# 1.1 Geographical accessibility (A-16)

## 1.1.1 Documentation sheet

Description	Percentage of women aged 15-49 years old living within 30 minutes of the nearest maternity service
Calculation	Numerator: the number of women aged 15-49 years old living within 30 minutes of the nearest maternity service.
	Denominator: total number of women aged 15-49 years old living in the same area.
	Results are presented by region.
	More detailed analysis, at the national level, are available in KCE report 323.1
Rationale	This indicator gives an overview of another dimension of access to health care: the geographical accessibility. Access to health care is a complicated concept and is largely dependent on the characteristics of the population and on the available health care facilities. The WHO recommends to use "geographic information regarding the spatial distribution of available health services in relation to population health needs. The geographic location of health services has a direct impact on health outcomes within countries, by affecting how quickly patients can seek care when faced with illness and injuries. Measuring the availability of and the physical accessibility to health services contributes to understanding the performance of health systems which facilitates the development of evidence based health policies." <sup>a</sup>
	By default, we used geographical accessibility to maternity services as a proxy for geographical accessibility to health services because of the availability of the data. However geographical accessibility to an emergency department would have been a better proxy. In the literature, effects of distance (or travel time) on the utilisation of maternity services have been extensively studied. An evidence review was published in 2015 <sup>2</sup> and no clear conclusions have been made about the association between travel time or distance between the mother's place of residence and maternity services and adverse outcomes. Even if most of the studies found no significant influence of travel time/distance on perinatal mortality <sup>3,4</sup> or on stillbirth <sup>3</sup> , higher distance could lead to an increase of stress and anxiety in pregnancy. <sup>5</sup> Other studies show an association with increased risks of foetal heart rate anomalies, meconium-stained amniotic fluid, and antenatal hospitalisations. <sup>4,6</sup> The likelihood of out-of-hospital delivery also increases with travel time. <sup>4,6,7</sup>
Limitation	This indicator gives the percentage of woman 15-49 with access to at least 1 maternity service within 30 minutes. However, the place of birth may be located further. In general, the choice of the hospital depends on women's preference and may differ from the nearest hospital of the mother's place of residence.
	In recent health service research, distance is commonly measured as car travel time over a road rather than the Euclidian distance between two points. <sup>8,9</sup> There is, however, no guidance on what a reasonable distance or travel time is. Therefore, a coverage of maternity services in terms of (road) travel time within 30 minutes places to a certain extent an arbitrary limit on proximity. It is, however, in accordance with the travel time in studies for other countries, such as France, the Netherlands and England. <sup>10-12</sup>
	The indicator is based on the scenario that women can reach a maternity service by car and does not account for emergency transport (such as ambulance) or public transport.
	Moreover, we cannot identify the risk level of the pregnancy. Thus, we cannot calculate the percentage of high-risk pregnancies in women aged 15-49 years old living within 30 minutes' of the nearest hospital site with a maternity intensive care service.
	Finally, only Belgian maternity services are taken into account so that the number of maternity services that can be reached in 30 minutes is likely to be underestimated for women living close to the national border.

