Understanding the distribution of healthcare firms through demographics on a municipal scale in the Netherlands.

Abstract

The healthcare sector is vital within welfare state of the Netherlands. As the pressure on the sector increases due to trends like ageing, the availability of healthcare becomes increasingly problematic. Across the spatial environment, inequalities in availability may be further amplified. Therefore, it is vital to understand how the current distribution of healthcare firms is located and what factors influence their location behaviour. This thesis tries to fill the existing research gap in the academic literature by researching the healthcare firm distribution on a municipal scale within the Netherlands. To accomplish this, aggregated LISA data on healthcare firms is tested within multiple multilinear regressions against several demographic indicators. The results show, that the distribution of healthcare firms can mainly be explained by total population and degree of urbanisation within a municipality. Additionally, healthcare firms in general locate in municipalities with a higher educated population. Surprisingly, the effect of the amount of elderly was negative in regard to the amount of healthcare firms. As the results of the quantitative analysis for both elderly and high educated population in relation to healthcare firm location are not conclusive. It is recommended additional case studies are conducted on both topics in the future.

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1.0 Introduction

1.1 The importance of the healthcare sector

Healthcare is vital for the wellbeing of a population (Fleuret & Atkinson, 2007; Steptoe, Deaton, & Stone, 2015). A well-functioning healthcare system is also a key component of governments like the Dutch welfare state. Especially as the aim of welfare states is to bear the responsibility in regards to wellness and healthcare for its citizens (Barr, 2020). Therefore, it is not surprising that in the Netherlands the healthcare sector has been a hotly debated topic for many years. News outlets report heavily on the current ongoing trends affecting this vital sector. Trends like ageing, employee shortages, and the covid-19 pandemic (De Waard, 2021). These trends affect the quality, availability and distribution of healthcare, which in turn has led to increased pressure on the sector in recent years. As this pressure on the healthcare sector is expected to increase in the coming years it is crucial to study these trends. How do these trends impact the healthcare sector?

The impact of short-term trends can be sudden and unexpected. Short-term impacts like the covid-19 pandemic caused enormous increases in hospitalisations, which the healthcare sector was barely able to deal with. The covid-19 pandemic has highlighted the vulnerability of the healthcare sector and forced the Dutch government to take drastic measures (de Vries et al., 2020). On the contrary, long-term impacts may be less visible to the public but require measures to be taken non the less. The impacts of the slowly ageing population of the Netherlands become slowly visible as demand for healthcare increases due to more elderly requiring care. This trend is expected to only increase within the coming decades (Auping, Pruyt, & Kwakkel, 2015). Availability constraints within the healthcare sector can arise in multiple ways. Lacking amounts of healthcare, specialized employees shortages, medical facilities that are unable to adapt to increase demand, and governmental policies not suited for the new demographic reality. The challenge ahead for firms in the Dutch healthcare sector is to adapt to these trends and become more future proof. Especially, as the current trends may cause regional differences in healthcare demand and availability to increase across the Dutch geographical landscape. Therefore, it is important to research what locational preference healthcare firms have and which factors influence these preferences. Studies like Flores and Aguilera (2007) and Siedschlag, Smith, Turcu, and Zhang (2013) have among many others, researched how firms determine their location preferences. However, their currently exists a gap within the academic literature as little research has been done on healthcare firm location preferences. This leaves the following question currently unanswered. What are the locational preferences of healthcare firms? Within the rest of this introduction it will become clear why this is an important question to answer, and why the Netherlands is an interesting case to study.

1.2 The geographical distribution of Dutch healthcare firms

Firstly, it is important to understand what the current state of the Dutch healthcare sector is and how it has developed over the last decades. The geographical development of the healthcare sector can be shown with the use of LISA data. LISA data lists all registered firms every year within the Netherlands with additional data such as firm type. Development within the sector will be shown over a 20 year period from 1999 to 2019. Not only is this a recent time period it also is an interesting time period to study for this sector. The number of registered firms has increased by 97% over this time period (Lisa, 2022). But more interestingly, the growth of registered healthcare firms has increased even more from 47.680 to 170.250 which indicates a growth of 257%.

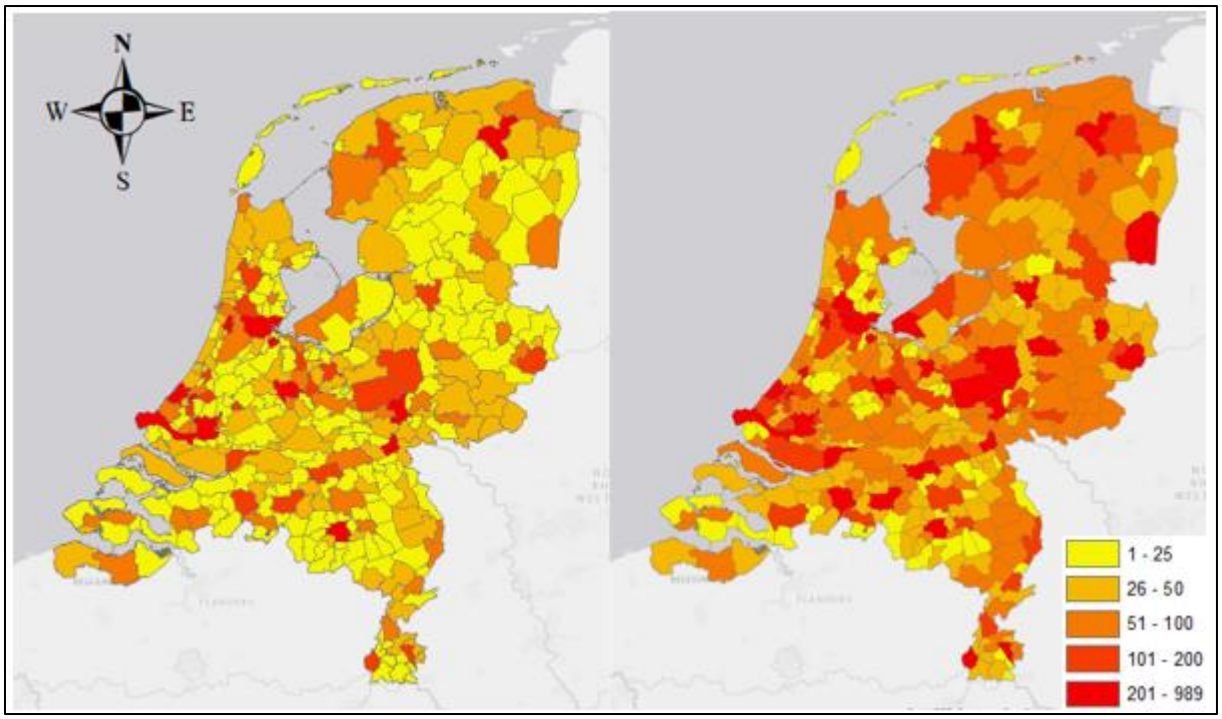

Figure 1 Total number of healthcare firms per municipality (1999 - 2019)

