Waiting for a psychologist in Midtjylland

- An examination of the long waiting times in the municipalities in Region Midtjylland

Final Project Report, Geografisk dataanalyse/Spatial Analytics

Emma-Marie Vitskov Jørgensen (202004214)

University of Aarhus, Jens. Chr. Skous Vej 2, 8000 Aarhus C, Denmark

Lecturer: Adéla Sobotkova

June 7th, 2023

Characters: 14101

Table of content

Abstract

You must wait for many months to get psychology treatment in Midtjylland. The longer a mental issue isn't treated, the worse it 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 a long waiting time, or between long waiting time and many people per psychology practice.

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

Github: Data, scripts, outputs etc. can be accessed through my GitHub repository: https://github.com/Emma-Marie/final_project_spatial.git

1. Introduction

Mental health is a hot topic among Danish media, politicians, researchers, and the population. Especially the long waiting times have been criticized, and in this project, I investigate the waiting times in Midtjylland. I focus on the waiting times for depression and anxiety because those mental issues are very common, and they have the longest waiting times compared to the 9 other causes which 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 times distributed across the municipalities in Region Midtjylland?*** I expect that the municipalities with the biggest populations and the most citizens per psychology practice have the longest waiting times. When I use the term Region with capital R I refer to the public organization Region Midtjylland, and not just the geographical area.

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, it causes inequality that the place you live determines your opportunity to get help.

2. Background

If a person suffers from light to moderate depression or anxiety, he or she can get a referral to a psychologist from the 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 psychologists 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. It is possible to get treated by a psychologist who isn't associated with the public health insurance and has a shorter waiting list, but then you must pay all costs. Long waiting times create inequality, because 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. The latter are at risk of falling further behind economically from work absenteeism or dropout from an education (NGUI et al. 2010, 1). 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 8610 million in lost production (Flachs EM 2015, 163-195).

The purpose of this spatial project is to visualize the waiting times in Midtjylland to give an overview of the most problematic municipalities 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 the number of citizens per psychology practice 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 of action (Region Midtjylland 2019, 10).

3. Software Framework

This project has been made on my 8 years old MacBook Air (2015), which has 8 GB RAM and runs the macOS Monterey (12.6.3) operating system. I installed R (4.3.0) and RStudio (2023.03.1+446).

4. Data Acquisition and Processing

The gadm36_DNK_2_sp.rds data is 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.

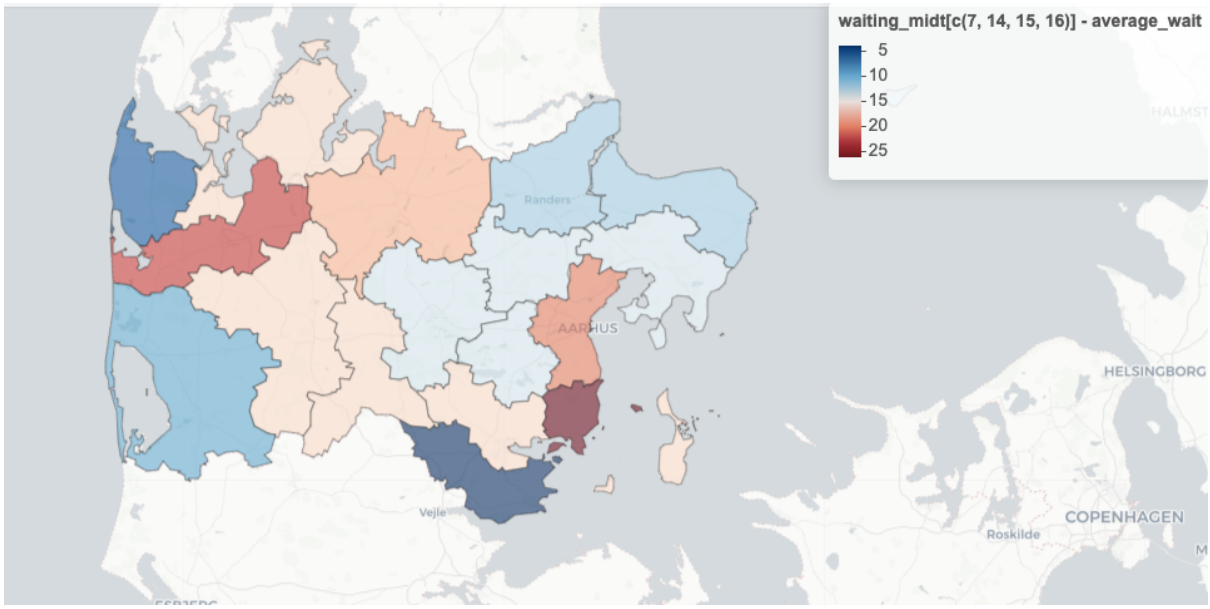
The waitingtime_regionmidt.csv data contains the average, minimum and maximum waiting times in weeks for the municipalities in Midtjylland in 2021 (Region Midtjylland 2022, 1). I assembled the data set by writing the data and the headings from the report into an excel document and saving it as a csv (ibid, 4).

