*Erasmus University Rotterdam*

*Master's Thesis – Health Economics*

*June 23, 2021*

# Healthcare exceptionalism

A study on the association between market share and quality of a healthcare provider in the Netherlands

*Hugo Franciscus van Nieuwkerk*

**Student ID**
483022

**Supervisor**
Raf van Gestel

**Wordcount**
11996

## *Abstract*

The Dutch healthcare system is designed in such a way that the Dutch population can choose between different healthcare providers when they want to consume health care. This freedom of choice of healthcare consumers creates competition in the healthcare market. The conventional wisdom for the healthcare sector is to allocate healthcare consumers to higher performance providers. In this thesis it is researched if higher performance healthcare providers have larger market shares in the Netherlands, focussing on six medical procedures: oesophageal carcinoma, gastric carcinoma, prostate carcinoma, pancreas carcinoma, knee replacement and hip replacement. For these medical procedures, it is first examined whether higher quality healthcare providers have larger market shares at one point in time. In this static allocation analysis, available data of 2019 is used. It is also examined whether higher quality healthcare providers generate larger market shares over time. This dynamic allocation analysis uses panel data that is available from 2016 to 2019.

Even though the existing literature assumes that higher performance providers also attract more patients, different results have been found in this thesis. No robust evidence across several different conditions and performance measures have been found that higher quality hospitals have larger market shares and grow more over time. In follow-up research, the limitations of this thesis should be considered. The limitations of this thesis are related to the market fixed effects, the different case-mixes of healthcare providers, the quality indicators, and the relatively short time period of the dynamic allocation analysis. Follow-up research could use the same methodological strategy focussing on other medical procedures or other countries. Besides that, follow-up research could try to examine why the Dutch inhabitants are not able, or willing, to choose for high(er) quality healthcare providers.

# *Contents*

## *Introduction*

The amount of money a country spends on its healthcare is often a significant proportion of its gross domestic product (GDP). Data on GDP spending of the Netherlands from OECD/European Union (2020) suggests that in 2018 and 2019, the Netherlands devoted 10 percent of its GDP to healthcare. This percentage is equivalent to approximately 80 billion euros. Data on GDP spending of the Netherlands from OECD/European Union (2020) also shows that the increase in health care expenditure in recent years was the highest since 2009. From an international perspective, the Netherlands ranks the 10th of Europe when looking at the percentage of the GDP spent on healthcare. This percentage is comparable to the percentage of health care expenditure in Norway, Denmark, and the United Kingdom.

Once the financial resources of the Netherlands have been spent, they cannot be spent on anything else. This raises the question for which purposes the Netherlands should use their scarce financial resources for. Also in healthcare, choices have to be made with regard to the spending of these financial resources. The distribution of the money spent in healthcare is determined by supply and demand. In this thesis, the focus will be initially on the demand side of healthcare because light will be shed on which providers patients prefer. Conclusions which can be derived from this can be used to reflect on the supply side of healthcare.

For many medical treatments in the Netherlands, patients can choose between healthcare providers. Especially in densely populated areas, patients often have a choice between multiple healthcare providers. People can differ in the decision which healthcare provider they prefer. Victoor, Delnoij, Friele and Rademakers (2012) claim that this decision depends on '' … a variety of structural, process and outcome characteristics, [and patients differ] in the relative importance [that] they attach to these characteristics.'' (p. 13). Specifically, one person does not necessarily have the same preference as another person, even if they encounter the same circumstances. Those differences in preferences are integrated in the Dutch healthcare system, in which patients are allowed to choose. Dutch patients are not 'tied' to a single healthcare provider. This is the result of the important role that healthcare insurers have in the Dutch healthcare market. All Dutch '' … residents are required to purchase … [a basic healthcare] insurance from private insurers'' (Wammes, Jeurissen, Westert, & Tanke, 2019, p. 137). Those healthcare insurers will purchase health care on behalf of the patients by selectively contracting healthcare providers. In this selective contracting, healthcare insurers must guarantee that patients have the opportunity to consume health care from different healthcare providers in the area nearby. As a consequence, providers of healthcare can compete with each other for those contracts in order to attract patients. They can do so by competing with each other on

prices and on quality of care.

In 2006, the Dutch healthcare was reformed and afterwards, hospitals were strongly incentivized to compete on prices (Roos et al., 2020). Such price competition is however expected to deteriorate healthcare quality (Gaynor, 2006). In anticipation, the reform also led to nation-wide hospital quality reporting on several quality indicators and hospital ratings (Beukers, Kemp & Varkevisser, 2014). This information provision is similar to 'report cards', which already have been used for more than 20 years in both the US and UK. The quality of a provider, or surgeon, can be evaluated by those report cards (Chen & Meinecke, 2012).

> These evaluations rely on either process measures or outcomes measures. Process measures … describe activities performed by professionals and staff, such as completion of immunizations or screening tests. [On the other hand,] outcome measures … assess the results of the health care intervention … [such as] complication rates, length of hospital stay, mortality [rates], and patient satisfaction with [health] care. (Werner & Asch, 2005, cited by Dhiman & Diaz, 2015)

By introducing similar quality indicators and hospital ratings throughout the Netherlands, the quality of providers has been made transparent.

This transparency is a precondition of quality competition, or at the very least it aims to avoid quality deterioration with price competition. If health care quality is rewarded by attracting patients, healthcare providers are expected to compete on quality, which in turn leads to better health outcomes. This mechanism is less obvious in the healthcare market compared to regular markets; information may be scarce, consumers may be inert (i.e., they may stick to the hospital that is closest by), etc. Nevertheless, it is important that consumers take quality in consideration when making a choice on their healthcare provider. As such, with price competition integrated in the Dutch healthcare system it is necessary that patients consider quality in their provider choice. When patients are choosing high(er) quality providers, quality of care can be improved while slowing the growth of health care spending (Roos et al., 2020).

This thesis will build on knowledge from previous related studies. Chandra, Finkelstein, Sacarny and Syverson (2016) researched if ‘’… higher quality hospitals have higher market shares and grow more over time.’’ (p. 2110), focusing on multiple medical procedures in the United States. Varkevisser, Van der Geest and Schut (2012) researched the same topic but focussed on only one medical procedure in the Netherlands. In this thesis, the evidence presented in the research of Chandra et al. (2016) will be extended by providing evidence outside the US, and more medical procedures will be taken into account compared to Varkevisser, Van der Geest and Schut (2012). This thesis provides healthcare

policy-relevant information, and it does so by reviewing whether the precondition for quality competition in the Netherlands is met. This will be researched by studying whether well performing healthcare providers, also obtain the largest (and increasing) market shares in the Netherlands. If that is not the case, it would imply that lower quality healthcare providers perform the same, or even a larger, number of treatments. The money spent on treatments of the lower quality healthcare providers could also be spent on treatments of higher quality healthcare providers, which would mean that the scarce resources can be used more efficient. Therefore, further research is necessary to find out how this ideal situation can be achieved.

**Objective and research question**

The objective is to find out if high(er) quality providers, compared to low(er) quality providers, also have larger market shares. The strategy of Chandra et al. (2016) will be adopted, focussing at static and dynamic allocation of patients. The static allocation of patients focusses at one point in time to find out if the best performing healthcare provider also have the largest market share. The dynamic allocation of patients focusses on multiple points in time to find out if better performing healthcare providers gain more market share over time. This thesis will be focused on the Dutch healthcare market, and multiple medical procedures will be taken into account. The medical procedures that will be considered are oesophageal carcinoma, gastric carcinoma, prostate carcinoma, pancreas carcinoma, knee replacement and hip replacement. The choice for these procedures will be clarified in the strategy section. The objective of this thesis, which focuses on the static and dynamic allocation of the mentioned medical procedures in the Netherlands, results in the following research question:

- Are higher quality healthcare providers attracting more patients in the Netherlands?
    - Is this different for oesophageal carcinoma, gastric carcinoma, prostate carcinoma, pancreas carcinoma, knee replacement and hip replacement?