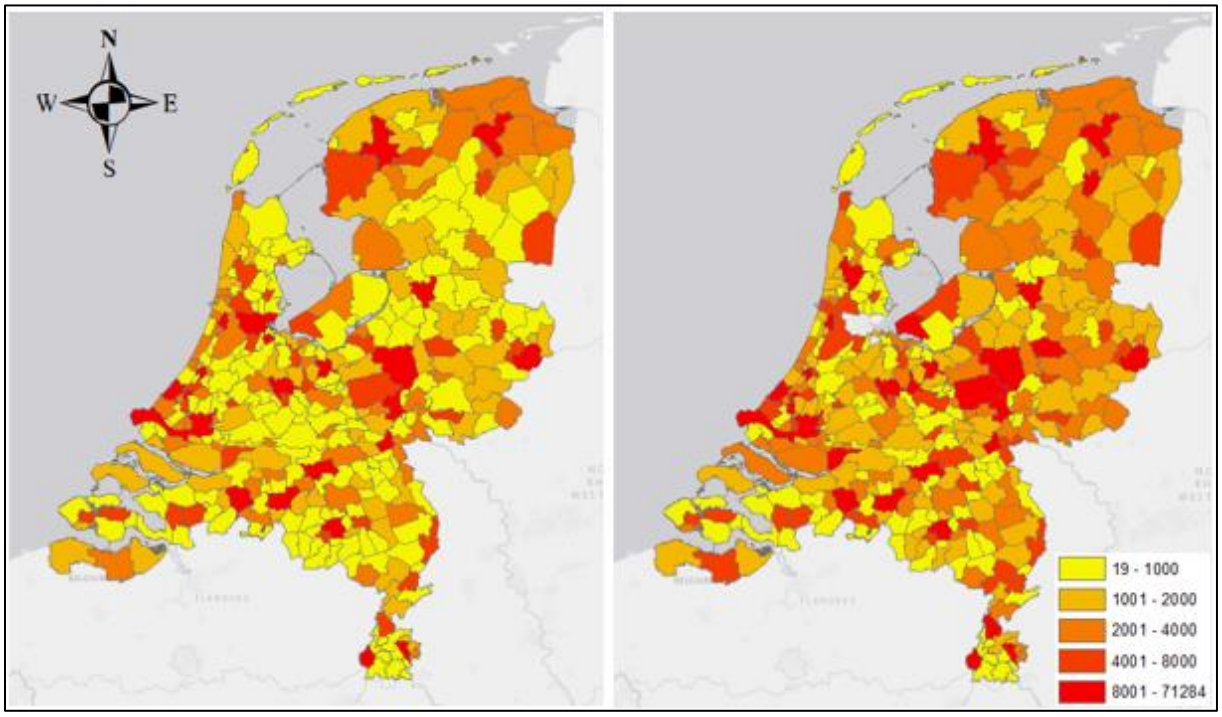

Figure 2 Total number of healthcare jobs per municipality (1999 - 2019)

In figure (1) Above, the spatial distribution of healthcare firms in the Netherlands is shown. As can be seen from figure (1) in most municipalities across the Netherlands the amount of healthcare firms has increased drastically. In the year 1999 almost all municipalities with more than 200 registered healthcare firms are large urban municipalities. For other municipalities, the healthcare firm count is often under 25. Twenty years later in 2019, the amount of healthcare firms still centres around these large urban regions but the number of firms in the periphery has increased strongly. Within these healthcare firms the amount of employees can differ greatly. Therefore it is important to see if similar

patterns apply when looking at the amount of healthcare jobs per municipality. This is especially true for the Netherlands, as over recent years the number of self-employed persons rapidly increased (Jansen, 2020). In figure (2) above, the amount of jobs in the healthcare sector is shown. When comparing figure (1) and (2) similar distributions patterns can be seen. The main concentration of healthcare jobs is within the large urban municipalities while there is a similar increase in the peripheral municipalities although slightly more scattered.

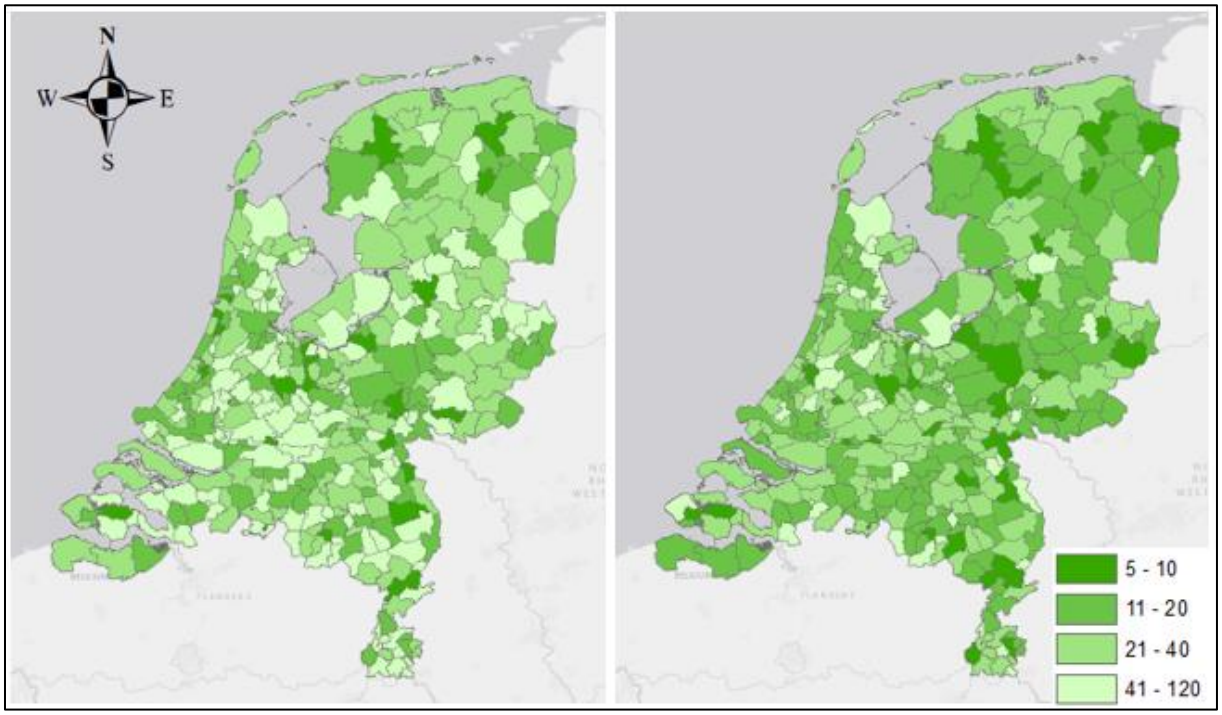

Figure 3 Healthcare jobs per population in municipalities (1999 - 2019)

Both the amount of firms and the amount of jobs within the healthcare sector are useful indicators when analysing municipal availability. However, these indicators don't show how availability is accounted for when correcting for population size. In figure (3) the amount of jobs per municipality is corrected for population size. Quite interestingly, in 1999 healthcare coverage was very unequally distributed among municipalities. While in 2019 healthcare coverage greatly improved for peripheral municipalities. Overall, all three figures show a great improvement and expansion in healthcare coverage.

1.3 Introduction to the research questions

As has been shown above, the Dutch healthcare sector is expanding rapidly with the amount of firms increasing at a much higher rate than the Dutch average. Furthermore, the spatial distribution of healthcare firms has improved as peripheral municipalities have increased coverage in healthcare between the 1999 and 2019 time period. Among these healthcare firms there are many different types with many locational preferences. The aim of this thesis is to fill the research gap that leaves the movements of healthcare firms caused by locational preferences to be unknown. Within this thesis, these locational preferences will be analysed through demographic characteristics of healthcare customers, or in other words population. The main research question this thesis tries to answer is:

What demographic factors determine the current spatial distribution of healthcare firms as a result of locational preferences?

To answer this main research question, three sub-research questions have been listed to dissect the main research question into three parts, which enables it to be better understood. These sub-research questions are listed below.

1. *Where does the healthcare sector place within the location choice literature?*

The first sub-research questions is focussed on analysing what lessons could learned from existing literature. As stated above, limited research has been conducted on healthcare location choices. However, healthcare optimization literature is available to see which factors are deemed relevant for certain healthcare firms. Furthermore, general location literature is still relevant as it is important to analyse which theories may be relevant for the healthcare sector. This sub-research question will only be covered within the literature review.

2. *What are the location choice preferences of the healthcare sector and what are the differences between different types of healthcare firms?*

The second sub-research question is aimed at not only understanding how healthcare firms move in general, but also understanding specific healthcare firms. This research question will be answered by using the understanding gained from the first research question and applying it to a quantitative analysis.

3. *What is the location choice difference between healthcare firms and other service sector firms?*

The final sub-research question is used to gain insight to see if healthcare sector firms are unique in their firm location movement. Therefore, the healthcare sector will be compared to other service sector firms in a final quantitative analysis. Together these three sub-research questions are used to answer the main research question.

