Waiting for a psychologist in Midtjylland

* Inequality between the municipalities in Region Midtjylland



Final Project Report, Geografisk dataanalyse/Spatial Analytics

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**Abstract**

You must wait for several many months to get a psychology treatment in Midtjylland. The longer a mental issue isn’t treated, the worse the issue might get, which effects the life and well-being of the individual, and costs society a fortune. I have used Mapview and Tmap to create four maps in RStudio, which gives an overview of the waiting times in the municipalities in Midtjylland. I conclude that there is no coincidence between a large population and long waiting times, or between long waiting times and many people per practice. Therefore, it might not solve the problem to add more practices to the most vulnerable municipalities.

**Keywords:** *psychologist; waiting time; mental health; Midtjylland*

**Github:** the data,the script the HTML version of the script etc. can be found on my GitHub: <https://github.com/Emma-Marie/final_project_spatial.git>

# **Introduction**

In the last 10 years, mental health has been a hot topic among Danish media, politicians, researchers in mental health and the population. The long waiting lists are due to a rising demand combined with the limited number of psychologists, who are part of the public healthcare service. I have chosen to focus on the waiting times for depression and anxiety, because these two mental issues are very common, and they also have the longest waiting time compared to the 9 other causes that can result in a doctor’s referral to a psychologist (Region Midtjylland 2022, 3-4). The aim of the project is to answer the following research question: ***How is the waiting time distributed across the municipalities in region Midtjylland?*** I expect that municipalities with a large population to have longer waiting times and more citizens per psychology practice, than municipalities with a lower waiting time.

The relevance of this project lies in the serious consequences of the long waiting times. The longer a person goes without treatment, the greater the likelihood that his or her disorder gets worse, and the longer the person must live with a reduced quality of life etc. (Ching-I Hung 2017, 7). It is expensive for the state to pay for sick leaves for the waiting patients as well as subsidy for their treatments (Flachs EM 2015, 163-195). Lastly, some citizens can afford to skip the line and pay full price for self-chosen psychologist, while other people are dependent on the public health insurance. This creates an inequality in the field of health in Denmark (kilde).

# **Background**

In Denmark, if a person suffers from light to moderate depression or anxiety, he or she can get a referral to a psychologist from you doctor (Region Midtjylland 2022, 1). With a referral, the government pays around 60% of the cost of the psychological treatment, and patients between 18-24 years get treated for free (Psykologer i Danmark). Only a certain number of psychologists are part of the public health insurance, and the high demand of psychological help makes the waiting times long.

Time without treatment is the most significant predictor of the severity of a depression, because of neuronal cell death, functional impairment, and because the probability of self-recovery decreases after 3 months (Ching-I Hung 2017, 7). The more serious the mental issue gets, the longer it will take to get well, and the greater the likelihood that medical or psychiatric treatment is needed. The individual also falls behind on education, job, friendships etc. It is possible to get treated by a psychologist who isn’t associated with the public health insurance and therefore has a shorter waiting list, but then you must pay all costs or pay for a private health insurance to cover some of the expenses. Therefore, long waiting times result in an inequality problem, where people with money can get treated fast and avoid the long-term consequences of waiting, while other people are forced to wait until they can get a psychologist through their referral. Furthermore, the latter are at risk of falling behind economically from work absenteeism or dropout from an education (NGUI et al. 2010, 1). It is also a problem of inequality that the place you live determines your opportunity to get help. The longer the patient waits for treatment, the longer the period of illness and the higher the cost for society. In 2015, depression alone costed the Danish society 1.220 million DKK in treatment and 3.110 million DKK in lost production, while anxiety costed 950 million DKK in treatment and care and 8610 million in lost production (Flachs EM 2015, 163-195).