Firstly, the institutional details of the Netherlands will be discussed in the theoretical framework to clarify the Dutch healthcare system. The theoretical framework will also focus on related studies and other theoretical concepts that can be linked to the topic of this thesis. Subsequently, a description of the dataset will be provided in the 'research methods' section. After the methods have been explained in detail, the descriptive statistics of the data will be described. Finally, the results from the analyses and its validity will be explained, after which an appropriate discussion and conclusion will be described.

# *Theoretical framework*

### *Institutional details*

To clarify the theoretical framework, it is useful to first focus on the institutional details of the Netherlands. The design of the healthcare system in the Netherlands is based on the fact that the Netherlands is a welfare state. The welfare state is a model of society in which the government plays a central role in protecting and promoting the well-being of its citizens by guaranteeing a minimum subsistence level and promoting equal opportunities (Vonk & van der Grinten, 2018). Due to a cost explosion in health care in the 1980s and a lack of quality in health care after that, the Dutch government introduced the model of regulated competition in health care. In this model, the healthcare consumers (citizens), the healthcare providers, and the healthcare buyers (insurers) can be seen as the three main actors. In the system of regulated competition, the consumers cause competition in the healthcare providers market and in the healthcare insurers market. This competition has the goal to ensure both cost control and higher quality of care. The Dutch government must ensure that this is not at the expense of solidarity and accessibility (Vonk & van der Grinten, 2018). Those three actors will be described in more detail.

In the Netherlands, '' … all residents are required to purchase [basic] health insurance from private insurers, which are required to accept all applicants.'' (Wammes et al., 2019, p. 137), to cover the costs of standard health care. This basic insurance is based on solidarity: everyone pays the same premium. Personal characteristics such as income, age, health status, and risk of illness do not determine the amount which have to be paid as premium (Hansen, Arts & Muffels, 2005). In this way, everyone contributes to the health care costs of those who become ill. The Dutch health care expenses are '' … primarily public [financed], through [those] premiums, tax revenues, and government grants'' (Wammes et al., 2019, p. 137). The combination of having healthcare insurance and the fact that health care expenses are primary public financed, makes consumers of care partly insensitive for the costs when consuming care. So, when looking at the consumers' point of view in the Netherlands, patients will most likely not pay attention to the cost of care. Instead, they will probably make choices that suit their personal preferences the best. However, this does not mean that the Dutch residents can consume unlimited health care. In the Netherlands, there are policy restrictions that lower the demand for care. For example, there are various co-payment obligations in the Netherlands that ensure that consumers pay attention to the costs of health care. Besides that, general practitioners act as gatekeepers of care. This should prevent medicalization of society in order to keep health care costs under control (Terluin, 2003).

Another way to prevent a huge rise in health care costs, is the facts that Dutch healthcare insurers are purchasing health care on behalf of the patients. To understand why the Dutch healthcare system is structured in this way, the role of the healthcare insurer will be explained. In the Dutch regulated healthcare market, healthcare insurers compete with each other to achieve a good price-performance ratio for healthcare (Strategists, 2015). The idea is that consumers have the freedom to choose their own healthcare insurer. This will cause competition for consumers between healthcare insurers. Consumers will, logically, choose insurance with the best value for money. This provides an incentive for health insurers to negotiate stricter with healthcare providers about price, quality, and accessibility and to provide better service than the competitors (Strategists, 2015). Healthcare insurers have thus been assigned the role of efficient, customer-oriented healthcare directors. As an extra incentive, healthcare insurers may strive for profit in the performance of their task.

The provider's point of view in the Netherlands is more complex. Because the focus of this thesis is on several medical procedures provided by hospitals and healthcare clinics, the provider payments of those entities will be explained. In general, providers get paid trough a diagnosis-treatment combination (DBC). When a patient visits a medical specialist, he or she will have a specific need for care. The specialist will diagnose the patient and determine a treatment, which is a part of a DBC. A DBC includes all consultations, treatments and checks needed to treat a medical problem. Each healthcare provider negotiates with a healthcare insurer about the quality, volume, and in most cases the price of a DBC. They agree on the quality of a DBC and how many treatments the provider may perform in total. An important aspect in these negotiations for this thesis; the price of a DBC is not fixed. The majority of the DBC prices are negotiable by providers and insurers, a smaller part of the prices of DBC's have been '' … set nationally by the Dutch Health Care Authority'' (Wammes et al., 2019, p. 142). This results in the fact that the negotiations could have led to different prices between healthcare providers, for the same DBC. Eventually, the goal of the healthcare providers is to make profit. They can do this by performing treatments, at the price negotiated with an insurer.

Like explained, each actor has its own interests that must be realized. Due to the conflict of interests between the actors, not every interest of the actors can be completely realized. Consequently, the three actors keep each other in balance because they constantly struggle to achieve their interests.

***Related literature***

This thesis will initially focus on the first mentioned actor, the consumers of care. Before theoretical concepts will be discussed, the context will be sketched because the topic of this thesis has been the

subject of discussion for some time. In the literature, other studies have estimated the relationship between public quality information and hospital demand. Two of these studies will be discussed first, from which the relevance and context of this thesis will become clear.

Varkevisser, Van der Geest and Schut (2012) focus on the healthcare market in the Netherlands. They have examined if patients choose hospitals with high(er) quality ratings. By researching this, they specifically focussed on the market of angioplasty. In the Netherlands, not every hospital is allowed to perform angioplasty. Only hospitals with a government-granted permission are allowed to perform a percutaneous coronary intervention (PCI), which refers to the medical term for angioplasty (Varkevisser et al., 2012). In this study, the quality of those government-granted PCI hospitals is measured by four different quality indicators. Firstly, the overall reputation of a hospital is examined. In addition, the study also specifically focusses on the reputation regarding cardiology. Thirdly, the percentage of patients who have a readmission within 12 weeks is examined, which can be seen as '' … a general indicator of treatment failure.'' (Varkevisser et al., 2012, p. 373). The fourth and last quality indicator is the percentage of patients with nosocomial pressure ulcers, which is very painful and causes discomfort. The researchers have used these four quality indicators to determine the quality of the hospitals. To determine the demand for angioplasty hospitals, the researchers have used data of a large Dutch healthcare insurer (Agis). By combining this dataset and the four quality indicators, Varkevisser et al. (2012) have researched if patients choose hospitals with high(er) quality ratings. Their '' … main finding is that in the Dutch market for angioplasty [is] sensitive to differences in hospital quality as measured by public quality ratings.'' (Varkevisser et al., 2012, p. 377).