The population_over_18.csv contains the number of citizens from 18-125 years in each municipality 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 to make RStudio able to interpret the data.

The psycology_practices_2018.csv contains the number of psychology practices which are part 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".

5. Empirical Results

5.1 Figure 1 – distribution of waiting times



The longest average waiting times are 26 weeks in Odder, 22 weeks in Holstebro, and 21 weeks in Aarhus. Those three municipalities could be the ones which the Region should focus its money and actions on. Even though Odder and Holstebro each has a higher average waiting time than Aarhus, Aarhus has the longest maximum waiting time of 65 weeks. In the other end of the scale, Hedensted has an average waiting time of 4 weeks, and Lemvig has 5 weeks.

5.2 Figure 2 – waiting times and population size

Fig 2: Waiting time and population size doesn't seem to correlate in all municipalities

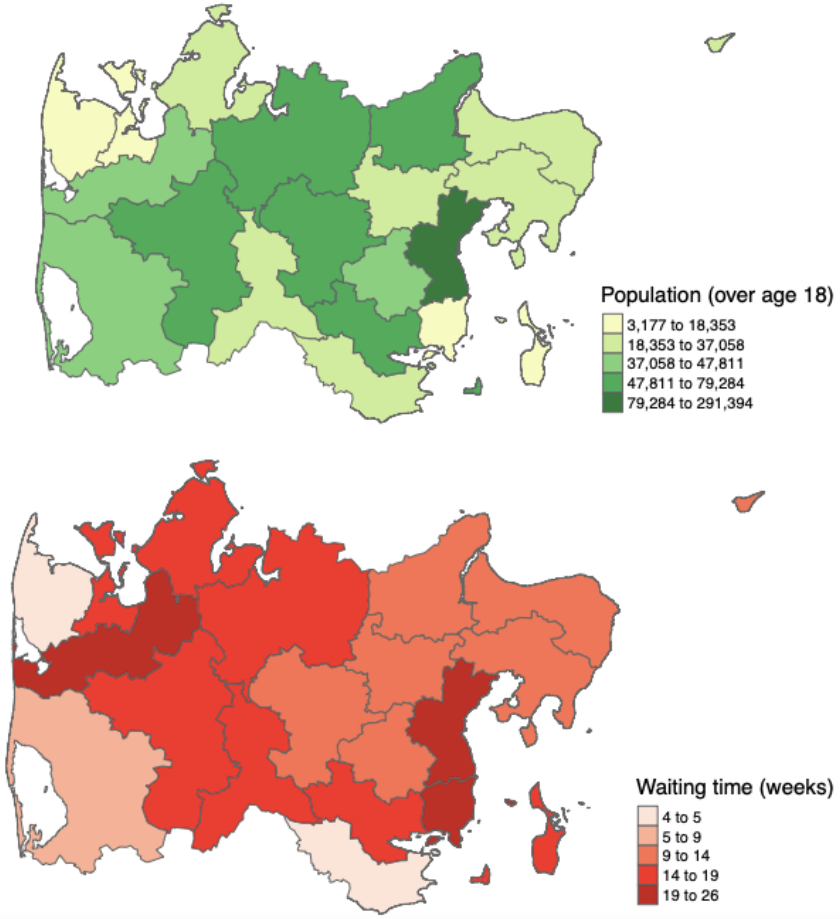
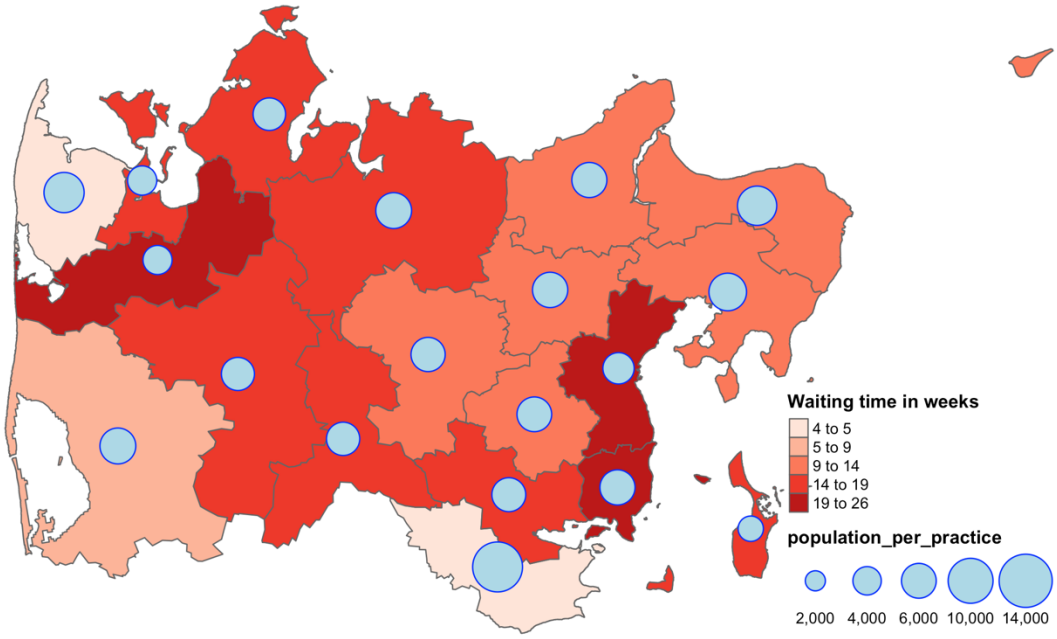


