly, and Sartrouville, for example (Map 2). Indeed, the municipalities around these towns have significant healthcare services, to such an extent that the populations of these municipalities are able to use them without having to resort to the healthcare services in Versailles,

Marly-le-Roi, and so on. The pressure on the doctors in these towns is therefore relieved to the benefit, in particular, of the inhabitants of these towns.

The integration of the multimodality of travel locally refined the analyses even though it did not radically modify the regional equilibria

The data from the Global Transport Survey (Enquête globale transport, EGT) highlighted the fact that in the Ile-de-France region very little healthcare-related travel was carried out by car in the densest areas of the region and that the multimodality of travel needs to be integrated into

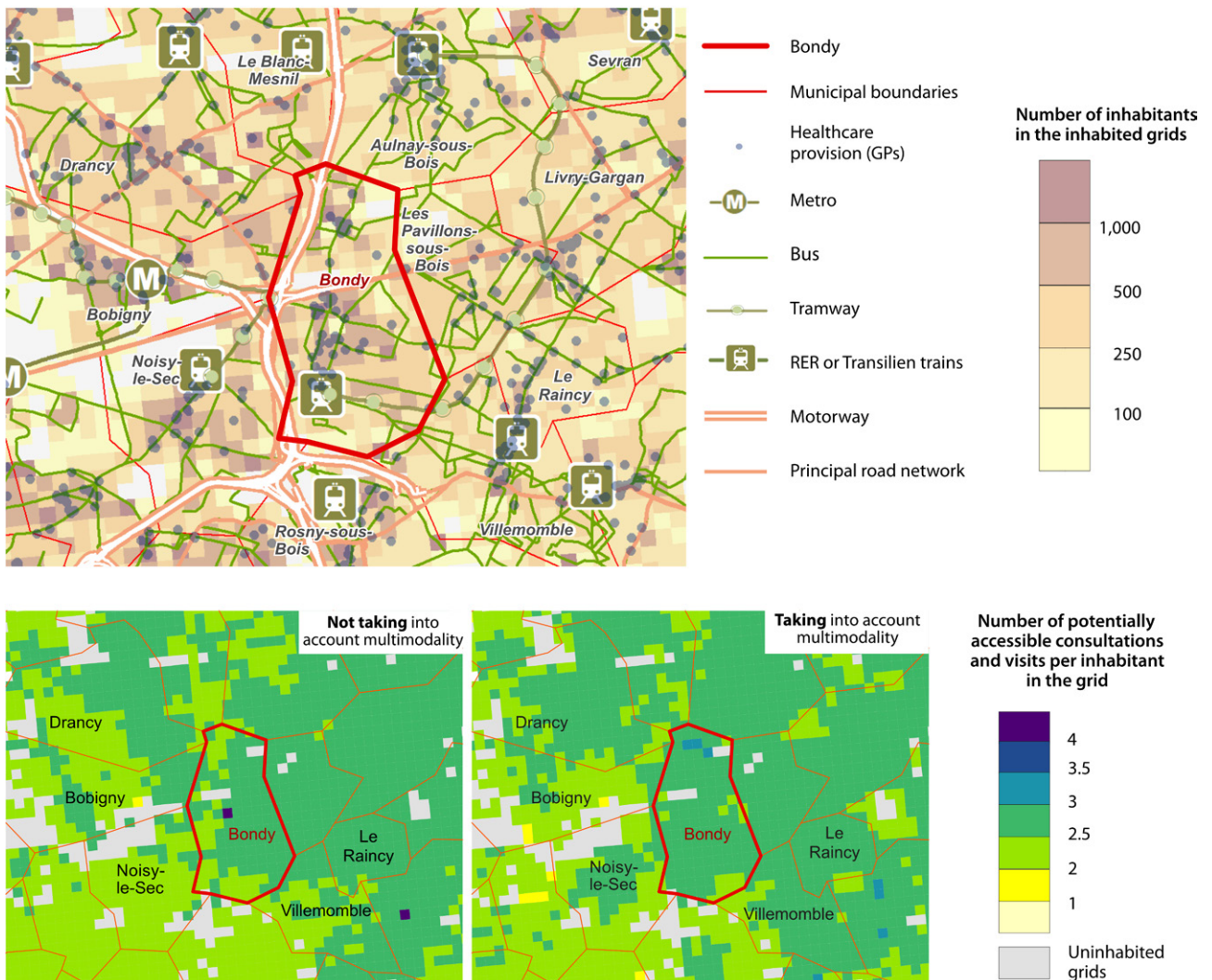


This article was based on the research work conducted jointly by the Institute for Research and Information in Health Economics (IRDES) and the Ile-de-France Régional Health Observatory (ORS IDF) on the inequalities of spatial access to GPs. It is based on the working paper n°80 of July 2019, published jointly by IRDES and ORS IDF: "Accessibility to General Practitioners in the Ile-de-France Region: A Methodology for Measuring Infra-communal Inequalities" by Lucas-Gabrielli V. (IRDES), and Mangeney C. (ORS Ile-de-France).