Chandra et al. (2016) conducted a similar study in the US. Even though the US healthcare system differs from the Dutch healthcare system, the results of this study could be relevant to the Dutch healthcare market. This is because the Netherlands and the US both have a healthcare system in which (regulated) competition plays an important role. ''In a system of … [regulated] competition, selective contracting and patient choice reward providers for quality improvements through increases in patient numbers and revenue.'' (Stadhouders, Kremer, Jeurissen & Tanke, 2019, p. 1312). In this design of the healthcare market, it is important that patients consider the quality of a healthcare provider when consuming care. Chandra et al. (2016) examined this allocation of patients in their paper. Chandra et al. (2016) tried to research empirically if, and to what extent, higher performing hospitals tend to attract greater market share. To examine this, they have used data of Medicare. Medicare is the US federal healthcare insurer which provides health insurance to the elderly over the age of 65, and the disabled. In this paper they looked at the allocation of those Medicare patients for several different medical procedures. They specifically focused on heart attacks, congestive heart failure, pneumonia, hip replacements and knee replacements. To determine the quality of hospitals which are performing those medical

procedures, the researchers used several quality measures. They were looking at the clinical outcomes, the extent to which practice guidelines are followed, and the overall patients' satisfaction with the healthcare provider. By combining the allocation of patients and the quality measures, they tried to find out if higher performing hospitals tend to attract a greater market share. Focussing on the clinical outcomes' measures and the process of care measures, they found robust evidence that higher performing hospitals tend to have (and gain) a greater market share. This conclusion is in line with the conclusion of the paper of Varkevisser et al. (2012). When focussing on the patients' satisfaction measurements, Chandra and his colleagues (2016) concluded something different. In their study, they did not find robust evidence that higher patients' satisfaction scores would result in having (or gaining) a greater market share.

In this thesis, the empirical strategy presented in Chandra, Finkelstein, Sacarny and Syverson (2016) will be adopted to the Dutch healthcare context. The available data allow to study a more extended set of medical procedures compared to Varkevisser, Van der Geest and Schut (2012). In addition, in this thesis more recent data will be used compared to those studies. Especially the paper of Chandra et al. (2016) is important in the realization of this thesis, because their methodological strategy will be adopted. This methodological strategy will be detailed explained in the research methods. Before explaining this, other theoretical theories will be linked to the topic of this thesis.

***Theoretical concepts***

In various countries, including the Netherlands, consumers have (limited) freedom to choose their own healthcare provider. This provider choice is a personal choice, which may differ from person to person because people have different preferences when choosing a healthcare provider. In 2017, researchers Aggarwal, Lewis, Mason, Sullivan and van der Meulen researched this 'provider choice' by patients. They stated that patients are willing to travel beyond the nearest provider for high(er) quality care. This allegation is also confirmed in the paper of Shalowitz, Nivasch, Burger and Schapira (2018). The objective of this paper was '' … to determine how patients balance [a] survival benefit against the burdens of travel to a distant treatment center.'' (Shalowitz et al., 2018, p. 44). In two discrete choice experiments the trade-off must be made between the quality of a healthcare provider and traveling 50 miles. The outcomes of these choice experiments shows that a larger amount of people is willing to travel as the quality of the healthcare provider (survival benefit) increases. Nevertheless, this is not the case for the entire population, "… elderly and low socioeconomic groups are less likely to travel beyond their nearest [healthcare] provider.'' (Aggarwal et al., 2017, p. 397) The same researchers also tried to find out for which specific characteristics of a healthcare provider consumers are willing to travel beyond their nearest

provider. They conclude that there is robust evidence that shorter '' … waiting times, indicators of better quality, and access to advanced technology'' (p. 379) would attract more patients (Aggarwal et al., 2017). Researchers Victoor, Delnoij, Friele and Rademakers (2012) found similar results, but they also mention that there is no such a thing as a typical patient. Not every patient will make the same decision in the same situation, it depends on the relative importance they attach to different factors which influences the decision of a provider (Victoor et al., 2012). The researchers conclude '' … that the [decision] process is much more complex than often assumed.'' (p. 13), because patients are not making completely rational choices.

Summarizing, specific characteristics of a healthcare provider do matter for the 'provider choice' by patients. Like mentioned in the related literature, other studies have researched if also the quality of care matters when a patient chooses a provider in the Netherlands. Varkevisser and colleagues have researched this for the angioplasty market in the Netherlands. They concluded that the '' … market for angioplasty … [is] sensitive to differences in hospital quality as measured by public quality ratings.'' (Varkevisser et al., 2012, p. 377). This is a very useful finding because they stated that this is '' … a necessary condition for competition to promote quality in hospital markets.'' (Varkevisser et al., 2012, p. 371). Having consumers of care who are willing to shift from low quality to high(er) quality providers, is necessary to guarantee quality in the Dutch healthcare system. To explain this necessity, the ratio between price elasticity and quality elasticity will be considered.

When prices are unregulated, it is uncertain how it will influence quality of care. Roos et al. (2020) state that '' … regulators may be hesitant to permit price competition in healthcare markets because of its potential to damage quality.'' (p. 1). In their paper, they try to '' … assess whether this fear is well founded.'' (Roos et al., 2020, p. 1). To understand the effects of unregulated prices, the effects of regulated prices is firstly explained. ''When prices [of health care] are regulated, providers are forced to compete on quality to attract patients or contracts with insurers. When prices are unregulated, the effect … on quality [of care is disputable].'' (Roos et al., 2020, p. 1). By explaining this uncertainty, price elasticity and quality elasticity will be used to illustrate the problem. Roos et al. (2020) suppose that the effect of unregulated prices on quality, depends on the fact how competition will affect the responsiveness of demand to quality (quality elasticity) relative to its responsiveness to price (price elasticity). If demand is more responsive to quality than to price, which means that better performing providers of health care will attract more patients, logically results in increasing the quality of care to attract patients. ''If demand is more responsive to price than to quality, [which means that cheaper providers will attract more patients, logically results in] driving down the price and sacrificing quality.'' (Gaynor, 2006, cited by Roos et al., 2020). To prevent this from happening, competition on quality must be promoted. As a result of that, demand will be more responsive to quality compared

to price (i.e., quality elasticity is bigger than the price elasticity). The Dutch healthcare policymakers try to encourage this by introducing several quality indicators and hospital ratings (Beukers, Kemp & Varkevisser, 2014). By making the healthcare market more transparent, healthcare providers can be compared with each other. A transparent healthcare market could '' … raise the quality elasticity relative to the price elasticity.'' (Roos et al., 2020, p. 3). As a result, quality would increase, and the provided price would not fall. To achieve this, patients must be willing to shift from low(er) quality providers to high(er) quality providers, otherwise the magnitude of the quality elasticity will not increase. Only if this happens, the purpose of competition between healthcare providers will be accomplished which is highly beneficial for society.

To conclude, the average patient is willing to travel beyond the nearest provider if another provider suits his or her preferences the best. In this choice, it is important for the functioning of the Dutch healthcare system that patients take the quality of the healthcare provider into account. If the patients are not willing to shift from low(er) quality to high(er) quality providers, providers do only have an incentive to decrease the price instead of improving quality. To counteract this from happening, the Dutch healthcare policy makers try to make the healthcare market more transparent by introducing quality indicators and hospital ratings.

# *Research methods*

### *Data*

The Dutch National Health Care Institute provides information on quality and health care processes of Dutch healthcare providers to the general public. Relevant for this thesis, they disclose data of hospitals and independent treatment centers which perform medical specialist care in the Netherlands (Open data Ziekenhuizen en Zelfstandige Behandelcentra / Medisch-specialistische zorg | Zorginzicht). Like general hospitals, independent treatment centers perform various medical treatments. Often these treatment centers are specialized in certain medical treatments that are more common in the population, they do not provide very specialized care such as treating cancer. Another difference between a hospital and a treatment center is that the goal of these enterprises. Independent treatment centers only focus on generating profit, while a hospital also has a social responsibility. In the available data, it is documented which and how much medical procedures each healthcare provider has performed per year. Several quality indicators are also documented in these data sets.

This thesis restricts itself to oesophageal carcinoma, gastric carcinoma, prostate carcinoma, pancreas carcinoma, knee replacement and hip replacement. For these medical procedures, the data set contains a sufficient number of observations and usable quality indicators. For clarification, the dataset will be described in more detail.