2.0 Literature review

2.1 The Dutch healthcare sector

Vital to understanding the movement of healthcare firms in the Dutch context is, how the healthcare systems is regulated by law. This is true as the firm climate created by government policies can heavily influence firm decision making (Chikán, 2008). Therefore, within this case study, it is important to set the stage within the decision making process movement of Dutch healthcare firms is decided. The current legislation in which Dutch healthcare firms operate was implemented in 2006. The regulation requires all Dutch citizens to enlist for basic health insurance at a healthcare insurance firm. This obligation to get health insurance stems from Dutch healthcare policy, which is aimed at providing accessible care with high quality for everyone (Rijksoverheid, 2022a).

Within the Dutch healthcare policy there are two main objectives: 1. Combining free market consumer choice to achieve low efficient pricing and, 2. Universal access to healthcare without consumer discrimination (Roos & Schut, 2012). To enforce this, health insurance companies are forced to accept everyone applying for the base health insurance package regardless of their health status. Currently the healthcare systems if funded by collective payment by every Dutch citizen. This eliminates a large part of the risk for insurance companies making it viable to leave out consumer discrimination. To keep prices at an optimum low-level competition is promoted between insurance companies trough separate negotiations with healthcare providers. For consumers of healthcare this means that costs of healthcare in the Netherlands are mainly regulated trough the coverage of the basic healthcare package. If the consumer has more healthcare needs than the base package provides an expanded package can be taken at a higher price. To further eliminate potential consumer discrimination the Dutch government set up a fund for healthcare insurance companies and healthcare providers. The negotiation procedure between can lead to slight price differences between different hospitals as quality of the treatment is of influence. This is called ‘prestatiebekostiging’ (Rijksoverheid, 2022b). Each different type of ‘health product’ has a different average price. Currently in total there are 4400 different health products in hospitals. Other healthcare providers like general practitioners, dentists, and physiotherapists have similar procedures set up to set their prices of health products. It is important to note that there is a yearly threshold after which treatment costs are taken care of by the health insurer. If costs aren’t covered by the healthcare insurance company costs are for the consumer directly.

In regards to firm location choice vital differences can be found between countries with health insurance regulations and those without regulation. It has been found that in the USA healthcare firms that provide adequate care mainly operate in wealthier neighbourhoods (Ohlson, 2020). The USA notoriously has a healthcare system that doesn’t provide basic health insurance for all inhabitants. Therefore this healthcare firm location behaviour isn’t expected to be found within the Netherlands.

2.2 Types of healthcare firms

In addition to the section above, it is important to discuss how healthcare firms within the Netherlands make their location decisions. As there are two firm main firm types within the healthcare sector. The first type of healthcare firms is a so called ‘for-profit’ healthcare firm and the second type of healthcare firm is a ‘non-profit’ healthcare firm (Jamali, Hallal, & Abdallah, 2010). The biggest difference between both types of firms is what goals they aim to achieve and thus how the firm is managed. The healthcare firms that fall in the for-profit category act most similar to regular firms. This implies, that there is a clear distinction between the ownership of the firm and the management (Eeckloo, Van Herck, Van

Hulle, & Vleugels, 2004). The managerial staff and board has to justify their decisions making processes towards the stakeholders. Furthermore, the main interest of the firm is aimed at increasing their profits and economic status. The non-profit healthcare firms have a much more complicated ownership and management situation. According to Brickley, Van Horn, and Wedig (2003), the lack of a control mechanism between board and ownership makes is a disadvantage in comparison to the for-profit firms. Within non-profit firms, the managerial staff lacks the financial incentives in form of bonusses to lack the drive to achieve maximum efficiency. This can majorly impact these non-profit firms against for-profit competition. In the Netherlands, almost all healthcare firms belong to the for-profit category. Therefore, in this thesis healthcare firms will be seen as for-profit firms to reduce complication. This implies in regards to location decision making processes that firms will act to maximizing their profits and locate in the optimal location to realize this. Maximizing profits and the search for efficiency seems obvious in regards to general firm literature. However, within the healthcare sector this is less obvious as NHS services funded through the government are sometimes substantially less efficient (Brekke & Sørgard, 2007).

2.3 Healthcare firm location choice

As stated in the introduction, the academic literature on the topic of healthcare firm location behaviour is limited and can be sorted in two categories. The first is optimization literature on optimal location for healthcare coverage. These studies contain mostly case studies from a governmental perspective and are focused on how to optimize the distribution of hospitals. These studies are mainly focused on giving policy advice but also use factors in their distribution models which are useful for this study. The second type of studies which are healthcare specific are focused on healthcare consumer preference. These sources will be used to analyse the demand for healthcare services. As the literature is thin in regards to studies analysing healthcare specific location preferences, general firm location theory literature will be used. Most of the theory on location theory is based on the needs of industrial firms. In this chapter relevant firm location theory will be used and compared in a healthcare sector environment. In firm location theory most models try to find an optimal location where transport cost of input resources are minimized (McCann, 2013). In classical and neoclassical economic models this is mainly focused around industrial firms. As transportation costs of products are often not applicable and not as intensive. Although, the first location theory models like the Weber model have limited factors that influence it. Newer models also add important factors like the labour market situation, quality of life, and level of education. According to Wu, Lin, and Chen (2007) these quality factors are both important for industrial and service firms. Within this literature review first general location theory will be linked to the healthcare sector. Then, the healthcare specific theory will be discussed.

2.4 The healthcare sector and agglomeration effects

One of the key factors for firms to operate is qualified employees. Firms will therefore try to locate in regions where the labour market provides qualified personal for their needs (Ciccone, 2002). For Healthcare firms these are employees that have the correct medical qualifications. This implies that firms in the healthcare sector will prefer to locate in regions that provide these employees. Often specialized employees can be found in urban regions as there are so called agglomeration effects present there. Within the literature there are three main sources of agglomeration effects: 1. Knowledge spill-overs, 2. Non-traded local inputs, and 3. Local skilled labour pools (McCann, 2013). The first factor knowledge spill-overs often arise in the healthcare sector due to investment in quality. This forces other firms to invest as they can't be left behind (Baicker & Chandra, 2010). It has to be noted however, that these knowledge spill-overs are less prevalent in the healthcare sector compared

to other sectors. According to Bates and Santerre (2005), a very important means of knowledge spill-over within the healthcare sector is face to face informal meetings. In agglomerated regions this is more prevalent as more healthcare firms are clustered together. The second agglomeration effect of Non-traded local inputs is very useful for healthcare firms. It is shown that innovation and quality of healthcare is heavily dependent on nearby other firms which are innovating (Baicker & Chandra, 2010). An example of a Non-traded local input is, when a pharmaceutical firm brings innovative products on the market of which local other healthcare firms can profit first from. The study of Friedson and Li (2015) argues that hospitals don't have to take these non-traded local input into count. It is further argued that, when hospitals locate a 'supportive cluster' of other healthcare firms locate around the hospital. The final agglomeration effect, local skilled labour pools, are as stated at the beginning of this paragraph very important for healthcare firms. Aside from the positive effects there is also a negative side effect of this high skilled labour pool. This is the so called wage effect.

As stated in paragraph above, the Dutch healthcare system operates via healthcare insurance companies. This implies that the cost of health procedures are similar for some health products. This creates a problem caused by more specialized and educated labour markets wanting higher wages (Otsuka, 2008). Within the Netherlands hiring employees within the Randstad areas is often done at higher wages than in rural regions. On the contrary, the study of Cohen and Paul (2008) finds that when the labour market is flexible and that there is close proximity to other medical firms labour costs are lower. At the opposite end of agglomeration economies other labour problems are at play. In rural areas the non-availability of skilled labour is a major problem. According to Scott et al. (2013), highly skilled employees are often in need of certain financial incentives to move to rural regions. As this is often not given as wages in rural areas are generally lower this creates a labour problem. It has been shown that most of the high skilled employees in rural regions have origins within those regions (McGrail, Humphreys, & Joyce, 2011). Luckily, there is also less need of skill labour as demand for healthcare is often lower in rural areas due to lower population counts (Joseph & Bantock, 1982).