the calculations, in a differentiated way depending on the types of area. Hence, in the hyper centre of Paris, only 9% of persons who consulted a doctor did so in a

M3

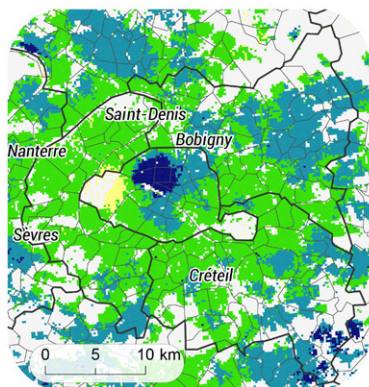
Infra-municipal local potential accessibility (IM-LPA) in Bondy, with or without taking into account the multimodality of travel



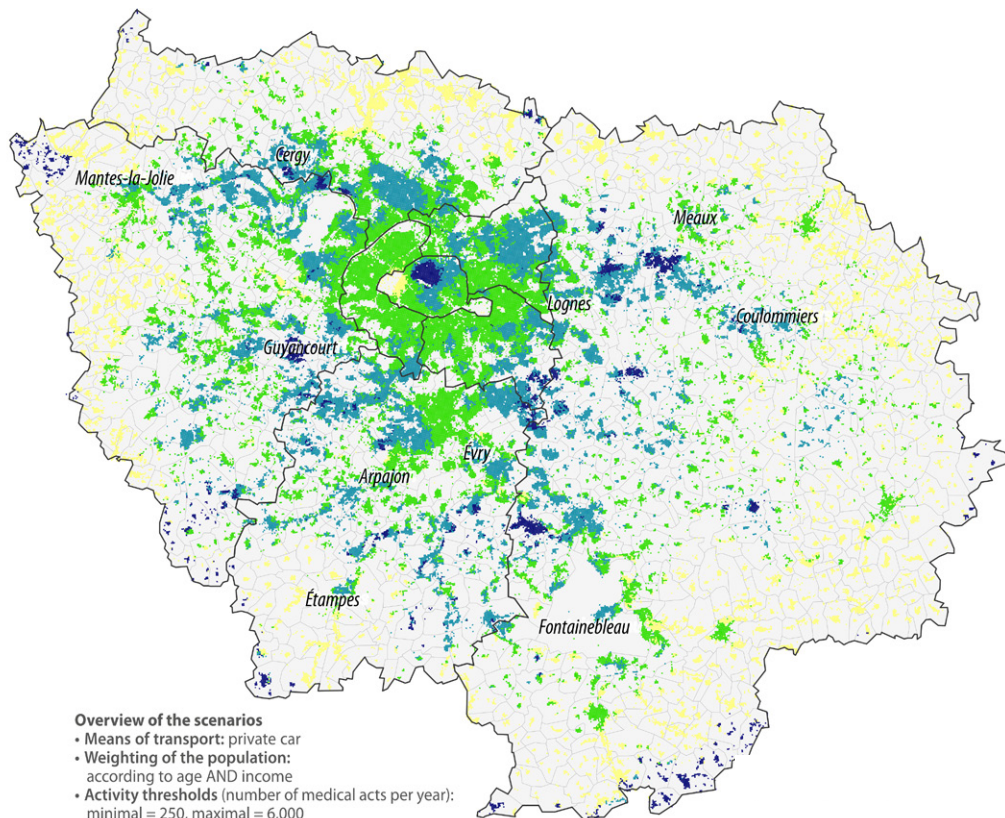
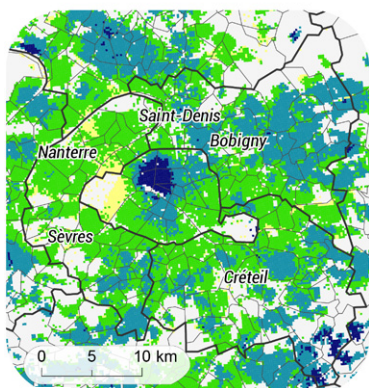
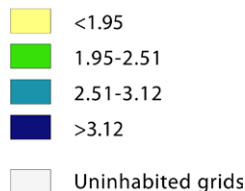
Sources: INSEE, SNIIRAM 2015, CNAM, (Distance calculation) IRDES/French Biomedicine Agency – Produced by: IRDES, ORS IDF.