The purpose of this spatial project is to visualize the waiting times in the municipalities in Midtjylland to give an overview of the most problematic areas of the region. I used spatial tools to investigate, if there is a connection between long waiting times in a municipality, and the size of its population, and a connection between the waiting times and the number of citizens per psychology practices on the public health insurance. The output is three figures (four maps) which can potentially be used by the region to understand the cause of the problem and to decide which areas are in the greatest need for more psychologists or other actions. It is the region who decides, how many psychologists in the region should be connected to the public health insurance (Region Midtjylland 2019, 10).

# **Software Framework**

This project has been made on my 8 years old MacBook Air (2015), which has 8 GB RAM and runs macOS Monterey (12.6.3) operating system. I installed R (4.3.0) and RStudio (2023.03.1+446). Data, scripts, outputs etc. can be accessed through my GitHub repository.

# **Data Acquisition and Processing**

The gadm36\_DNK\_2\_sp.rds data is the data downloaded from the GADM database and assigned to the municipalities variable. The data is a Spatial Polygons data frame and contains the geometry of each municipality in Denmark as multi polygons. It’s the spatial data of this project.

The waitingtime\_regionmidt.csv data contains the average, minimum and maximum waiting times in weeks for each municipality in Midtjylland in 2021. The waiting times apply to non-urgent patients with light to moderate depression or anxiety (Region Midtjylland 2022, 1). I assembled the data set by writing the data and the headings from the report into an excel document and saving it as a csv (ibid, 4).

The population\_over\_18.csv data set contains the number of citizens from 18-125 years in the 19 municipalities in Midtjylland (Danmarks Statistik 2021). I have chosen the adult population because the waiting times applies to persons older than 18. After I downloaded the data as an excel file from dst.dk, I removed the word “år” (years) from each row and only kept the age number. Otherwise, RStudio couldn’t interpret the data.

The data in psycology\_practices\_2018.csv contains the number of psychology practices which are art of the public health insurance in each municipality in Midtjylland in 2018 (Region Midtjylland 2019, 12). I assembled the data set by writing the numbers from the report into an excel document and saved it as a csv. I chose the column names to be “municipality” and “practices”.

# **Empirical Results**

## 5.1 Figure 1 – distribution of waiting times

A picture containing map, text, atlas, world

Description automatically generated

The longest average waiting times are 26 weeks in Odder, 22 weeks in Holstebro, and 21 weeks in Aarhus. These could be the areas on which the region should focus its money and actions. Even though Odder and Holstebro each has a higher average waiting time than Aarhus, Aarhus has the longest maximum waiting time, which is 65 weeks. In the other end of the scale, Hedensted has an average waiting time of 4 weeks, Lemvig has 5 weeks and Ringkjøbing-Skjern has 9 weeks.

## 5.2 Figure 2 – waiting times and population size

A picture containing text, map, atlas

Description automatically generated

Fire 2 shows, that Aarhus has a long average waiting period and a very big population, and Viborg, Herning and Horsens has relatively long waiting times (14-19 weeks) and relatively big populations (47811-79284 persons). But some of the other municipalities break this tendency. Odder and Samsø has very long waiting times, but quite small populations. So, the population size can’t explain the long waiting times, at least not in all municipalities. One could argue that the region should invest in areas such as Aarhus and Holstebro, because their waiting times are long and the populations are big, which could indicate, that a lot of people are affected by the waiting times. On the other hand, a big population doesn’t necessarily mean, that a lot of people need a psychologist.

## 5.3 Figure 3 – waiting time and population per practice

A map of china with blue circles and white text

Description automatically generated with low confidence

The “population\_pr\_practice” is the number of citizens per practice in a municipality. The explanation to why some municipalities has longer waiting times than others doesn’t seem to lay in size of the population relative to the number of practices. Hedensted and Lemvig only have a waiting time of 4-5 weeks, but they have around 10,000 people per practice. Aarhus and Odder has some of the highest waiting times of 19-25 weeks, but Odder has around 6,000 persons per practice, and Aarhus only has around 4,000, and both numbers seem to match the

number of persons per practice in most of the other municipalities. Therefore, more practices in the vulnerable areas might not necessarily solve the waiting time problem. In the future, it would be relevant to look more at the demographics of each municipality. Waiting times might be a more serious problem in municipalities with many students or a higher share of citizens in transfer income, who might not be able to afford a psychologist who isn’t part of the public health insurance.