According to Otsuka (2008), agglomeration economies both bring positive and negative effects for firms in the service sector. Generally, it is found that firms operating in the service sector like the healthcare sector, don't always benefit from heavy competition. Their product differentiation is much harder compared to for example industrial firms. A noteworthy finding by Van Sandt, Carpenter, Dudensing, and Loveridge (2021), is that firms that provide lower quality of healthcare often cluster around firms that provide a higher quality. High quality healthcare firms mostly prefer high population counts when choosing to locate. Similar findings are done by Otsuka (2008), who state that service firms prefer higher population counts to accessibility and transport costs which the main difference between service sector firms and industrial firms.

2.5 Healthcare demand

According to Wu et al. (2007), there are three main factors influencing demand for healthcare in an area from a firm perspective. 1. Total population, 2. Local population density, and 3. Local population age. These three factors determine the amount of people looking for healthcare treatment and are the health consumer. The first demand factor is an obvious one. Each individual in the total population is one more potential healthcare consumer that could require treatment. In the Netherlands the yearly amount of population requiring specialists treatment is around 37,2% (CBS, 2022). This implies that when looking to locate as a healthcare firm the size of the firm should correspond with the population amount. Aside from total population, population density is important as well. Population density is of importance as high population density increases the amount of potential consumers of healthcare in the direct vicinity of the firm. Population density strongly corresponds with how urban an area is. This

is especially important for consumers when more healthcare firms are available and quality is equal. Then, the distance to the firm can be the deciding factor. The final factor, population age is determining an increased treatment demand for some types of healthcare firms. A population with a high percentage of the demographic in higher age groups leads to higher demand for elderly related treatment. Case studies show that a higher percentage of elderly leads to a higher number of hospitalizations (Vrhovec & Tajnikar, 2016).

Aside from total healthcare demand, healthcare specific demand is also of importance as shown above. Therefore, it is important for healthcare firms to catch as much of the healthcare demand in their region among competing firms. However, which factors influence how the consumer chooses it's treatment location? The study of Güneş, Melo, and Nickel (2019) stresses that both good accessibility and high quality of healthcare services are the main drivers of consumer healthcare choice. For accessibility to be rated highly three main points must be met: 1. Minimizing travel costs for healthcare consumers, 2. Maximizing population access to their healthcare firm, and 3. Minimizing travel time to the healthcare facility. Within the literature the first two factors often used synonymously. This is also true for the study of Afshari and Peng (2014), who find that both travel dynamics and availability are the most determining factor in the decision making process of healthcare consumers. In studies that research a specific healthcare type results vary slightly. For nursing homes, accessibility close by the homes of their relatives is deemed most important according to Schmitz and Stroka (2014). Furthermore, the costs of being taking in is of high importance while the quality of care is not as important.

An interesting finding by Lewis, Willis, and Collyer (2018) is that the quality of the neighbourhood in which the healthcare facility is located is assumed by consumers to be associated with the quality of care. Consumers often think that a medical facility within a wealthy neighbourhood must be better than one within a poorer one. Finally, it is found to be important that demand is rather differently structured from both a consumer and a healthcare firm perspective in comparison to other firm types. In the Netherlands this is caused by healthcare insurance companies function as a middle man like discussed previously. According to Gerfin (2019), this has increased demand for healthcare significantly as cost-sharing is effective to increase quality among consumers.

2.6 Healthcare optimization studies

Within the limited available literature on the spatial distribution of healthcare firms almost all work has been written on optimization models. The aim of these models is to achieve optimal distribution and availability of healthcare facilities, so that policy can be improved to aim to achieve these optimal distributions. Outside of these models within the real world these situations rarely happen. Furthermore, these models can't be used to examine location choices of real firms as these models simply don't depict a real situation. Non the less it is useful to study them as factors in the models are expected to influence healthcare firms in the real world as well. It has to be noted that most models on healthcare spatial optimization models are on specific healthcare types and scenarios (Afshari & Peng, 2014).

Within the literature it is found that the main factor in most healthcare optimization models is accessibility. This factor is important as it greatly influences both cost and efficiency. Minimizing transport cost and travel time is mutually beneficial for the healthcare firm and consumer. According to Li, Serban, and Swann (2015), measurements of accessibility should also include quality of infrastructure as well as how often congestion occurs. Furthermore, the importance of public transport shouldn't be underestimated (McLafferty, 2003). This is especially true for healthcare firms around

poorer regions as those who don't have access to cars are very restricted in healthcare availability otherwise (Tao, Yao, Kong, Duan, & Li, 2018).

Next to accessibility, measures of availability are often covered within these healthcare location optimization models. Waiting times are often used as well as the amount of population per healthcare spot within a local area. (Li et al., 2015). When trying to predict a real world situation the type of healthcare is of importance. When researching elderly home availability measuring total population is not useful. Instead, only elderly population should be used as measurement (Gu, Li, & Li, 2018). The study of Tao et al. (2018) finds that models on elderly homes are often modelled incorrectly. Especially in rural areas as higher amounts of elderly population reside there with less elderly homes available. The same is true for more specialized healthcare. Rarely academic hospitals are located in rural areas. This implies that those living in rural areas that are in need of specialized healthcare have more problems acquiring the care they require. On the contrary, it is found that people that have the financial capability are much more willing to travel further for more specialized healthcare (McLafferty, 2003). Specialized and high quality healthcare is thus also important to measure although creating good measurements for this is difficult. Finally, population characteristics are important as many inequalities may are as mentioned above through income, but also other characteristics like ethnic groups and group mobility.

2.7 Hypothesis

As the position of the healthcare sector within the location-place theory has become clear it is now possible to set up hypothesis on what this might imply. First the expected location choices and preferences of healthcare firms will be discussed in general. This consists of agglomeration effects, healthcare demand, and location optimization benefits. Then, differences between different types of healthcare firms will be discussed. Finally, the comparison between healthcare firms and other service firms will be discussed.

In regards to the location choice preferences of the healthcare sector, the following can be expected based on possible agglomeration effects discussed above. As stated by Ciccone (2002), healthcare firms require employees that have the correct medical qualifications. Therefore, firms will need to locate in areas where these workers are present if efficiency is to be achieved. This is where urban regions or agglomerated areas have more benefits for healthcare firms than rural regions. Especially, as specialized medical personal is found to need financial incentives to move to rural regions (Scott et al., 2013). Also other benefits can be gained from locating in urban agglomerations. Knowledge spill-overs lead to both increased healthcare quality and innovation (Baicker & Chandra, 2010; Bates & Santerre, 2005) Closely related to quality is the perceived quality by consumers. Lewis et al. (2018) found that the quality of the neighbourhood in which a healthcare firm is located is perceived as the quality of healthcare provided. Therefore healthcare firms might prioritise to locate in wealthier neighbourhoods when possible.

H1: *Healthcare firms will primarily locate in urbanized areas.*

H2: *Healthcare firms will locate in areas where specialized medical personnel is present.*

H3: *Healthcare firms will locate in wealthy neighbourhoods*.

Another reason locating in urbanized areas is important for healthcare firms is their prime driver of demand which is population. According to Wu et al. (2007), this is the main factor of which healthcare firms can benefit. In areas that are more urbanized more densely packed population can be profited

of. This implies, that in general in areas with high population numbers a higher number of healthcare firms are expected to be present. Another finding is that in regions with a population that is older more healthcare is demanded (Vrhovec & Tajnikar, 2016; Wu et al., 2007). Therefore, healthcare firms will choose to locate in areas where a higher aged demographic is present.

H4: *Healthcare firms will locate in areas with high population numbers.*

H5: *Healthcare firms will locate in areas with a higher aged demographic*

From healthcare optimization models the importance of availability and accessibility are stressed as vital for healthcare firms. According to Li et al. (2015), it is both mutually beneficial for firm and consumer to keep travelling costs to a minimum. This further reinforces the plausibility of H1 above.

Another important factor is the different types of healthcare firms that are present. Different healthcare firms have differing location preferences (Gu et al., 2018). Based on the expectation above additional expectations can be set for different healthcare firms. Healthcare firms that require more highly specialized personal are expected in terms of locations preferences to respond more strongly to areas in which this is present. The same holds for healthcare firms that are specialized in elderly care. In areas with a higher aged demographic more elderly specialized healthcare firms are expected to be present.