M4

The results of different scenarios



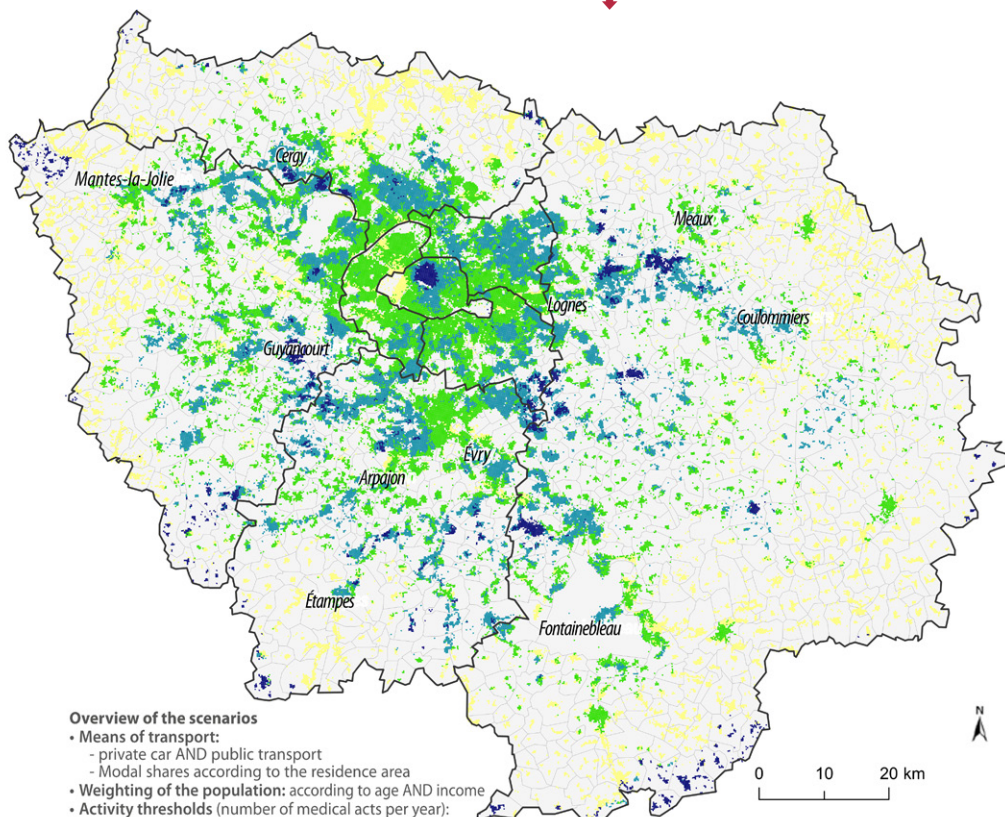
Number of potentially accessible consultations and visits per inhabitant of the grid



Overview of the scenarios

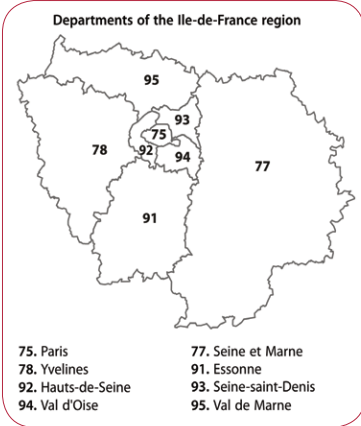
- Means of transport: private car
- Weighting of the population: according to age AND income
- Activity thresholds (number of medical acts per year): minimal = 250, maximal = 6,000
- Including the effects of competition

Infra-municipal LPA Taking into account the effects of competition Integrating the multimodality of travel



Overview of the scenarios

- Means of transport:
 - private car AND public transport
 - Modal shares according to the residence area
- Weighting of the population: according to age AND income
- Activity thresholds (number of medical acts per year): minimal = 250, maximal = 6,000
- Including the effects of competition



Sources: INSEE, SNIIRAM 2015, CNAM, (Distance calculation) IRDES/French Biomedicine Agency – Produced by: IRDES, ORS IDF.

private car, while travelling on foot or by public transport were very often used (in 47% and 39% of the cases respectively). The situation is the opposite for the inhabitants of rural municipalities, where the car is the main form of transport (84%).