## 5.4 Main elements in digital workflow

My digital workflow began by processing the gadm36\_DNK\_2\_sp.rds data**.** First I used the function st\_as\_sf() to convert the data frame into a simple features (sf) object. The geometry type is multipolygon. I projected the data set by assigning it the EPSG code 25832 using st\_transform()to be able to map it on a 2D surface. The CRS is now “ETRS89 / UTM zone 32N”. ETRS89 refers to the datum, which is the mathematical model of Earth used to map the geometry, and “UTM zone 32N” refers to a specific cylinder projection, which is the primary projection used to map Denmark (epsg.io 2020). I filtered out the rows with the name “Midtjylland” in the NAME\_1 column and assigned these rows to a separate data frame. I changed the column name “NAME\_2” to “municipality” to match the column name of the other data sets. I translated the headers in the data frame from waitingtime\_regionmidt.csv from Danish to English using rename() because I wanted it to match the written language of this project. I defined the column names of the population\_over\_18.csv data frame with colnames(). I assigned the rows with the value “subtotal” in the “age” column to a new data frame, because I only needed the total number of adult citizens for each municipality. Finally, I merged the four data sets by the “municipality” column.

I used Mapview to create an interactive map that shows the waiting times in each municipality on top of a map of Denmark. I chose Mapview because this library makes it possible to click on each municipality and get its name and its min, max and average waiting time. I used Tmap to create a map showing the waiting times, and another showing the adult populations. My first plan was to create a cartogram, but it wasn’t self-explanatory enough, so I ended up doing the two tmaps instead. Lastly, I used Tmap to create a waiting time map as the previous one, and then I used tm\_bubbles()to create a bubble for each municipality with a size representing the relative number of citizens per psychology practice. For this task I had to find the centroid of each municipality with st\_centroid().

# **Critical evaluations**

## 6.1 Evaluation of the results

The number of psychology practices is from 2018 while the population count and waiting times are from 2021. Therefore, the numbers aren’t completely compatible, but unfortunately, I wasn’t able to find a count of practices from 2021. I think it’s fair to assume, that the number of practices hasn’t changed significantly from 2018-2021, because the number didn’t change at all from 2015-2018 (Region Midtjylland 2019, 11). But any conclusions from comparing the waiting times and the relative number of practices should be considered with this reservation in mind.

Oher things to bear in mind are:

1. I compare the waiting times to the adult population of the municipalities, but a higher number of citizens doesn’t necessarily equal a higher number of people with mental illnesses.
2. The number of practices might not be an exhaustible measure for the psychological coverage in each municipality, because the number of services which the psychologists give vary a lot (ibid.).
3. The maps I have created can only point towards correlations and not causality. Even if I had seen a tendency that the municipalities with the longest waiting times had the highest number of persons per practice (which wasn’t the case for all municipalities), I wouldn’t be able to say whether the latter was the cause of the former.

## 6.2 Evaluation of method

Dealing with a division of Midtjylland into municipalities, one must be aware of the modifiable area unit problem (MAUP). If the municipalities were differently designed, the results might look different. The results also depend on the data clustering. I have chosen the Jenks optimization method for clustering the data for figure 2 and 3. The population of Aarhus is so much bigger than the populations of the other municipalities, that the differences in population size among the other municipalities would be washed away if I clustered it using “pretty”, “equal” or “quantile” as style argument instead of “jenks”. Another thing to bear in mind is that the categories showing waiting time and population size on the Tmap maps are overlapping. This means, that the same data can be present in two different categories and represented by two different colours, and that isn’t optimal.