<sup>&</sup>lt;sup>a</sup> <u>https://www.who.int/choice/geoaccess/en/</u>

Data source	National Geographic Institute; FOD – SPF; Statbel					
Technical definitions	This indicator calculates the travel time between a woman's place of residence and the nearest maternity service using a Geographic Information System (GIS). The geographical location of each maternity service is based on the official address of the maternity service as provided by the FOD – SPF in April 2019. A total of 104 different maternity services are geocoded to the latitude and longitude of the official site address.					
	For each maternity service, the area within an isochrone is calculated by the NGI – IGN using the Network Analysis module of ArcGIS. The area within an isochrone comprises all streets or street segments around a maternity service that can reach the maternity service within a specified time limit, taking into account traffic on the chosen time reference point. In ArcGIS, isochrones are constructed with a propriety solver, the network service area solver, based on an extension of Dijkstra's algorithm for finding shortest paths. <sup>13</sup> TomTom historical traffic data speed profiles are used, representing the normal traffic situation in Belgium on an average weekday: times represent average travel time by car for a specific street segment for the last two years, taking into account possible distorting factors like outlier driver behaviour, exceptional weather conditions, road works or traffic accidents. <sup>14</sup>					
	From Statbel, the NGI – IGN received the number of Belgian women between 15 and 49 years old in 2016, per European Environment Agency (EEA) reference grid cell. <sup>15</sup> The EEA reference grid subdivides Belgium geographically in cells with a resolution of 1km <sup>2</sup> . For each of these grid cells, it is determined per maternity service if they fell within the isochrone. For cells falling partly in and partly out of the isochrone, two scenarios are defined:					
	• Intersects area: the cell needs to be contained entirely or partially within the area to count. In this definition, the number of women that can reach a maternity service within the time limit can be overestimated because grid cells that fall partially outside of the isochrone are counted as well.					
	• Within area: the cell needs to be contained entirely within the area to count. In this definition, the number of women that can reach a maternity service within the time limit can be underestimated because grid cells that fall partially outside of the isochrone are not counted. This definition also creates artificial areas of unreachability at the borders when these coincide with the isochrones.					
	More details can be found in KCE report 323. 1					
	Regions are defined from the point of view of the women living in that region, i.e. all women between 15 and 49 years old in 2016 living in a reference grid cell that falls (at least partially) in the given region are considered. This implies that regional results slightly overlap, as a very limited number of reference grid cells can spread over two different regions. In addition, isochrones can spread over two different regions. A woman is considered to have access to a maternity service within 30 minutes as soon as such a maternity service falls within the isochrone, even if the maternity service is located in another region.					
Dimension	Accessibility					
Related	Percentage of women aged 15-49 years old living within 15 minutes (45 minutes) of the nearest maternity service (secondary indicator)					
indicators	Median number of maternity services that can be reached within 30 minutes (15; 45 minutes) by women aged 15-49 years old (secondary indicator)					

### 1.1.1 Results

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Based on the 2016 population, more than 99% of women between 15 and 49 years old can reach one or more maternity services within 30 minutes, given normal traffic conditions on an average weekday (see Table 1 and Figure 1 for intersects area definition, Table 2 and Figure 4 for within area definition). The ones who cannot reach such a service in 30 minutes live mostly near the border and in the south of the country (no information is available on women living in these areas actually traveling across the borders to deliver). In the Brussels Capital Region, all women between 15 and 49 years old can reach one or more maternity services within 30 minutes. In Flanders, this proportion is very close to 100% (99.9% or 99.7% depending on the definition, see Table 1 and Table 2), and in Wallonia it is slightly lower (99.5% or 98.9% depending on the definition, see Table 1 and Table 2).

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The 30 minutes limit represents an average traffic situation on a weekday. A 15 minutes limit can be used as a conservative limit to assess the current reachability in heavy traffic. A 15 minutes isochrone average weekday traffic is therefore considered as a stand-in for a hypothesised 30 minutes isochrone heavy traffic. In other words, we assume that the distances that can be reached within 15 minutes in average weekday traffic, take 30 minutes in heavy traffic. As heavy traffic is mostly problematic in large cities, this method clearly underestimates the distance that can be reached outside these large more congested cities. Still, globally, in Belgium, a large part of the considered population (84% to 92% depending on the definition, see Table 1 and Table 2) can reach one or more maternity services within 15 minutes, given normal traffic conditions. More importantly, this proportion is close to 100% in the Brussels Capital Region (see Table 1 and Table 2), as well as in and around large cities (see Figure 2 and Figure 5). Women who cannot reach such a service in 15 minutes live mostly away from large cities, where congestion is less an issue (see Figure 2 and Figure 5).

Finally, within 45 minutes, given normal traffic conditions on an average weekday, almost all women between 15 and 49 years old can reach one or more maternity services, in the three regions of the country (see Table 1 and Figure 3 for intersects area definition, Table 2 and Figure 6 for within area definition).

The median number of maternity services that can be reached by a woman between 15 and 49 years within 30 minutes in average traffic conditions is 11 or 13 depending on the definition used. That means that half of the population can reach at least 11 different maternity services within 30 minutes. This number is the highest in Brussels (22 or 28), the lowest in Wallonia (8 or 9) and close to the Belgian one in Flanders (12 or 14) (see Table 1 and Table 2). A large part of Flanders, Brussels and the northern part of Wallonia have access to eight or more maternity services within 30 minutes, given normal traffic conditions on an average weekday (see Figure 1 and Figure 4).1 Using a time limit of 15 minutes, the median number of maternity services that can be reached by a woman between 15 and 49 years is still 11 or 12 in the Brussels Capital Region. It is considerably lower, but still above 1 in Wallonia and Flanders (2 in Wallonia and 2 or 3 in Flanders, depending on the definition) (see Table 1 and Table 2).