H6: *Healthcare firms that require more specialized personal will locate in areas where more specialized personnel is present.*

H7: *Healthcare firms specialized in elderly care will locate in areas where a higher aged demographic is present.*

When the locational preferences of the healthcare sector are compared to other services sector firms similarities are expected to be found. For both healthcare as service sector firms main demand is caused by high population numbers (Otsuka, 2008; Wu et al., 2007). Therefore, the location process is expected to be relatively similar.

H8: *Both healthcare firms and other service sector firms are expected to have similar location patterns.*

3.0 Methods

3.1 Introduction to empirical research

To answer both the second and third research question a quantitative analysis is required. This quantitative analysis will be built on the knowledge gathered within the literature review above. Furthermore, the hypothesis resulting from the literature review will be tested. Therefore, the aim of this quantitative analysis is to uncover more about the location preferences of healthcare firms. This is done by analysing both the current distribution and the movement over time of healthcare firms. The quantitative analysis will consist of three analysis steps consisting of multiple regressions. First, all firms within the healthcare sector will be researched to see how the healthcare sector locates in general. In addition to the amount of firms also the amount of healthcare jobs will be investigated. Then, different types of healthcare firms will be analysed further to see whether location behaviour differences within the healthcare sector exist. Finally, the healthcare sector will be compared to other service firms to see if there is a difference in firm location behaviour between them.

Each of these three main analysis consist of two main research steps. First, the spatial distribution of healthcare firms in 2019 will be analysed to see which demographic factors affect the spatial distribution of these firms. Additionally, the growth percentage of healthcare firms in a 20 year period will be tested against the growth percentage of municipal demographic values. For both of these research steps the same data of municipal demographic values will be used with slight changes. These are the following demographic characteristics: ageing, total population, degree of urbanisation, housing value, migrant background, and high educated population. The data of all these demographic values is provided by the CBS of the Netherlands and is freely accessible. The firm type and location data is provided by the LISA register of which the data is not freely accessible. The time period for which the second research step is done is the 1999 – 2019 period unless stated otherwise. Further elaboration on the quantitative analysis is first provided on the research steps and then additional information is provided on each variable.

3.2 Research step one

The first research step is used to see the 2019 spatial distribution of healthcare firms. The spatial distribution is measured in aggregated numbers of firms per municipality, as stated above. The spatial distribution will function as the dependent variable. The independent variables within this regression are the demographic characteristics. These demographic characteristics are also measured per municipality. The regression formula is shown below.

$$Y_{i2019} = \beta_0 + \beta_x X_{i2019} + \varepsilon_i$$

- Y_{i2019} = Dependent Variable (Amount of healthcare firms in 2019 for each municipality)
- β_0 = Constant
- β_x = Coefficient of the independent variables
- X_{i2019} = Independent variables
- ε_i = Error term

3.3 Research step two

The second research step is very similar in structure to the first one. Only this time percentual changes over time are used as data instead of year data. The percentual data is calculated by calculating the

percentual change between the demographic values per municipality in 2019 and the 1999 values. Like the first research step the demographic values are used as independent variables while the LISA firm data is used as the dependent variable. The regression formula is shown below.

$$\Delta Y_{i99-19} = \beta_0 + \beta_x \Delta X_{i99-19} + \varepsilon_i$$

- $\Delta Y_{i99\text{-}19}$ = Dependent Variable (Percentual change in the amount of healthcare firms between 1999 – 2019)
- β_0 = Constant
- β_x = Coefficient of the independent variables (Percentual change in the demographic values between 1999 – 2019)
- ΔX_{i2019} = Independent variables
- ε_i = Error term

3.4 LISA register firm data

The data acquired from the LISA register will function as the main dependent variable within the regressions. From the LISA dataset which contains all firms for each year in the Netherlands the years 1999 and 2019 are used unless stated otherwise. All firms that have less than 5 registered employees are excluded from this quantitative analysis. This choice is made to exclude any self-employed people which have registered as a firm. Self-employed firms have often registered their home address as firm location, while work is sometimes conducted elsewhere. Therefore, firm location choice processes don't apply to them. Aside from Self-employed firms, it also excludes some alternative 'healthcare' firms which are not useful for this analysis. For the healthcare sector, the SBI code of Q is applicable which contains all healthcare firms. For different type of healthcare firms the following SBI sub categories are used: 1. Medical care, which include Academic hospitals, general hospitals, and categorical hospitals. 2. General practitioners, which include general practitioners practices. 3. Dentists, which include dentist practices and dentist specialists. 4. Elderly care, which include nursing homes. These four sub groups are chosen as within the literature most case studies on healthcare cover these firm types. Also all the service sector SBI to compare to the healthcare sector. For this the following SBI codes are used which covers the entire service sector: wholesale & retail (G), transport & storage (H), lodging & catering (I) information and communication (J), Financial (K), real estate rental & trade (L), Advice & research (M), educational (P), and other services (S). Now all the different SBI configuration used in this quantitative analysis are clear, total firm amounts are aggregated per municipality.

3.5 CBS data and variables

As stated above within the analysis, six main demographic variables will be used. Below, an elaboration will be given on why these variables were chosen. Within the regressions, these demographic values function as independent variables. The datasets from which the variables are taken is de 'regionale kerncijfers Nederland' and 'Kerncijfers wijken en buurten' datasets.

Total population

The first variable included in the empirical analysis is total population. Healthcare demand is highly dependent on the amount of potential consumers. Furthermore, high population in municipalities often indicates the urban level. Firms can benefit from agglomeration effects and therefore it is useful

to test to what extent total population attracts healthcare firms (McCann, 2013; Wu et al., 2007). The CBS data gives the total population number of each municipality. Within the regression total population is measured for each municipality x1000.

Degree of urbanisation

Similar to total population, the degree of urbanisation can tell much about the potential agglomeration effects that might occur in the municipality. As stated in the literature review the higher more urban and densely populated a municipality is the more customers close by for healthcare firms to attract. Although measures urbanisation are no indication of relative distance it can enable more people to be within range of the healthcare sector. Especially for the less mobile population. Therefore it could be viewed as an indication of accessibility. The data provided by the CBS is again straightforward as it classifies the amount of addresses per square kilometre with an degree of urbanisation.

Ageing

As stated in the literature review and hypothesis, the effect of ageing is one of the main drivers of healthcare demand (Wu et al., 2007). It also is the main locational difference between healthcare firms and other service sector firms. Ageing is also one of the major problems currently facing the Netherlands with high impacts on the healthcare sector (Hartholt et al., 2012; Jacobzone & Oxley, 2002). As the ageing process has been ongoing over the last years and still continues to rise it is important to include in this analysis. The data of the CBS classifies a person falling in the category ageing when one is aged 65 and above. The CBS data provides the percentage of the population of a municipality falling in the aged category.

Highly educated population

The fourth variable is highly educated population. This variable has no data available for 1999. However, a measure of education has to be included as the literature review has showed that it is vital within healthcare location choice. Sources like Ciccone (2002), show that the status of the labour market can be important for healthcare firms that require specialized personal. The CBS classifies an individual as highly educated when either a HBO or university degree has been attained. The data shows the percentage of the total municipal category that falls within the group.

Average housing price

The fifth variable is average housing price. This variable is used as a measure of wealth. Housing value is a great substitute for other wealth measures like personal income as those are often private. Furthermore, in the literature review it was found that quality of the neighbourhood is seen as a measure of healthcare quality (Lewis et al., 2018). CBS data provides the average housing value (WOZ) of each municipality.

Migrant population

The last variable which is used for all regressions is migrant population. This variable mainly functions as a control variable. The CBS classifies migrants as both those who are of 1st and those of 2nd generation. Also, both migrants from a western as a non-western background are included. The data comes in percentages of the total population.

3.6 Additional information

For the second quantitative analysis a slight data adjustment is conducted within the second research step. As for some firm types 0 firms are located within municipalities. It is not possible to calculate percentual changes from 0 values. Therefore these values have been replaced with 1. This research choice is conducted as municipalities that went from 0 firms to 6 firms have significant relative gains.