This dataset contains data of hospitals and independent treatment centres that provide medical specialist care in the Netherlands. The Dutch healthcare sector has many different healthcare providers spread all over the country. Since 2016, the Dutch National Health Care Institute publishes annual pivot tables detailing which and how many medical procedures each provider has performed. In addition, these pivot tables also include procedure-specific quality indicators. These annual pivot tables have been made available from 2016 to 2019. Table 1 shows the number of providers and treatments performed per selected medical procedure for different years. This table shows that the dataset includes multiple providers per medical procedure and information about a (very) large number of medical procedures performed. The decreasing number of healthcare providers is remarkable, which is the result of a common trend. Over the past decades, more than 130 hospital mergers have taken place in a number of successive waves of mergers in the Netherlands (Varkevisser, 2019).

**Table 1**

*Amount of Providers and Treatments performed per Medical Procedure*

| | *2016* | *2017* | *2018* | *2019* |
|---|---|---|---|---|
| Oesophageal carcinoma: | | | | |
| - amount of providers | 20 | 19 | 17 | 16 |
| - total treatments performed | 792 | 819 | 769 | 757 |
| Gastric carcinoma: | | | | |
| - amount of providers | 20 | 18 | 17 | 17 |
| - total treatments performed | 484 | 392 | 413 | 353 |
| Prostate carcinoma: | | | | |
| - amount of providers | . | . | 26 | 21 |
| - total treatments performed | . | . | 2826 | 3461 |
| Pancreas carcinoma: | | | | |
| - amount of providers | 17 | 18 | 18 | 17 |
| - total treatments performed | 622 | 719 | 733 | 712 |
| Knee replacement: | | | | |
| - amount of providers | 95 | 97 | 92 | 90 |
| - total treatments performed | 24678 | 24753 | 25609 | 26186 |
| Hip replacement: | | | | |
| - amount of providers | 92 | 95 | 91 | 89 |
| - total treatments performed | 29476 | 30034 | 31751 | 33549 |

*Note. Information is derived from the pivot tables which have been published online: Open data Ziekenhuizen en Zelfstandige Behandelcentra / Medisch-specialistische zorg | Zorginzicht. The information about the amount of providers and the amount of total treatments performed for prostate carcinoma is unknown for the years 2016 and 2017.*

The dataset of the Dutch National Health Care Institute also includes procedure-specific quality indicators. The Dutch National Health Care Institute has decided which quality indicators the providers have to document per medical procedure. These mandatory quality indicators differ per medical procedure because different aspects are important when focussing on specific medical procedures. These objective indicators indicate the quality of the healthcare provider in various aspects. To elucidate it, table 2 shows which quality indicators are available per medical procedure.

**Table 2**

*Available Quality Indicators per Medical Procedure*

| Medical procedure | Available quality indicator | Explanation (if necessary) |
|---|---|---|
| Oesophageal and gastric carcinoma | - Percentage of patients who were having a complicated process while undergoing the curative resection<br>- Percentage of patients who died within 30 days after surgery | A complicated process is the development of a postoperative complication associated with an extended hospital stay (> 21 days), re-intervention or death |
| Prostate carcinoma | - Percentage of patients undergoing a surgery with complications with Clavien-Dindo score 3, 4 or 5 within 30 days of primary treatment | To standardize surgical outcome reporting, a classification of surgical complications consisting of five grades have been introduced. ''The basic principle of this classification – termed Clavien-Dindo Classification - is based on the therapy needed to treat the complication.'' (Dindo, 2014, Abstract). The higher the score, the more severe the complication is (Dindo, 2014) |
| | - Percentage of patients with a PSA less than 0.1 ng/ml 6 months after surgery | PSA is an abbreviation of Prostate Specific Antigen. An elevated PSA level may indicate the presence of prostate cancer. (Bangma, Roobol, de Koning, Denis & Schröder, 2009) |
| Pancreas carcinoma | - Percentage of patients undergoing a surgery with complications with Clavien- | To standardize surgical outcome reporting, a classification of surgical complications consisting of five grades have been |

| | | | |
|---|---|---|---|
| | | Dindo score 3, 4 or 5 within 30 days of primary treatment | introduced. ''The basic principle of this classification – termed Clavien-Dindo Classification - is based on the therapy needed to treat the complication.'' (Dindo, 2014, Abstract). The higher the score, the more severe the complication is (Dindo, 2014) |
| | - | Percentage of patients who died within 30 days after surgery | |
| Knee and hip replacement | - | Percentage of deep postoperative wound infections within 90 days after surgery (according to PREZIES definition) | ''PREZIES is the Dutch acronym for 'prevention of hospital-acquired infections by surveillance'.'' (Van der Kooi, Mannien, Wille & Van Benthem, 2010, p. 168). This definition is used to identify wound infections after surgery |
| | - | The difference between preoperative PROM score and postoperative PROM score (measured by the EQ-5D index score) of patients with osteoarthritis in whom a total knee/hip prosthesis is placed | Patient reported outcome measures (PROMs) aim to assess the success of a treatment by patients' perspective. This can be measured by using the EQ-5D, which focusses on 5 dimensions of quality of life. (Parsons, Griffin, Achten & Costa, 2014) |
| | - | Percentage of patients undergoing a revision within 1 year after surgery | |

*Note. Information is derived from the pivot tables which have been published online: Open data Ziekenhuizen en Zelfstandige Behandelcentra / Medisch-specialistische zorg | Zorginzicht. An explanation has only been given for the quality indicators where there may be a lack of clarity.*

### *Methods*

When analysing the data, the methodological strategy of Chandra et al. (2016) will be adopted. This means that this thesis will focus on static and dynamic allocation of patients. By the static allocation of patients, the correlation between provider performance and market share at one point in time will be explored. By the dynamic allocation of patients, the correlation between provider performance and market share will be explored over time. For constructing the regression equations for the static and dynamic analysis, the equations in the article of Chandra et al. (2016) will be adopted. These equations will be performed by using the statistical program STATA.

#### *Static allocation*

The static allocation analysis will focus on the six aforementioned medical procedures: oesophageal carcinoma, gastric carcinoma, prostate carcinoma, pancreas carcinoma, knee replacement and hip replacement. The static allocation analysis will be used for trying to examine if better performing healthcare providers, in terms of quality, also have larger market shares at one specific moment in time. The following regression equation will be used to examine this:

$$(1)\ \ln(Nh) = \beta_0 + \beta_1 qh + \alpha_M + \varepsilon_h$$

Where *Nh* is a measure of the market size of the hospital, measured by the amount admissions. This dependent variable is written as a logarithm in order to make a relative comparison in stead of making an absolute comparison. $qh$ is a measure of the quality of hospital $h$, $\alpha_M$ are market fixed effects and $\varepsilon_h$ is the unobserved residual.

When running the static analysis, a multiple linear regression will be used. This statistical technique is chosen because it allows to control for multiple factors that simultaneously affect the dependent variable. In the data that will be used in this thesis, several quality indicators per medical procedure are available (table 2) which possibly influences the dependent variable. In the static analysis, the dependent variable will be the amount of provided medical procedures and the independent variables will be the available quality indicators. A multiple linear regression will be performed separately for each medical procedure to examine, per medical procedure, whether there is a correlation between the dependent variable and the independent variables. A positive correlation

between the dependent variable and quality-indicator-variables ($\beta_x$) would indicate that a better performing provider attracts more patients, and thus have a larger market share. A negative, or an absence of a, correlation between the dependent variable and the quality-indicator-variables ($\beta_x$) would indicate that lower quality providers have a larger, or the same, market shares compared to their high-quality counterparts. This would '' … suggest that forces beyond quality competition are driving the allocation of market activity.'' (Chandra et al., 2016, p. 2133).