(ID) Indicator	Belgium	Year	Flanders	Wallonia	Brussels
Percentage of women aged 15-49 years old living within 30 minutes of the nearest maternity service	99.8%	2019	99.9%	99.5%	100%
Percentage of women aged 15-49 years old living within 15 minutes of the nearest maternity service	92.3%	2019	94.4%	85.8%	100%
Percentage of women aged 15-49 years old living within 45 minutes of the nearest maternity service	100%	2019	99.9%	99.9%	100%
Median (Q1-Q3) number of maternity services that can be reached within 30 minutes by women aged 15-49 years old	13 (8-22)	2019	14 (9-21)	9 (6-13)	28 (24-29)
Median (Q1-Q3) number of maternity services that can be reached within 15 minutes by women aged 15-49 years old	3 (2-7)	2019	3 (2-5)	2 (1-4)	12 (11-13)
Median (Q1-Q3) number of maternity services that can be reached within 45 minutes by women aged 15-49 years old	34 (22-47)	2019	37 (24-46)	23 (15-33)	55 (54-57)

Time represents average travel time by car in normal traffic situation on an average weekday. Intersects area definition implies that the cell needs to be contained entirely or partially within the area to count in the isochrone. Q1 and Q3 stand for first and third quartile.



Figure 1 – Maternity services reachable within 30 minutes (intersects area definition)

Orange dots represent maternity services April 2019. Time represents average travel time by car in normal traffic situation on an average weekday. Intersects area definition implies that the cell needs to be contained entirely or partially within the area to count in the isochrone.



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Orange dots represent maternity services April 2019. Time represents average travel time by car in normal traffic situation on an average weekday. Intersects area definition implies that the cell needs to be contained entirely or partially within the area to count in the isochrone.



Figure 3 – Maternity services reachable within 45 minutes (intersects area definition)

Orange dots represent maternity services April 2019. Time represents average travel time by car in normal traffic situation on an average weekday. Intersects area definition implies that the cell needs to be contained entirely or partially within the area to count in the isochrone.

#### Table 2 – Within area definition

(ID) Indicator	Belgium	Year	Flanders	Wallonia	Brussels
Percentage of women aged 15-49 years old living within 30 minutes of the nearest maternity service	99.4%	2019	99.7%	98.9%	100%
Percentage of women aged 15-49 years old living within 15 minutes of the nearest maternity service	84.0%	2019	84.9%	76.8%	99.9%
Percentage of women aged 15-49 years old living within 45 minutes of the nearest maternity service	99.8%	2019	99.8%	99.8%	100%
Median (Q1-Q3) number of maternity services that can be reached within 30 minutes by women aged 15-49 years old	11 (7-18)	2019	12 (7-17)	8 (5-11)	22 (20-25)
Median (Q1-Q3) number of maternity services that can be reached within 15 minutes by women aged 15-49 years old	2 (1-5)	2019	2 (1-4)	2 (1-3)	11 (10-11)
Median (Q1-Q3) number of maternity services that can be reached within 45 minutes by women aged 15-49 years old	30 (19-44)	2019	32 (22-42)	20 (13-30)	52 (51-53)

Time represents average travel time by car in normal traffic situation on an average weekday. Within area definition implies that the cell needs to be contained entirely within the area to count in the isochrone. Q1 and Q3 stand for first and third quartile.



Figure 4 – Maternity services reachable within 30 minutes (within area definition)

Orange dots represent maternity services April 2019. Time represents average travel time by car in normal traffic situation on an average weekday. Within area definition implies that the cell needs to be contained entirely within the area to count in the isochrone.





Orange dots represent maternity services April 2019. Time represents average travel time by car in normal traffic situation on an average weekday. Within area definition implies that the cell needs to be contained entirely within the area to count in the isochrone.



Figure 6 – Maternity services reachable within 45 minutes (within area definition)

Orange dots represent maternity services April 2019. Time represents average travel time by car in normal traffic situation on an average weekday. Within area definition implies that the cell needs to be contained entirely within the area to count in the isochrone.

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