I have made my project findable by providing meta data in section four in this report, in the metadata table on page 11-12 and in my GitHub README. The GADM data is saved in the “scripts” folder and the other three data sets can be accessed through the “data” folder in my public GitHub repository. The population data from Danmarks Statistik would be a bit tricky to find it on the danmarksstatistik.dk because you must click of the right boxes to get a data set exactly like mine. Reusability has been achieved by choosing a MIT license for the project, which makes other people able to use my script etc. In this report, I have described the main elements in my digital workflow which makes other people able to do the same things to the data as I did.

# **Conclusions**

*Summarize the achieved goals and highlight the most important lessons learnt while working on the project..*

I have used spatial tools to investigate the waiting times for psychologists in the municipalities of Midtjylland. The

# **References**

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Styrelsen for Dataforsyning og Effektivisering (SDFE)

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## 8.2 Digital tutorials and internet resources.

Demarsylvain

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Whatlf

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# **Required Metadata**

## Table 1 – Software metadata

|  |  |  |
| --- | --- | --- |
| **Nr** | **Software metadata description** | ***Please fill in this column*** |
| S1 | Current software version | *R 4.3.0 GUI 1.79 Big Sur*  *RStudio: 2023.03.1+446* |
| S2 | Permanent link to Github repository where you put your script or R project | <https://github.com/Emma-Marie/final_project_spatial.git> |
| S3 | Legal Software License |  |
| S4 | Computing platform / Operating System | macOS Monterey 12.6.3 |
| S5 | Installation requirements & dependencies for software not used in class |  |
| S6 | If available Link to software documentation for special software |  |
| S6 | Support email for questions | [202004214@post.au.dk](mailto:202004214@post.au.dk) |

## Table 2 – Data metadata

|  |  |  |
| --- | --- | --- |
| **Data sets** | | |
| **Data sets** | | |
| D1 | gadm36\_DNK\_2\_sp.rds | From GADM.org which provides spatial data for all countries and their sub-divisions. Loaded into RStudio directly from the database with the getData() function. Has a “geometry” column which makes it possible to map each municipality in Denmark. Is also placed in the “scripts” folder on Github. |
| D2 | waitingtime\_regionmidt.csv | Contains the average, maximum and minimum waiting times for each of the 19 municipalities in Midtjylland from November 1st, 2021. The numbers are from a report written by Region Midt in March 2022. The waiting times are measured in weeks. They apply to non-urgent patients who fall under cause 10 (light to moderate depression) or 11 (light to moderate anxiety). I created the data set on my own by writing the data and the headings from the report into an excel document and saved it as a csv. The data has the following columns: "kommune" (municipality), "Maksimum pr. 1. Nov 2021" (maximum per November 1st, 2021), and "Minimum pr. 1. Nov 2021" (minimum per November 1st, 2021). |
| D3 | population\_over\_18.csv | The data is Danmarks Statistik. It contains the number of citizens from age 18-125 in the 19 municipalities in Midtjylland. I have chosen only the adult population, because the waiting times from waitingtime\_regionmidt.csv only applies to persons older than 18. The population is from October 1st 2021.  Following the link, you get to page “Folketal den 1. i kvartalet efter køn, tid, område og alder” (population on the 1s of the quarter by sex, time, area, and age) on dst.dk. To get the data, I selected all ages above 18, all municipalities in Region Midtjylland, "i alt" (total) in the "køn" (gender) box, and "“2021K4” (the 4th quarter of 2021) in the "Kvartal" (quarter) box. After I downloaded the data, I removed the word “år” (year) from each age so only the age number was left, because otherwise RStudio couldn't interpret the data (Danmarks Statistik 2021). |
| D4 | psycology\_practices\_2018.csv | The data is from a report by Region Midtjylland (Region Midtjylland 2019, 12). I assembled the data set myself by writing the numbers from the report into an excel document and saving it as a csv. I named the headings “municipality” and “practices”. The numbers are from November 2018. |
| D5 | waiting\_midt.csv | The four data sets above joined together by the “municipality” column. Located in the “data\_output” folder. |