Therefore these results can't simply be ignored. Using the value of 1 least impacted the outcome of the analysis while still being credible. The regressions excluding 0 values is shown in the appendix. Another problem that has to be discussed, is the problem of reversed causality. It could be plausible that healthcare firm location decisions influence the demographics within the municipalities. However, the study of Graham, Melo, Jiwattanakulpaisarn, and Noland (2010) finds that mainly urbanization economies lead to higher levels of productivity due to a higher amount of firms locating there and not vice versa. Finally, it would be very beneficial to be able to analyse the effects of changes in educational level on the amount of healthcare firms. However, only data between the 2014 – 2019 period is available. This time period is proven to be too short for gathering significant results as is shown in the appendix. Therefore, this won't be included within the quantitative analysis.

4.0 Results

4.1 Location behaviour of the healthcare sector

The first regression set is used to examine the location behaviour of the entire healthcare sector. This is done using four regressions. The first regression depicts the 2019 healthcare firm distribution shown in table (1). Next, a regression is conducted to see how over the 1999-2019 period changes in demographics and firm amounts have reacted to each other. This regression is shown in table (2). The final two regressions analyse the amount of jobs in healthcare instead of number of firms. This is, as stated in the methods, done separately to see whether there are significant differences between the indicators. The first of the healthcare jobs regressions is shown in table (3) and depicts again the 2019 firm distribution. Then the last figure shows the relation between demographic changes and amount of jobs in healthcare changes. This is shown in table (4).

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model 5	(6) Model 6
Total Population	0.824***	0.647***	0.585***	0.553***	0.535***	0.533***
	(0.0578)	(0.0605)	(0.0634)	(0.0641)	(0.0630)	(0.0698)
Degree of Urbanisation = 1		66.92***	60.12***	54.22***	46.36***	45.93***
		(9.911)	(10.08)	(10.25)	(10.25)	(11.89)
Elderly			-1.863***	-1.957***	-1.559**	-1.562**
			(0.636)	(0.632)	(0.628)	(0.631)
Highly Educated				1.437***	2.736***	2.729***
				(0.554)	(0.638)	(0.645)
Average Housing Value					-0.259***	-0.259***
					(0.0667)	(0.0668)
Migrant Background						0.0478
						(0.659)
Constant	40.45***	31.29***	106.2***	71.71**	88.94***	88.70***
	(5.062)	(4.957)	(26.04)	(29.05)	(28.82)	(29.05)
Observations	352	352	352	352	352	352
R-squared	0.367	0.440	0.454	0.464	0.487	0.487

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1 Healthcare sector firms 2019

As can be observed from table (1) above, the 2019 healthcare firm distribution regression shows many significant results. Firm location in 2019 is mainly explained by the amount of population within the municipalities, as the R-squared is already high in the first model. Not only total population is significant with p<0.01, also the degree of urbanisation, amount of highly educated, and average housing value are highly significant. The degree of urbanisation and the amount of elderly have positive effects on the amount of firms within a municipality, while higher housing values have a negative effect. Also significant is the portion of elderly within a municipality although the coefficient shows a surprising negative relation. This implies that a higher percentage of elderly within a municipality results in less healthcare firms locating there. The amount of migrants within a municipality has no effect on the amount of firms.

Table (2) below, shows how healthcare firms respond to demographic changes. As can be seen, healthcare firms respond positively to changes in population amounts in municipalities with p<0.01 significance. Ageing, house value, and migrant population aren't found to be significant. This implies that healthcare firms mainly react positively to increases in total population counts.

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
Change in Total Population	1.617***	1.717***	1.731***	1.601***
	(0.314)	(0.318)	(0.318)	(0.329)
Change in Elderly Population		0.274*	0.226	0.249
		(0.150)	(0.156)	(0.157)
Change in Housing Value			-0.141	-0.165
			(0.131)	(0.132)
Change in Migrant Population				0.311
				(0.207)
Constant	122.1***	100.3***	130.0***	121.1***
	(5.866)	(13.30)	(30.66)	(31.18)
Observations	352	352	352	352
R-squared	0.070	0.079	0.082	0.088

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2 Response of Healthcare Firms to demographic changes 1999 – 2019

As can be observed in table (3) below, the 2019 healthcare jobs distribution regression depicts quite similar results to healthcare firm regression, as is shown in table (1). Again, total population, degree of urbanisation, highly educated, and average housing value have highly significant results. However, again the effect of an elderly population has a contrasting results then derived from the literature. Also, the amount of migrants within a municipality has a negative influence on the amount of healthcare jobs. What is remarkable within this model is the R-squared. A huge amount of the distribution of healthcare jobs is explained by total population count with 0.913.

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model 5	(6) Model 6
Total Population	85.29***	82.75***	82.86***	81.91***	81.52***	83.22***
	(1.410)	(1.536)	(1.629)	(1.642)	(1.625)	(1.788)
Degree of Urbanisation = 1		959.4***	971.6***	797.5***	628.3**	969.9***
		(251.8)	(259.1)	(262.8)	(264.4)	(304.7)
Elderly			3.366	0.597	9.187	12.00
			(16.36)	(16.20)	(16.20)	(16.16)
Highly Educated				42.38***	70.37***	75.67***
				(14.20)	(16.45)	(16.53)
Average Housing Value					-5.585***	-5.662***
					(1.720)	(1.711)
Migrant Background						-37.46**
						(16.88)
Constant	-769.4***	-900.7***	-1,036	-2,053***	-1,682**	-1,494**
	(123.4)	(125.9)	(669.5)	(744.6)	(743.4)	(744.1)
Observations	352	352	352	352	352	352
R-squared	0.913	0.916	0.916	0.918	0.921	0.922

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 Healthcare sector jobs 2019

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
Change in Total Population	2.023***	2.194***	2.171***	1.979***
	(0.492)	(0.497)	(0.497)	(0.514)
Change in Elderly Population		0.468**	0.549**	0.582**
		(0.235)	(0.244)	(0.245)
Change in Housing Value			0.239	0.204
			(0.205)	(0.207)
Change in Migrant Population				0.460
				(0.324)
Constant	78.89***	41.59**	-8.731	-21.93
	(9.183)	(20.80)	(47.94)	(48.76)
Observations	352	352	352	352
R-squared	0.046	0.057	0.061	0.066

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 Table 2 Response of Healthcare jobs to demographic changes 1999 – 2019

The last model of the general healthcare location analysis shows the effect of demographic changes over time compared to changes in healthcare jobs. This is presented above in table (4). Again similar results can be found compared to the firm analysis in table (2). Total population is again the main significant variable that influences the amount of healthcare positively. In addition also increases in elderly population is found to have a positive effect on creating more healthcare jobs within a municipality.

4.2 Location behaviour of different type of healthcare firms

To further analyse the location behaviour of the healthcare sector the sector will be further dissected. Four clearly distinct sub classifications will be analysed. The following four types of firms will be researched as explained in the methods: 1. Medical firms, 2. General practitioners, 3. Dentists, and 4. Elderly homes. Also, all other healthcare firms are included as an extra category to show how other healthcare firms influence the analysis above. For each type of healthcare two regressions are conducted similarly to the analysis above. No growth analysis will be conducted as the time period is too short. Also, only the regression that includes education is shown as the extended model is more complete.

In table (5) below, the relation of the four different type of healthcare firms and the demographic values are shown. As can be observed, all four healthcare firms are strongly impacted by population size within municipalities. This is to be expected based on the literature. A strong contradiction from the previous regressions is the effect of ageing. All four types of healthcare firms have positive coefficients while the entire healthcare sector had a negative coefficient. This is caused by other types of healthcare firm that are included in the other category. Quite interesting is that a positive significant results are found in regards to elderly population all researched firm types. On the contrary, all other healthcare firms exluded have a strong significant negative coefficient. Degree of urbanisation is only significant for other healthcare firm types. Also, higher house value impacts the amount of general practisioners and nursing homes negativly as both coefficients are negative. The percentage of inhabitants with a migrational background impacts medical firms, nursing homes and general

practisioners primarily. This can be partly explained by migrants often locating within large urban cities in which hospitals are alse found. The variable of education shows unexpected results. Of all firms the one which requires the least highly educated personal has a significant results with a positive coeffiicent. This implies that nursing homes are found in municipalities of which inhabitants have a high level of education.