A variable for market fixed effects will also be used in the regression. Like earlier explained, the Dutch inhabitants can choose between different providers when ´consuming´ care. Researcher Van Loghum (2011) states that the Dutch population is willing to travel beyond the closest healthcare provider for better quality care or a shorter waiting time. However, researchers Shalowitz, Nivasch, Burger and Schapira (2018) state that the willingness to travel is not infinite. The market fixed effects will take this into account. Healthcare providers that are geographically close to each other can be seen as competitors. When making this geographical division, it was decided to use the existing Education and Training Regions in the Netherlands (Onderwijs-en OpleidingsRegio's (OOR) | Kennisbank Medische Vervolgopleidingen). There are eight Education and Training Regions (OORs) in the Netherlands. An OOR is a regional training network in which the university hospital of that region works together with the general hospitals in the area. Since these OORs work together, it can be assumed that these hospitals are geographically relatively close to each other. That is why these OORs are used to visualize the hospital competition market. The healthcare providers were manually assigned to the relevant OORs, so that the market fixed effects can be considered. The only difference between the originally OORs and the OORs used in this thesis, is that the two OORs of Amsterdam have been merged to one OOR. From a geographical point of view, the two OORs of Amsterdam are located close to each other which makes it plausible that these healthcare providers can be regarded as one market. They were split in the original OORs because Amsterdam has two university medical hospitals, each with its own OOR.

Summarized, when running the static analysis, a multiple linear regression will be used, for each of the medical procedures separately, over the most recent year for which the data is available (2019).

***Dynamic allocation***

The medical procedures that will be included in the dynamic allocation analysis are oesophageal carcinoma, gastric carcinoma, knee replacement and hip replacement. Only for these four medical procedures, the dataset includes sufficient information which is necessary to create a valid panel

data set. For clarification, ''A … panel data set is one that follows a sample of individuals over time, and thus provides multiple observations on each individual in the sample.'' (Hsiao, 2014, p. 1). Hsiao (2014) appoints that panel data sets, compared to conventional cross-sectional data sets, for economic research possesses major advantages such as estimating more accurate inference of model parameters. In contrast to the static allocation analysis, the dynamic allocation analysis evaluates whether increasing quality within hospitals also leads to increasing patient volumes. So, in the dynamic allocation analysis we are interested in the dynamic process between market shares and the quality of healthcare providers. To analyse this, the data must be sufficient for the year 2019 and some years before. Only for the medical procedures of oesophageal carcinoma, gastric carcinoma, knee replacement and hip replacement the Dutch National Health Care Institute collected information about the number of medical treatments performed and quality indicators for several consecutive years. Because this information is available from several consecutive years, it is possible to see whether there is a correlation between the quality of the healthcare provider and the number of treatments performed over time. With this data, a panel dataset will be constructed between 2016 and 2019. The following regression equation will be used to examine this:

$$(2)\ \Delta \mathrm{N}h = \beta_0 + \beta_1 qh + \alpha_M + \varepsilon_h$$

Where $\Delta Nh$ refers to a measure of the hospital's growth rate in admissions. $qh$ is a measure of the quality of hospital *h*, $\alpha_M$ are market fixed effects and $\varepsilon_h$ is the unobserved residual. The market fixed effects are constructed in the same way as constructed in the static allocation analysis.

When running the dynamic analysis, a fixed effects model will be used. This statistical technique is chosen because panel data will be used. The name fixed effects refer to the fact that some variables do not change over time. Fixed effects are variables that are constant across individuals but can vary between individuals. For example, ethnicity, gender, and age do not change or do change at a constant rate over time, and those examples can vary between individuals. For purposes of research and experimental design, these variables are treated as a constant. The problem in economic modelling is that not every constant, which affects the dependent variable, can be included. This is because not every constant can be measured, or they are simply too many. These variables, which may be important but are not included, can generate an omitted variable bias. A fixed effects model can solve this problem.

''[The] fixed effects regression is a method for controlling for omitted variables in panel data when the omitted variables vary across entities but do not change over time.'' (Stock & Watson, 2012, p. 356). A fixed effects regression is normally specified as follows:

$$(2a)\ Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it}$$

According to Stock and Watson (2012) there are some important notations when using panel data. The researchers state that it is important to keep track of both entity and time. *i* Refers to the entity, and $t$ refers to the time period. The intuition behind a fixed effects model is the data will be demeaned by time. The underlying principle in this approach is that the mean of a time invariant variable, is the variable itself. If the mean of any time invariant variable will be calculated for one unit in the sample, the average value will be exactly the same to all the observations in the sample because those variables do not change. When demeaning the data in regression (2b), those constant time invariant variables will be distracted.

$$(2b)\ Y_{it} - \bar{Y}_t = \beta_1 X_{it} - \beta_1 \bar{X}_t + \alpha_i - \alpha_i + u_{it} - \bar{u}_t$$

As a result of this, it is possible to estimate the effect of the variable of interest on the dependent variable without including all the constant time invariant variables. ''If there are other observed determinants of *Y* that are correlated with *X* and that change over time, then these should also be included in the regression to avoid omitted variable bias.'' (Stock & Watson, 2012, p. 358).

A separate fixed effects model, as explained in regression (2), will be used for each of the four mentioned medical procedures to examine, per medical procedure, whether there is a correlation between the dependent variable and the independent variables. The dependent variable will be a measure of the hospital's growth rate in admissions between year X and year X-1. The available quality indicators will be used as independent variables (table 2). A positive correlation between the dependent and independent variables would indicate that better performing provider, in terms of quality, see larger gains in patient admissions, and therefore having larger market shares.

Summarized, when running the dynamic analysis, a fixed effects model will be used, for each of the medical procedures separately, over the most recent consecutive years for which the data is available (2016-2019).

**Descriptive statistics**

To give some more insight in the available data, some descriptive statistics of the quality indicators of each medical procedure are shown in table 3. A distinction will be made between the year 2019 (static analysis) and period of 2016 to 2019 (dynamic analysis).

**Table 3**

*Descriptive Statistics of the Quality Indicators*

| | 2019 | | 2016 - 2019 | |
|---|---|---|---|---|
| | Mean | Range | Mean | Range |
| **Prostate carcinoma** | | | | |
| *% complications* | 2,23 | 0,76 – 6,94 | . | . |
| *% PSA-level* | 7,14 | 0,97 – 16,33 | . | . |
| **Pancreas carcinoma** | | | | |
| *% complications* | 25,64 | 9,30 – 44,50 | . | . |
| *% dead* | 2,96 | 0 – 7,20 | . | . |
| **Oesophageal carcinoma** | | | | |
| *% complicated process* | 27,37 | 11,50 – 38,60 | 16,96 | 0 – 82,72 |
| *% dead* | 2,50 | 0 – 6,60 | 1,98 | 0 – 10,20 |
| **Gastric carcinoma** | | | | |
| *% complicated process* | 18,59 | 0 – 28,20 | 11,63 | 0 – 52,38 |
| *% dead* | 2,68 | 0 – 10,70 | 2,86 | 0 – 12,50 |
| **Knee replacement** | | | | |
| *% infection* | 1,73 | 0 – 100 | 0,83 | 0 – 100 |
| *PROM* | 0,20 | 0 – 1 | 0,18 | -0,10 – 1 |
| *% revision* | 0,35 | 0 – 2,49 | 1,12 | 0 – 19,22 |
| **Hip replacement** | | | | |
| *% infection* | 0,89 | 0 – 5,88 | 0,96 | 0 – 8,57 |
| *PROM* | 0,24 | 0 – 1 | 0,21 | -0,31 – 1 |
| *% revision* | 1,09 | 0 – 3,75 | 1,67 | 0 – 8,28 |