The integration into the measurement of the levels of accessibility to general practitioners of the multimodality of travel and modal practices differentiated according to the types of areas locally refined the analysis when the transport public network is significant. For example, the town of Bondy (in Seine-Saint-Denis) has a

SOURCES AND METHODS

Two-Step Floating Catchment Area (2SFCA) measurements are based on the construction of floating areas that take into account the surrounding healthcare provision and demand. They are calculated in two phases. The first phase consists of calculating the density ratio, which links the volume of the resource concerned located in the geographical unit j to the population located just around j up to a certain reference distance d . The second stage consists of adding up, for each geographical unit of residence i , the ratios previously calculated for all the resources located at a distance less than the reference distance d . The result provides the density.

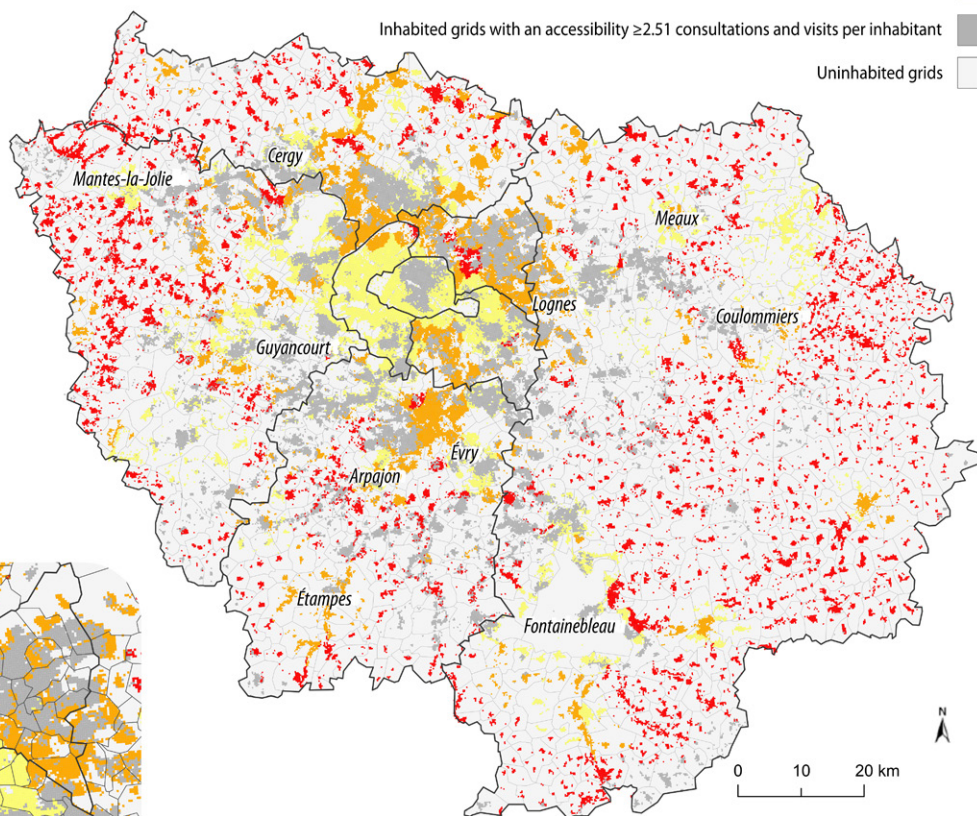
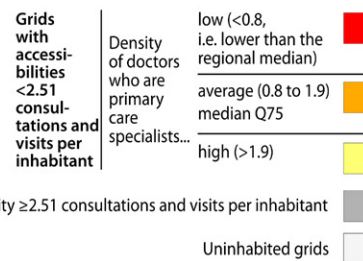
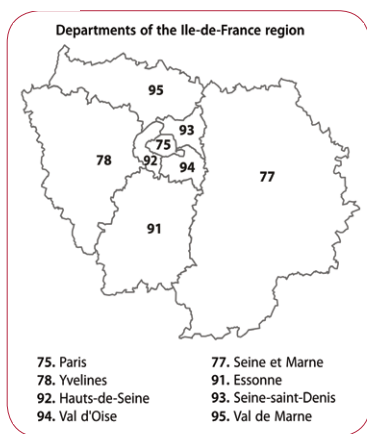
This method, used to define local potential acces-

sibility (LPA) on the municipal level, was refined via a change of scale, taking into account the social dimension of the needs and mobility practices that combine the car and public transport, as well as by a better identification of the interaction between healthcare provision and demand.