VARIABLES	(1) Medical Firms	(2) General Practitioners	(3) Dentists	(4) Nursing Homes	(5) Other
Total Population	0.0243***	0.175***	0.185***	0.0938***	0.0551
	(0.00106)	(0.00311)	(0.00230)	(0.00313)	(0.0690)
Degree of Urbanisation = 1	-0.0929	0.761	0.324	0.520	44.41***
	(0.181)	(0.531)	(0.392)	(0.533)	(11.75)
Elderly	0.0206**	0.0945***	0.0588***	0.148***	-1.884***
	(0.00958)	(0.0281)	(0.0208)	(0.0283)	(0.623)
Highly Educated	-0.00661	0.0189	0.0274	0.0838***	2.606***
	(0.00980)	(0.0288)	(0.0213)	(0.0289)	(0.638)
Average Housing Value	-0.000311	-0.00802***	9.15e-05	-0.0110***	-0.240***
	(0.00101)	(0.00298)	(0.00220)	(0.00299)	(0.0660)
Migrant Background	0.0276***	-0.0996***	0.0316	-0.0898***	0.178
	(0.0100)	(0.0294)	(0.0217)	(0.0295)	(0.651)
Constant	-1.340***	0.356	-4.107***	-2.533*	96.33***
	(0.441)	(1.296)	(0.957)	(1.301)	(28.70)
Observations	352	352	352	352	352
R-squared	0.742	0.937	0.971	0.800	0.276

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 Healthcare firm types compared 2019

Below in table (6) the regression is presented, which shows the results of firm growth for different healthcare types as a result of demographic changes. Medical firms appear not te be influenced in their decision choices through demographic changes on a municipal level. For general practitioners increased ageing in municipalities causes less firm location within them. General practitioners do however respond to population changes and population density increased as both have positive effects on the amount of GP's locating there. Finally, for nursing homes municipalities that both have population and house value increases gained more firms. On the contrary municipalities with a decrease in population density have less nursing homes located within them.

VARIABLES	(1) Medical Firms	(2) General Practitioners	(3) Dentists	(4) Nursing Homes	(5) Other
Change in Total Population	-0.0178	2.483***	1.167*	1.781***	1.271***
	(0.154)	(0.783)	(0.632)	(0.640)	(0.465)
Change in Elderly Population	-0.0115	-0.738**	0.0782	0.465	0.303
	(0.0735)	(0.373)	(0.301)	(0.305)	(0.222)
Change in Housing Value	-0.0564	-0.0436	0.369	0.705***	-0.228
	(0.0619)	(0.314)	(0.254)	(0.257)	(0.187)
Change in Migrant Population	0.117	0.479	-0.164	0.431	0.448
	(0.0970)	(0.492)	(0.398)	(0.403)	(0.293)
Constant	13.66	272.5***	92.59	-85.78	145.4***
	(14.62)	(74.19)	(59.90)	(60.69)	(44.08)
Observations	352	352	352	352	352
R-squared	0.006	0.058	0.017	0.055	0.041

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 Response of different Healthcare Firms to demographic changes 1999 - 2019

4.3 The healthcare sector and the service sector compared

The final quantitative analysis within this thesis, is used to compare the healthcare sector and other service sector firms. The results presented in table (7), are similar for the healthcare firms as shown in the analysis above in table (1). The healthcare firm analysis is still included as it is easier to compare. For the service sector the exact same analysis is done. As can be seen from the table, many differences can be found between healthcare firms and service sector firms. Only similar results can be found in the effect of total population as it is both positively significant for healthcare firms and service sector firms. For degree of urbanisation, elderly, and highly educated population no relation is found with service sector firms. For average housing value and migrant background a significant result is found but a differing one compared to healthcare firms.

VARIABLES	(1) Healthcare firms	(2) Service sector firms
Total Population	0.533***	11.93***
	(0.0698)	(0.232)
Degree of Urbanisation = 1	45.93***	-41.55
	(11.89)	(39.57)
Elderly	-1.562**	1.805
	(0.631)	(2.099)
Highly Educated	2.729***	-1.857
	(0.645)	(2.147)
Average Housing Value	-0.259***	0.675***
	(0.0668)	(0.222)
Migrant Background	0.0478	-4.436**
	(0.659)	(2.193)
Constant	88.70***	-257.6***
	(29.05)	(96.65)
Observations	352	352
R-squared	0.487	0.925

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 Healthcare firm / Service sector firms compared 2019

The results of the analysing which shows how service sector firms react to demographic changes over time, are shown below in table (8). The results for the service sector show that service firms don't react much trough demographic changes. Only population influences location changes trough demographics. For population the positive coefficient is far smaller than for the healthcare sector. For the other variables the service sector does not show a relation between changing municipal demographics and changes in firm location.

5.0 Discussion

5.1 Healthcare firms and population

As the results of the quantitative analysis have been shown, it is time to interpret the findings with the literature and hypothesis stated in chapter 3. First, the general location choices of healthcare firms will be discussed. Then, for each consecutive topic the additional findings of healthcare firm type and comparison to service sector will be discussed. As was expected from the literature, this quantitative analysis shows that healthcare firms are strongly influenced by population demand. In table (1) & (3) it can be seen that both when looking at healthcare firms and jobs distribution in 2019 population is the main explanatory variable. As expect the relation between population and healthcare firms is positive. Therefore the findings of Wu et al. (2007) that population is the single most important driver of healthcare demand and the H4 hypothesis are reinforced by the quantitative analysis *(H4: Healthcare firms will locate in areas with high population numbers.)*. Not only can the current location of healthcare firms partly be explained by municipal population counts, it also partly explains firm movements over time. This is shown in both table (2) & (4). Quite interesting is that, when further analysing the coefficients of change in total population in both tables, it can be seen that a scaling effect arises. For each change within the population of a municipality, the amount of healthcare firms changes by 1.601 and the amount of healthcare jobs by 1.979. This implies that the healthcare sector is heavily affected by population movement.

When further dissecting the healthcare sectors distribution in 2019, all four distinct types of healthcare firms are also positively affected by population amounts (table 5). While this is not the case when looking at population changes in table (6). Remarkable is that for other healthcare firm types, this is not the case. Furthermore, over time firm location of general practitioners and nursing homes do respond strongly to population changes. On the contrary, to the current distribution of healthcare firms over time there is also a responds of other healthcare firms to population changes. When comparing the healthcare sector to the service sector, both strongly respond to population amounts. This relation is both found in the current distribution of healthcare firms in municipalities, as well as the movement as was expected in H8 *(H8: Both healthcare firms and other service sector firms are expected to have similar location patterns).*

5.2 Healthcare firms and urban density

Aside from benefiting from high demand due to population numbers healthcare firms also are expected to benefit from agglomeration effects within urban locations (Baicker & Chandra, 2010; Bates & Santerre, 2005). Within the quantitative analysis, the results show that within the Netherlands a part of the 2019 distribution of healthcare firms can be explained by the degree of urbanization of municipalities. This relation vanishes however when looking at the four different healthcare firms types. The found relation between healthcare firms in general, is caused by all other firm types within the healthcare sector as can be seen in table (5). This implies that the H1 hypothesis only partly holds true in this quantitative analysis *(H1: Healthcare firms will primarily locate in urbanized areas)*. Comparing the service sector to the healthcare sector and similar effects can be found. The service sector has no relation with the degree of urbanization in municipalities. Therefore, H8 holds up when compared with the four different healthcare firm types but not when compared to the entire healthcare sector *(H8: Both healthcare firms and other service sector firms are expected to have similar location patterns)*.