*Note. As described in the methods section, the dynamic allocation analysis does not focus on the medical procedures of prostate carcinoma and pancreas carcinoma.*

The descriptive statistics show that the means of the indicators related to complications are significantly higher than the means of the other indicators. Apparently, it is not uncommon for

complications to occur when focussing on these medical procedures for which a complications indicator is available. This is especially the case when focussing on the percentage of complicated process of the procedure for oesophageal carcinoma. Somewhere in the years from 2016 to 2019, there was a healthcare provider who labelled 82,72% of their total treatments performed as a complicated process. On the other side, there was also a healthcare provider who labelled 0% of their total treatments performed as a complicated process. The range of the infection indicator for the knee replacement procedure is also remarkable, because this quality indicator has a range from 0% to 100%. This means that there is at least one healthcare provider who has not causes any infections, and that there was at least one healthcare provider who causes an infection every time they performed this treatment. Finally, it is useful to explain is the range of the PROM-score. Like earlier explained, PROMs aim to assess the success of a treatment by patients' perspective. Looking at the range of the PROM-score, it appears that the health of patients can also deteriorate after a knee or hip revision because the descriptive statistics shows that the PROM-score can also be negative.

# *Results*

**Static allocation**

Table 4 presents the central results regarding to the static allocation analyses. These estimates have been derived from regression (1). This regression was performed separately for each quality indicator, as this was also done in the article by Chandra et al. (2016). In the first instance, the available quality indicators are included separately in order to estimate the individual effect.

**Table 4**

*Static Allocation Estimates of the Individual Quality Indicators*

| **Gastric carcinoma** | | **Oesophageal carcinoma** | | **Pancreas carcinoma** | |
|---|---|---|---|---|---|
| **complicated process** | **dead** | **complicated process** | **dead** | **complication** | **dead** |
| 0.046 | 0.097 | 0.007 | 0.070 | 0.089 | -0.041 |
| (0.429) | (0.482) | (0.655) | (0.193) | (0.005) * | (0.661) |

| **Prostate carcinoma** | | **Hip replacement** | | | **Knee replacement** | | |
|---|---|---|---|---|---|---|---|
| **complication** | **PSA** | **revision** | **PROM** | **infection** | **revision** | **PROM** | **infection** |
| -0.033 | 0.048 | -0.035 | -0.144 | -0.064 | 0.263 | -0.028 | -0.382 |
| (0.721) | (0.085) | (0.803) | (0.184) | (0.904) | (0.114) | (0.000) * | (0.217) |

*Note. Each column represents an independent regression, in which only the above-mentioned quality indicator and a dummy variable for each Education and Training Region are included. The p-values of the estimates are listed in parentheses. * Means that the estimate is significant at a 5% level.*

When focussing on table 4, only two estimates are statistically significant. Although these estimates are significant, they are different from what would be logical. The estimate of the PROM-score of knee replacement would indicate that an increase of one percentage point in the PROM-score, would result in a 2,8% smaller market share, ceteris paribus. This effect is significant at a 5% level. Also, the estimate of the complication quality indicator is not very logical. The estimate of the complication quality indicator would indicate that an increase of one percentage point in the complication quality indicator, would result in an 8,9% larger market share, ceteris paribus. This effect is significant at a 5% level.

After this, it was examined whether interesting results could be obtained when the quality indicators were included in the regression together. For most of the medical procedures, this was not the case. Including the available quality indicators per medical procedure at the same time in a regression did not yield significant estimates. Only for the medical procedures of knee replacement and pancreas carcinoma significant estimates were obtained. These estimates are shown in table 5.

**Table 5**

*Static Allocation Estimates when the Quality Indicators are included Together*

| **Pancreas carcinoma** | **Knee replacement** |
|---|---|
| **complication** | **revision** |
| 0.092 | 0.080 |
| (0.003) * | (0.592) |
| | |
| **dead** | **PROM** |
| -0.079 | -0.324 |
| (0.046) * | (0.325) |
| | |
| | **infection** |
| | -0.217 |
| | (0.009) * |

*Note. Each column represents an independent regression, in which the mentioned quality indicators and a dummy variable for each Education and Training Region are included together. The p-values of the estimates are listed in parentheses. * Means that the estimate is significant at a 5% level.*

When focussing on the medical procedure of pancreas carcinoma, both estimates are now statistically significant at a 5% level. The quality indicator which focusses on the percentage of deaths can be interpreted as: the estimate would indicate that an increase of one percentage point in deaths, would cause a 7,9% smaller market share, ceteris paribus. This effect is significant at a 5% level. The other significant estimates could be interpreted the same, thereby paying attention whether the estimation is positive or negative. The reason why these estimates have changed compared to table 4, is that the coefficients are now jointly estimated. By doing this, every new added variable changes all the other coefficients which already have been estimated in the model.
This is one reason why a multiple regression is performed, to see the net effect of a coefficient on the dependent variable.

**Dynamic allocation**

Table 6 presents the central results regarding to the dynamic allocation analyzes. Again, each cell shows results from a separate regression using the reported quality measure.

**Table 6**

*Dynamic Allocation Estimates of the Individual Quality Indicators*

| Hip replacement | | | Knee replacement | | |
|---|---|---|---|---|---|
| **revision** | **PROM** | **infection** | **revision** | **PROM** | **infection** |
| -1.373 | 36.198 | -1.742 | -3.299 | 93.253 | -2.647 |
| (0.710) | (0.527) | (0.760) | (0.334) | (0.243) | (0,754) |

| Gastric carcinoma | | Oesophageal carcinoma | |
|---|---|---|---|
| **complicated process** | **dead** | **complicated process** | **dead** |
| 0.184 | -4.924 | 0.294 | -4.176 |
| (0.748) | (0.307) | (0.228) | (0.095) |

*Note. Each column represents an independent regression, in which only the above-mentioned quality indicator and a dummy variable for each Education and Training Region are included. The p-values of the estimates are listed in parentheses. * Means that the estimate is significant at a 5% level.*

Like table 6 shows, none of the estimates are statistically significant. Therefore, it cannot be assumed that better performing healthcare providers tend to gain larger market shares over time. For example, the revision indicator of the hip replacement indicates that a 1 percentage point increase in revision rate is associated with a 1,4 percentage points lower growth in hip replacement patients relative to other hospitals in the same market, ceteris paribus. This effect is highly insignificant at a 5% level. The other estimates could be interpreted in the same way. Also, if the quality indicators were included in the regression together, none of the estimates are statistically significant.

The reason why few statistically significant effects are observed in the static and dynamic analyses, can be caused by several factors. However, these factors are not always identifiable. Nevertheless, a reason why few significant effects are found can be devised. The relatively low number of observations could be one of the reasons why few significant effects are observed. This is because

information is scarce in a small data set, and the scarcity of information makes it difficult to estimate significant effects (Lateh, Muda, Yusof, Muda & Azmi, 2017). This is mainly because outliers, a data point that deviates (strongly) from the rest of the data, can distort the data easily. As shown in table 1, the number of providers per medical treatment variates between 16 and 90. Compared to other datasets in which information from thousands of individuals is available, the dataset used in this thesis can be considered as small. Especially in the static allocation analysis, which only focusses at 2019, the available information is limited. Because the dynamic allocation analysis focusses on multiple time periods, the number of observed healthcare providers is higher ranging from 33 to 260. These relatively low number of identical healthcare providers available in the data could be one of the reasons why few significant effects are observed.