The construction of the indicator was based on the use of data provided by different partners (CNIL agreement): the National Health Insurance Fund (CNAM) (healthcare provision), the Health Insurance Local Branch CPAM in the Val-d'Oise (the actual flow of healthcare consumption), the Institute for Urban Planning and Development (IAU IDF), IDF Mobilités, IRDES, and the French Biomedicine Agency (ABM) [distance-time matrices].

M5

Levels of accessibility to general practitioners according to the alternative healthcare provided by primary care specialists



Overview of the scenarios

- Means of transport: private car AND public transport (modal shares according to the residence area)
- Weighting of needs: according to age AND income + the differentiated consultation time (+ 5% for the wealthiest grids)
- Activity thresholds (number of medical acts per year): minimal = 250, maximal = 6,000

Reading: In this case, the specialists concerned are paediatricians, medical gynaecologists, obstetric and medical gynaecologists, geriatricians, private psychiatrists, and psychiatrists who work as private and public sector professionals. Healthcare provision was recorded in the municipality and the neighbouring municipalities were then linked to the municipality's population and neighbouring municipalities (thereby creating evened-out densities). Significant alternative provision refers in this case to an evened-out density greater than 1.9 for 10,000 inhabitants (third quartile), low provision to an evened-out density lower than 0.8 (median), and intermediary provision was located between the two thresholds.

Sources: INSEE, SNIIRAM 2015, CNAM, (Distance calculation) IRDES/French Biomedicine Agency – Produced by: IRDES, ORS IDF.

highly developed road network, but it also has a significant public transport network (see Map 3). The taking into account of the multimodality of travel increases the measurement of the level of accessibility to general practitioners in most of the municipality's grids. At the same time, this also modifies the accessibility measured in the surrounding towns. All the same, on a regional level, the integration of multi-modal practices into the indicator has little effect on the conclusions reached by preceding measurements (see Map 4).

The integration of systematic interactions in modelling must also include the complementarities between healthcare professionals: indeed, a lack of general practitioners will not have the same impact, depending on the characteristics of the populations concerned, as well as the availability of primary care specialists. And, in an even more integrated manner, the absence of primary care specialists (gynaecologists, paediatricians, or psychiatrists in particular) in a region will have an impact on the pressure on general practitioners (Buyck et al., 2013). An initial simulation was carried out that included all the grids

in which accessibility to general practitioners may be considered as poor with regard to the alternative availability of specialists whom the patients could potentially consult (Map 5). This simulation led us to significantly revise the conclusions that might have been reached previously, with, this time, regions affected by reduced accessibility, which are generally located in the socially disadvantaged or more rural areas in regions. The combined inclusion of the social dimension to take into account the healthcare needs and the absence of primary care specialists makes it easier to highlight issues connected with accessibility to a general practitioner in the most fragile regions.

* * *

Many questions remain unanswered: the validity—particularly temporal—of the data, the validity of the calculations over the long term due to the rapid and sometimes radical changes in healthcare provision on a local level, due to the closures of practices and departures due to retirement, the integration of the financial and temporal dimensions of the accessibility,

and the distinction between consultations and visits, with the latter occurring in a more restricted perimeter around the doctor's practice, while being more time consuming for the doctors.

Lastly, this study has once again highlighted the importance of the normative choices that need to be made in any measurement of spatial accessibility to healthcare—normative choices that should be discussed with the actors of the healthcare system. With a view to helping in decision making and public policies, the modelling of the levels of spatial accessibility to GPs can only be finalised by including—using a proactive approach—phases of statistical calculation and geographical representation of the results on different scales, and also interchange with institutional and/or local partners (Regional Health Agencies (ARS), local elected officials, healthcare professionals, and users). This was done to refine and validate the selected scenarios by comparing them to the perceptions of the users in a given region, but also, ultimately, in order to take into account the specificities of certain regions or certain populations. ♦

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