Figure 2 shows, that Aarhus has one of the longest average waiting times and the biggest population in Midtjylland. Viborg, Herning and Horsens have relatively long waiting times and relatively big populations. But some of the other municipalities break this tendency. Odder and Samsø have long waiting 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 big populations could indicate, that a lot of people are affected by the very long 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

Fig 3: Long waiting time doesn't seem to correlate with many persons per practice



"population_pr_practice" is the number of citizens divided by the number of psychology practices in a municipality. The explanation to why some municipalities have longer waiting times than others doesn't seem to lay in the size of the population relative to the number of practices. Hedensted and Lemvig have waiting times between 4-5 weeks, but they have around 10,000 people per practice. Aarhus and Odder have 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 those numbers seem to match the number of persons per practice in most of the other municipalities across waiting times. 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 on transfer income, who might not be able to afford a private psychologist without public subsidy.

5.4 Main elements in digital workflow

I use the function `st_as_sf()` on the gadm36_DNK_2_sp.rds data to convert the data frame into a simple features object. The data is projected when I assign it to the EPSG code 25832 using `st_transform()` and the projection makes it possible to map the data on a 2D surface. Now, the CRS is ETRS89 / UTM zone 32N. ETRS89 refers to the datum, which is the mathematical model of Earth used to map the data, and UTM zone 32N refers to a

specific cylinder projection, which is the primary projection used to map Denmark (epsg.io 2020). I filter out the rows with "Midtjylland" in the NAME_1 column and assign these rows to a separate data frame, which is the data frame I use from now on. I translate the headers in the waitingtime_regionmidt.csv data frame from Danish to English using `rename()` so they match the written language of this project. I define the column names of the data frame from population_over_18.csv with `colnames()`. The rows with the value "subtotal" in the "age" column are assigned to a new data frame, because I only need the total number of adult citizens for each municipality. I use 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 map showing the adult populations. On a fourth map 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 found the centroid of each municipality with `st_centroid()`.

6. Critical evaluations

6.1 Evaluation of the results

The population sizes and waiting times are from 2021, while the data about psychology practices is from 2018, because I couldn't find a count of practices from 2021. I think it's reasonable to assume, that the number of practices in each municipality hasn't changed significantly from 2018-2021, because the number didn't change from 2015-2018 (Region Midtjylland 2019, 11). But any conclusions from comparing the waiting times and the population per practice should be considered with this reservation in mind.
Oher things to bear in mind are:

a) 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.
b) 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.).
c) The maps 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

My first attempt to compare the waiting times and the population sizes, was to create a map showing the waiting times in different colors, and a cartogram showing the same waiting time colors but with the municipality geometry distorted so the size of each municipality represented its population size. After showing the figure to different persons I found that it wasn't self-explanatory enough, so I ended up doing the two tmaps instead. I deliberately chose red colors to visualize the waiting times to emphasise the seriousness of the long waiting times.

Dealing with a division of Midtjylland into municipalities, one must be aware of the modifiable area unit problem. If the municipalities were differently designed, the results might have been different. The results also depend on the data clustering. I chose 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 clustering argument instead of "jenks". The categories showing waiting times and population sizes in figures 2 and 3 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 chose a MIT license for the project, to make the project reusable for other people.