Statistical studies often look at the value of a model's R-squared, as an indication of the quality of the estimated model. In general, the R-squared is '' … defined as the ratio of explained variance to the overall outcome variance.'' (Rights & Cole, 2018, p. 865). In other words, the R-squared measure indicates the proportion of outcome variance that can be explained by a given model (Hayes, 2021). The R-squared is always estimated on a scale from zero to one. A R-squared value of zero indicates that the estimated model explains none of the variability of the response data, and a R-squared of one indicates that the estimated model explains the total variability of the response data. The R-squared values of the static allocation models, in which the quality indicators are included separately, are considerably low. The majority of these R-squared values are (far) below 0.4, which can be interpreted as weak effect size. This means that the estimated models do not explain a large part of the overall outcome variance.

When focussing on the estimated dynamic allocation models for which the quality indicators are included separately, the R-squared values are even lower. Therefore, these models do even explain a smaller part of the overall outcome variance. Given the R-squared values of the estimated models, it can be concluded that the models can not be seen as good estimators in the examination of the market share of a healthcare provider. It is therefore plausible that there may be confounders that are not included in the estimated models.

## *Discussion*

The results obtained in this thesis do not suggests that, within a market, more market share (patients) tends to be allocated to higher quality provider at one point in time. The opposite is found when focussing on some of the static allocation estimates of the individual quality indicators. From those estimates, only two of them are statistically significant. Nor do these statistically significant effects corresponds to what would be logically. A higher score on the PROM indicator, what should mean that more health gains have been achieved, results in a lower number of admissions. And a higher complications rate, would result in a larger number of admissions. When focussing on the static allocation estimates when the quality indicators are included together, only the medical procedure of pancreas carcinoma is interesting because both estimates are statistically significant at the same time. With almost all other medical procedures no significant effect is found. The results of this thesis do also not suggest that higher quality providers gain more market power over time. In the dynamic allocation analysis, zero significant effects were found.

These results are not entirely consistent with other related studies. Varkevisser et al. (2012) concluded in their research '' … that hospitals with a good reputation [(PROMs)] and low readmission rates … attract more patients.'' (p. 377). This conclusion is not in line with the estimates conducted in this thesis. For the medical procedures of hip and knee replacement we do have the same quality indicators as in the research of Varkevisser et al. (2012), but in this thesis the estimates of those indicators are not statistically significant. Because those types of quality measures were not available for the other medical procedures, no further comparison can be made with the research of Varkevisser et al. (2012). Chandra et al. (2016) conducted a similar study in the US. In their conclusion, they made a division between clinical outcomes' measures and the process of care measures on the one side, and patients' satisfaction scores on the other side. They found robust evidence for the clinical outcomes' measures and the process of care measures that higher performing hospitals tend to have (and gain) a greater market share. When focussing on the other side, Chandra and his colleagues (2016) concluded that they did not find robust evidence that higher patients' satisfaction scores would result in having (or gaining) a greater market share. The results found in this thesis are not in line with the first statement, but they are in line with the second statement. The estimates obtained in this thesis regarding to the PROMs are not positive and statistically significant at the same time.

Therefore, these results correspond with the second finding of Chandra et al. (2016). In general, it can be concluded that the results of this thesis do not totally correspond with the results of previous studies.

**Validity**

The fact that the data includes every single Dutch secondary healthcare provider per medical procedure, results that this dataset can be seen as a valid reflection of the Dutch secondary healthcare market. The dataset contains information of thousands of patients who have received treatment related to the mentioned medical procedures. The dataset also contains multiple objective hospital-level quality indicators with few missing values.

The type of the mentioned medical procedures is conducive for the validity of this thesis. This is because it they are all non-emergency medical procedures, meaning that patients did have a choice which provider to go to. This is different when, for example, the focus is on cardiovascular diseases. These illnesses often occur suddenly, leaving the patient with no time to make a rational choice in the decision by which healthcare provider he or she wants to be treated. Therefore, the medical procedures used in this thesis are appropriate to use in answering the research question.

The results that found may also be relevant for other medical procedures in the Netherlands. For the external validity, it is important that the nature of the other medical procedures must correspond to the nature of the included medical procedures, namely that it is about non-emergency medical procedures.

**Limitations**

That the results found in this thesis do not correspond with the results of previous studies, may be caused by the limitations of this study. To start with the potential threat that healthcare providers may have a different case-mix. Meaning that healthcare providers with relatively easier patients have an advantage that the results of quality-of-care indicators are more favourable. As a result, it could be the case that the quality indicators do not fully represent the quality of the providers. Researchers Chen and Meinecke (2012) mention that this is also a problem with the report cards, which should provide insight into the quality of a healthcare provider. In their research they even state that it is possible that some healthcare providers are trying to get a different case mix. ‘’Suppose that there are two hospitals of different quality, high and low, with the same patient volume.’’ (Chen & Meinecke, 2012, p. 47). The high-quality provider will have more favourable outcomes related to the quality indicators, compared to the low- quality provider. If the low-quality healthcare provider wants to imitate the favourable outcomes of the high-quality provider, then it would be an option to avoid sicker persons to avoid unfavourable results (Chen & Meinecke, 2012). The fact that the case-mix of healthcare providers differs, whether it is caused on purpose or by incidence, always causes the outcomes to be biased. As a result, the measured quality of a healthcare provider does not

correspond with the 'real' quality of the healthcare provider. This ‘real’ quality of a healthcare provider could only be measured if a patient, with exactly the same personal characteristics and with exactly the same degree of illness, is treated by every healthcare provider. Then a fair comparison could be made that focusses on the health gains achieved caused by treatment. Nevertheless, this will never be feasible in practice because patients always differ from each other in several aspects. Most likely the different case-mixes have also influenced the results of this thesis. Because the Dutch healthcare system is based on regulated competition, healthcare providers will try to find a way in which they can outsmart their competitors. It is naïve to think that healthcare providers only play according to the rules that the government has devised, they will try to win the competition even if it is on a slightly unfair way. The data in this thesis will therefore also suffer from this bias, but to what extent exactly is unknown. It is also very difficult to standardize for this, leaving the only option left to accept it.

Regarding to the quality indicators some uncertainties can be detected. Measuring the best performing hospital is controversial, this is because the concept 'quality of care' must be considered. The dataset includes several indicators which indicate the quality of a healthcare provider, but the question is whether there are better indicators that are not included in this dataset. Besides that, there is also an increasing criticism of the ‘outdated’ quality indicators. For example, the percentage of patients who died after surgery can be seen as an ‘outdated’ quality indicator, because it is purely an outcome-oriented indicator focused on one aspect of quality. Quality indicators which focus on a broader aspect of quality are increasingly appreciated nowadays, like the PROMs. This is because ‘’ … they capture more dimensions of health and more sensitively.’’ (Appleby & Devlin, 2004, cited by Gutacker, Siciliani, Moscelli & Gravelle, 2016, p. 230). Besides that, ‘’ … they embody much better adjustment for case-mix, because they incorporate the pre-operative PROMs data.’’ (Gutacker et al., 2016, p. 231). As described in the previous section, the different case-mixes of healthcare providers can be seen as a potential threat. The advantage of PROMs is that this indicator incorporates a pre-operative score and a post-operative score. This makes it possible to keep track of the health improvement a treatment has caused. Lastly, the PROMs take the opinion of the patient into account. All these strengths are not applicable to the ‘outdated’ quality indicators. In addition, Gutacker and his colleagues (2016):

> Find that demand is more responsive to quality measures based on the change in patient health status due to treatment, rather than to crude measures such as [mortality] rates … or … readmission [rates]. Thus, hospitals wishing to attract patients can do so by improving aspects of quality with a more immediate link to outcomes experienced by all patients. (Gutacker et al., 2016, p. 242)

When this knowledge is applied in this thesis, it appears that the quality indicators which have been

used are not that optimal as thought they were. Only for two of the six medical procedures, PROMs are available as a quality measure. The quality measures used in the regressions of this thesis are mainly crude measures: infection rates, mortality rates and complication rates. Little attention is paid to the improvement patients make as a result of medical treatment.