5.3 Healthcare firms and population demographics

From the literature, it was concluded that healthcare firms are highly dependent on population. Not only for demand purposes, as shown above, but as well for getting the correct employees (Ciccone, 2002). From the quantitative analysis, it is shown that healthcare firms do locate in municipalities with a high percentage of highly educated inhabitants (table 1 & 3). This effect is both found for healthcare firms as jobs in the healthcare sector. This results supports the H2 hypothesis *(H2: Healthcare firms will locate in areas where specialized medical personnel is present).* The results of the quantitative analysis differ from the H6 hypothesis. *(H6: Healthcare firms that require more specialized personal will locate in areas where more specialized personnel is present).* For the three firm types that require highly educated personnel (Medical firms, GP's, and Dentists) no relation is found as is shown in table (5). For nursing homes and other healthcare firms, a relation has been found however. The previous mentioned results contradict the existing literature and therefore for no conclusive conclusions can be draw. It is plausible however, that short distances between municipalities in the Netherlands and the small relative distance between cities in the Netherlands in general influences this dynamic. Highly educated personal might locate in less busy neighbouring municipalities and choose to commute slightly larger distances to work. The service sector is found to not have a relation with the percentage of highly educated inhabitants in a municipality (table 7). In general, more data on education is required to see whether a relation between changes in educated population and healthcare firms does exist.

Another population characteristic of importance for healthcare firms, is the demand from the percentage of elderly in an area. However, the quantitative analysis shows contradicting results to the literature and the H5 hypothesis *(H5: Healthcare firms will locate in areas with a higher aged demographic).* The 2019 distribution of healthcare firms does have a relation with healthcare firms only opposite as expected. The firms in the healthcare sector have located more in municipalities with less numbers of elderly, as table (1) shows. Comparing the different healthcare firm types shows interesting results. All four healthcare firm types have an opposite relation to the healthcare sector overall. These contradicting results are explained by the other healthcare firms, as table (5) shows. There is however no support for H7 as all different firm types have similar coefficients aside from medical firms *(H7: Healthcare firms specialized in elderly care will locate in areas where a higher aged demographic is present)*. Healthcare firms are not found to respond to changes in elderly population over time, but the amount of healthcare jobs within a municipality does positively change. Within the service sector no relation with elderly population is found.

The final two population characteristic that can be explored are, relative wealth by means of average housing value and migrant background. According to Lewis et al. (2018), the quality of a healthcare firms is closely related to the quality of the neighbourhood it is located in. the results in table (1), show that although this might be true healthcare firms won't locate in wealthier neighbourhoods. Instead the opposite is true as GP's, dentists, and non-classified healthcare firms will locate in poorer neighbourhoods. Therefore, H3 is shown to be not correct *(H3: Healthcare firms will locate in wealthy neighbourhoods)*. Unlike healthcare firms, service sector firms do locate in wealthier neighbourhoods, as is shown by table (7).

6.0 Conclusion & Future recommendations

6.1 The location behaviour of healthcare firms in the Netherlands

As has been analysed in this thesis, the location preferences of healthcare firms are very complex to understand and research. Many different factors influence the current spatial distribution of healthcare firms and how it has come to be. Factors put forward by the academic literature based on both healthcare theory and general theory, have shown certain factors of importance. The most important of these factors is the source of demand within the healthcare sector. Both in the literature as well as the quantitative analysis, population is shown to be most important in explaining location behaviour of healthcare firms. Furthermore, it is shown that healthcare firms are most responsive to changes in population amounts over time. This effect is shown to be similar for all four tested types of healthcare firms as well as for other types of service sector firms.

Similar to total population amounts, the effect of the degree of urbanization has been shown as important. This urban-rural relation was also established within the literature. This relation is well supported by the quantitative analysis in this thesis. The results show, that firms and jobs in the healthcare sector are more located within urban regions. However, the quantitative analysis was unable to find the same relation when looking at individual firm types in the healthcare sector. One factor that has proved most vital in explaining healthcare firm location behaviour on a municipal scale, is population amount. As already shown by the literature as the most important factor for healthcare demand, this quantitative analysis also shows, that healthcare firms locate in municipalities with higher population amounts.

Further discussion on potential agglomeration effects within the healthcare sector primarily focussed on the labour market. Specialized employee requirements should make healthcare firms locate mostly within municipalities with a higher number of highly educated inhabitants. The quantitative analysis has further reinforced the existing of this relationship. Within this thesis a relation between the amount of highly educated within a municipality and healthcare firm placement has been established. It is found that healthcare firms are more located within highly educated municipalities than other service sector firm. However, the origin of this relationship needs further research as the dissection within the quantitative research was unable to find conclusive answers. For the three healthcare firm types with highly educated worker requirements, no relation is found.

Finally, literature has indicated that ageing is a problematic phenomenon which has a high impact on the healthcare sector. Sources state that aside from population amounts, the amount of elderly within a region is the second most important driver of healthcare demand. However, the quantitative analysis shows that indeed that there is a relation between elderly population and healthcare firms only a negative one. This surprising result is contradicting the literature. This effect can be explained by the influence of firm types within the healthcare sector that haven't been studied closely in this thesis. For medical firms, GP's, Dentists, and Nursing homes there is a positive relation to the amount of elderly within a municipality. Other service sector firms are not found to have a relation to the amount of elderly within a municipality.

6.2 Future recommendations

This thesis has shown the difficulty of researching a highly complex sector like the healthcare sector. However, these difficulties can be used to give recommendation and directions future research can take. While looking at the healthcare sector in total is useful, it can't easily be used to explain firm

movement. The four different types of healthcare firms further analysed in this thesis, show differing location preferences in regards to municipal demographics. Therefore, in future work researching a specific healthcare firm type is more useful as their location preferences can be more precisely uncovered. Another research choice that can give more insight on location preferences, is using a lower geographical research level or using firm specific location data. Although, this gives additional research difficulties with data availability it can be useful as within large municipalities many demographic differences can be present for differing neighbourhoods. Additionally, an analysis that has better measurements of healthcare availability can greatly improve targeted analysis to see where potential availability problems may arise in the future. Another factors which this thesis hasn't been able to research is availability through infrastructure. The literature showed that better infrastructure may be vital in the location decision process of healthcare firms.

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8.0 Appendix

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model 5
Change in Total Population	0.0797	0.0828	0.0884	0.0945	0.0895
	(0.0758)	(0.0761)	(0.0762)	(0.0763)	(0.0765)
Change in Elderly Population		0.0257	0.0296	0.107	0.0700
		(0.0499)	(0.0499)	(0.0801)	(0.0885)
Change in Highly Educated Population			0.0577	0.0612	0.0621
			(0.0457)	(0.0457)	(0.0458)
Change in Housing Value				-0.0972	-0.123
				(0.0791)	(0.0836)
Change in Migrant Population					0.0745
					(0.0768)
Constant	11.45***	11.04***	9.964***	9.923***	9.698***
	(0.867)	(1.185)	(1.458)	(1.458)	(1.476)
Observations	352	352	352	352	352
R-squared	0.003	0.004	0.008	0.013	0.015

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 1 Response of Healthcare Firms to demographic changes 2014 – 2019 (Education included)

VARIABLES	(1) General Practitioners	(2) Dentists	(3) Nursing Homes	(4) Other	(5) Medical Firms
Change in Total Population	2.415***	1.254*	1.858***	1.346***	-0.326
	(0.802)	(0.651)	(0.647)	(0.477)	(0.462)
Change in Elderly Population	-0.810**	0.103	0.511	0.249	0.267*
	(0.384)	(0.312)	(0.310)	(0.228)	(0.156)
Change in Housing Value	-0.0490	0.382	0.748***	-0.240	-0.0384
	(0.318)	(0.258)	(0.257)	(0.189)	(0.109)
Change in Migrant Population	0.527	-0.107	0.421	0.447	0.446*
	(0.513)	(0.416)	(0.414)	(0.305)	(0.235)
Constant	281.8***	91.76	-96.57	151.2***	7.441
	(75.82)	(61.50)	(61.19)	(45.04)	(27.19)
Observations	336	336	336	336	129
R-squared	0.060	0.019	0.062	0.043	0.057

*** p<0.01, ** p<0.05, * p<0.1

Appendix 2 Table 6 Response of different Healthcare Firms to demographic changes 1999 - 2019 (0 values excluded)