7. Conclusions

My goal was to investigate the psychologist waiting times in the municipalities of Midtjylland. For this task I used the spatial tools Mapview and Tmap to create maps, which made it possible to investigate whether the municipalities with the longest waiting times also had the biggest populations and the most people per psychology practice. I found that Odder, Holstebro and Aarhus have the longest waiting times, but Odder has a relatively small population, and all three municipalities has relatively few people per practice compared to, for example, Hedensted and Lemvig, which has low waiting times. Therefore, population size and people per practice can't explain the waiting times in all municipalities. The most important lessons learnt were that the data clustering is defining for the results, and that map type and colors are decisive for whether the message reaches the recipient or not.

8. References

8.1 Domain-specific literature

Ching-I Hung et al.

2017 ”Untreated duration predicted the severity of depression at the two-year follow-up point”, *PLoS ONE 12(9).*

Danmarks Statistik

2021 Population data, “Folk1A: Folketal den 1. i kvartaletefter område, køn, alder og civiltilstand”, *dst.dk*: https://www.statistikbanken.dk/statbank5a/selectvarval/define.asp?PLanguage=0&subword=tabsel&MainTable=FOLK1A&PXSId=199114&tablestyle=&ST=SD&buttons=0

(visited 2023-06-02)

epsg.io

2020 “EPSG:25832”, https://epsg.io/25832 (visited 2023-06-03), last revision 2020-03-30

Flachs EM et al.

2015 “Sygdomsbyrden i Danmark - sygdomme”, Statens institut for folkesundhed, Syddansk Universitet, København: Sundhedsstyrelsen, 163-195: https://www.sst.dk/da/sygdom-og-behandling/~/media/00C6825B11BD46F9B064536C6E7DFBA0.ashx

NGUI et al.

2010 ”Mental disorders, health inequalities and ethics: A global perspective”, *Int Rev Psychiatry*. 2010 ; 22(3): 235–244

Psykologer i Danmark

”Tilskud til psykolog”, *psykologeridanmark.dk:* https://psykologeridanmark.dk/tilskud-til-psykolog/ (visited 2023-06-02)

Region Midtjylland
2019 ”Praksisplan for psykologer”, *rm.dk:* https://www.rm.dk/siteassets/politik/udvalg/samarbejdsudvalg-for-primar-sektoren/psykologer/praksisplan-for-psykologer-2019.pdf

Region Midtjylland
2022 ”Fakta om psykologyderområdet i Region Midtjylland”, *rm.dk:* https://www.rm.dk/api/NewESDHBlock/DownloadFile?agendaPath=%5C%5CRMAPPS0221.onerm.dk%5CCMS01-EXT%5CESDH%20Data%5CRM_Internet%5Cdagsordener%5Cregionsraadet%202022%5C26-01-2022%5CAaben_dagsorden&appendixId=330776

Styrelsen for Dataforsyning og Effektivisering (SDFE)
2017 ”UTM/ETRS89: Den primære kortprojektion i Danmark”, Copenhagen, Denmark

8.2 Digital tutorials and internet resources.

Demarsylvain
2019 “How do I combine a dataframe with a spatial dataframe when receiving errors with both left_join and merge?”, *Stackoverflow*: https://stackoverflow.com/questions/56116443/how-do-i-combine-a-dataframe-with-a-spatial-dataframe-when-receiving-errors-with (visited 2023-06-04)

Kabacoff, Robert I.
2017 “Merging data”, *Quick-R*: https://www.statmethods.net/management/merging.html

Marco Sandri
2020 “Add Color Palette to Mapview Map”, *Stackoverflow*: https://stackoverflow.com/questions/60099307/add-color-palette-to-mapview-map (visited 2023-05-20)

Naveen
2023 "How to rename column in R", *SparkBy{Examples}*: https://sparkbyexamples.com/r-programming/rename-column-in-r/ (visited 2023-05-20)

UseR10085
2020 "How to put title of a map outside of the panel (tmap package)", *Stackoverflow*: https://stackoverflow.com/questions/61355422/how-to-put-title-of-a-map-outside-of-the-panel-tmap-package (visited 2023-05-30)

Whatlf
2022 "How do I stop r from using the first row of data as the column name?", *Stackoverflow*: https://stackoverflow.com/questions/72958558/how-do-i-stop-r-from-using-the-first-row-of-data-as-the-column-name (visited 2023-06-02)

9. 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

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. The data set is located 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 Midtjylland 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 from 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 populations are from October 1st 2021. Following the link, you get to the webpage called "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 (Danmarks Statistik 2021). To get the data, I selected all ages above 18 in the "alder" box, all municipalities in Region Midtjylland in the "område" box, "i alt" in the "køn" box, and "2021K4" in the "Kvartal" box. After I downloaded the data, I removed the word "år" (year) from each age so only the age number was left
D4	psycology_practices_2018.csv	The data set is from a report by Region Midtjylland and contains the number of practices connected to the public health insurance in each municipality in 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 after they have been pre-processed. Located in the “data_output” folder.