Integrating the market fixed effects in the regressions could be done in different ways. In essence it was all about generating a variable which enables grouping healthcare providers together that are geographically close to each other, and thus can be seen as competitors. In this thesis, the eight Education and Training Regions of the Netherlands has been used to make this division. Nevertheless, another option was also possible. The healthcare providers could also be clustered per province. If this option was chosen, the distribution of healthcare providers would have been more concentrated because there are more provinces than Education and Training Regions in the Netherlands. This does not necessarily mean that this choice would be better. Both options, the training regions and the provinces, have the same disadvantage. Clustering hospitals into one area does ensure that, for healthcare providers that are centrally located in the area, that area gives a representative picture of the competitors. This is not the case for healthcare providers who are located on the outside of such an area. To clarify this, the Groene Hart hospital is taken as an example. The Groene Hart hospital is located in Gouda, a small town in the west of the Netherlands. The Groene Hart hospital officially belongs to the Training and Education Region Leiden, to which the HMC hospital also belongs. The distance between these two hospitals, which belong to the same region, is 35 kilometres by car. However, there is a hospital which is located closer to the Groene Hart hospital but does not belong to the same Training and Education Region. The distance between the Ijselland hospital and the Groene Hart hospital is 19 kilometres by car. Even though these hospitals are located closer to each other, they do not belong to the same Training and Education Region. Therefore, it can be concluded that it does not necessarily mean that these Training and Education Regions provide a representative reflection of the competitors of a hospital. Even though this hospital division by Training and Education Regions was not optimal, it was decided to use these regions. A different way in which you look at the competitors per healthcare provider is practically not feasible within this time frame. Besides that, it also raises the question of who can be counted ascompetitors and who not.

The last limitation of this thesis is linked to the dynamic allocation analysis. This analysis focusses on the period of 2016 to 2019, which can be seen as a fairly short period. Other healthcare related studies, which have also used panel data, often look at more years compared to the number of years used in this thesis. For example, Lightwood and Glantz (2016) used a panel data set over the years 1992 to 2009 to examine the relation between smoking behaviour and healthcare expenditure.

Behera and Dash (2020) also used a panel data set in their research on healthcare financing, which focusses on the years of 1995 to 2013. Compared to these studies, the panel data set used in this thesis is relatively short. In essence this is not necessarily a problem, but it could have influenced the results of the dynamic allocation analysis. It is plausible that patients do not immediately avoid a healthcare provider when the healthcare provider offers poorer quality care for a year. The patients may not be aware of the decreasing quality, or the general practitioner may be in the habit of referring patients with a particular disease to a specific healthcare provider. It is plausible that this will change if a healthcare provider performs low(er) quality care for several consecutive years. This will stand out, with the consequence that patients will not consume health care from these underperforming healthcare providers. This could partly be caused by the interference of general practitioners, who have a gatekeeper function in the Netherlands. It can be assumed that those gatekeepers are better informed about the quality of the healthcare providers which are located in the area nearby, because they work with them on a daily basis. Logically, it can therefore be assumed that it has no consequences if a healthcare provider performs low(er) quality care for one year, but that it does have consequences if a healthcare provider performs low(er) quality care for several consecutive years. It could therefore be argued that there is a 'delay' in the correlation between the quality of a healthcare provider and the number of treatments performed. If data was available over a longer period of time, this shift from patients to better performing healthcare providers might have been reflected in the data. As a result, different results might have been generated in the dynamic allocation analysis. In conclusion, it could be that the time period of the panel data in this thesis is too short to find a significant correlation between the quality of a healthcare provider and the number of treatments performed. This relatively short time frame of the panel data used in the dynamic allocation analysis can thus be seen as a limitation of this thesis.

**Further research**

In further research, the research strategy of this thesis could be used to examine the relationship between quality and market share for other medical procedures as well. Besides focussing on other medical procedures, it could also be interesting to apply this research strategy to other countries. This is because the design of other countries' healthcare systems could influence the results. When this research strategy would be used in further research, it is important to take the limitations of this thesis into account. There are several aspects of this thesis that could be improved in future research which have been explained in the ´limitations´ section. Recapitulatory, providers may have a different case-mix which should be considered when analysing the results. It is recommended to look at a longer period in the dynamic allocation analysis, and the market fixed effects could be included

in the regressions in a different way. Finally, 'quality' in healthcare is a very broad concept that cannot be encompassed by a few indicators. Therefore, it is advisable to include several quality indicators in the research. Besides that, it is recommended to use quality indicators that measure a value or percentage for every patient, focussing on the improvement of a patient caused by treatment. In this thesis, the indicators which have been used mainly focusses on a negative aspect of care, for example: complication rate and infection rate. It has been found that it is beneficial for research to also have indicators that focus on the positive aspect of care, which should be measured in every patient. Unfortunately, these quality indicators were not always available in the dataset which is used in this thesis.

In further research, it is also possible to continue to build on the results found in this thesis. No convincing evidence has been found that higher quality hospitals attract more patients both at one point in time and in multiple points of time in the Netherlands. According to the results found in this thesis, patients do not pay attention to the quality of a healthcare provider when consuming care. Further research can focus on two aspects related to this.

It is possible that the inhabitants of the Netherlands are not well informed about quality differences between healthcare providers. If that is the case, follow-up research could focus on why the inhabitants of the Netherlands are not aware of the quality differences between healthcare providers. In this situation, the Dutch inhabitants are willing to choose for higher quality providers, but not able to do so. More research could also be conducted that focuses on how to get well-informed consumers of care.

It is also possible that the Dutch inhabitants are able to choose for higher quality providers, but that they are not willing to do so. Compared to the previous situation, it can now be assumed that the Dutch inhabitants are well informed about the quality differences between healthcare providers. It is possible that they base their choice on aspects other than the quality of the healthcare provider. In further research it can be determined whether this is the case and what those other preferences are. It is also possible to examine how the Dutch population can be directed to high(er) quality providers instead of the low(er) quality providers. Policy interventions could be developed in order to achieve this.

# *Conclusion*

In this thesis, it was examined whether higher quality healthcare providers have, and gain, larger market shares. This was researched for six different medical procedures, offered in the Netherlands. It has been explained in the methodology section that this has been examined in two different ways, using the static allocation analysis and the dynamic allocation analysis. In the static allocation analysis, only a limited number of statistically significant effects were found. This implies that, looking at one point in time, higher quality providers do not attract more patients compared to lower quality providers. In the dynamic allocation analysis, no statistically significant effects were found. This also implies that, looking at multiple points in time, higher quality providers do not attract more patients compared to lower quality providers. It can therefore be assumed that patients do not pay attention to the quality of a healthcare provider when consuming care. As described in the thesis, this is not conducive to the functioning of the healthcare system in the Netherlands.

These findings are, in general, in contradiction with findings of related studies. In related studies, they usually find evidence that higher quality healthcare providers attract more patients compared to lower quality healthcare providers. Since this evidence is not supported by the results found in this thesis, it would imply that scarce resources are used inefficiently. In addition, based on the results found in this thesis, it can also be stated that quality competition between Dutch healthcare providers does not function optimally. For follow-up research, it is recommended to examine how the scarce resources can be allocated more efficiently, and how the quality competition of healthcare providers can be promoted.

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