Master thesis

Quality of healthcare in the aftermath of hospital mergers: the case of the UMCG/OZG

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Executive summary

Introduction Managed competition in the healthcare industry was introduced in the Netherlands in 2006. This resulted in healthcare institutions, including hospitals, merging together to strengthen their economic position and improve their quality of care. Different arguments were given for the expected increase in quality of care, but no scientific evidence was found for the improvement of quality in hospitals after merging. Thus, this research was conducted focusing on a specific case: the merger of the Universitair Medisch Centrum Groningen (UMCG) and the Ommelander Ziekenhuis Groningen (OZG). Two types of surgeries were selected for examination, percutaneous coronary intervention (PCI) and the implementation of pacemakers and implantable cardioverter-defibrillators (ICD). The research question concerning the case was formulated as: *What is the impact of the UMCG/OZG hospital merger regarding the quality of care of cardiovascular surgeries over time when considering process and outcome indicators? What is the impact of the UMCG/OZG hospital merger regarding the quality of care of cardiovascular surgeries over time when considering process and outcome indicators?*

Methods This study is a retrospective quantitative study, using hospital data from 2012 up until 2019 which was conducted from the Inspectie Gezondheidszorg en Jeugd (IGJ). Two types of performance indicators were chosen, these were the process and outcome indicators. Furthermore, four hypotheses were conducted which were tested to answer the research question and two control hospitals were selected, these were the Universitair Medisch Centrum Utrecht (UMCU) and the Martini Hospital in Groningen. The hypotheses were: Hypotheses 1: *The UMCG/OZG merger has led to an improvement of outcome indicators over time.* Hypothesis 2: *The UMCG and OZG had better surgery outcomes over time for PCI procedures and cardiac pacemaker implementation than the Martini hospital and the UMCU.*

Hypothesis 3: *The quality of processes of UMCG/OZG decreased during the merger.*

Hypothesis 4: *The quality of processes of the UMCG/OZG increased again after the merger.*

Results Eventually a total of 5409 PCI-procedures and 9737 implementations of pacemakers/ICD's were performed over the years 2012 up until 2019 in the four studied hospitals. The four hypotheses were tested. Hypotheses 1 was rejected. According to the descriptive statistics there is no improvement of outcome indicators over time within the merged hospitals. Subsequently, hypothesis 2 was partly rejected, as the UMCG/OZG merger has had better surgical outcomes for the implementations of pacemakers/ICD's than the UMCU and OZG. For the PCI-procedures it turned out that the unmerged hospital had better outcomes. Hypothesis 3 was accepted, since the quality of processes did decrease during the merger for the UMCG as well as the OZG. Finally, hypothesis 4 was rejected as well as there was no registered increase in the quality of processes at the UMCG and OZG one year after the finalization of the merger.

Discussion/conclusion Within the specific case, there does not seem to be a clear effect of hospital mergers on the quality of care. Even more, performance indicators do not seem to be able to provide all answers within the quality of care even though they remain important. Further research with more hospital data is needed to find the effects of hospital mergers on quality of care.

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1. Introduction

In 2006 managed competition was introduced in the healthcare industry in the Netherlands. As a response to this, multiple healthcare institutions started merging to strengthen their economic position and improve their provided quality of care. Hospitals were a part of these institutions that merged together.

Hospital mergers might bring a number of private and public benefits. First, they have shown to be helpful in improving the economical position of hospitals (Brekke et al. 2017, Dafny et al. 2019), since mergers help hospitals to increase their resources and therefore broaden their products and services. Even more, merging could help hospitals which are struggling financially to survive (Su, 2017). Second, because of the merging, certain healthcare interventions would become concentrated at specific hospitals, which would result in some hospitals performing this intervention more often than they are able to do right now and thus becoming more experienced with these interventions (Schmid and Varkevisser 2016, Fulop et al. 2002). According to Schmid and Varkevisser (2016) and Fulop et al. (2002) this would eventually increase the quality of care within the hospitals.

However, mergers can also lead to some undesirable consequences. Su (2017) found that due to mergers mortality rates in hospitals increased, however the readmission rates decreased. Different scholars (Westra 2020, de Kam et al. 2020, Roos 2018, Warren 2019) did not find any evidence for an increase in the quality of care. This shows ambiguous evidence for the effect of mergers on quality of care. Besides, there are even some scholars claiming that these mergers of hospitals posed a risk on the quality of care provided (Batterink et al. 2016, de Kam et al. 2020). De Kam et al. (2020) found that quality inspectors are worried that the mergers are a threat for the quality of care, because the mergers would detract from the time and attention necessary to secure the quality. Even more, it would disrupt the present safety routines and practices within the hospital. This is mostly due to the

relocation of personnel and care practices as different locations have different care practices and different equipment, personnel may make mistakes simply by not being used to these different practices and equipment. It can get riskier when personnel have to switch constantly between locations, thus also has to switch constantly between the practices and equipment. Additionally, Brekke et al. (2017) argue that mergers could even lower the quality of care as hospitals might be driven to merge due to financial reasons and therefore not engage in improving quality. Often, the regulatory emphasis in assessing mergers is on the price effects. However, price is not all that matters in the healthcare sector. Quality is also very important.

When taking this into consideration, it can be said that the effects of hospital mergers on quality of care are unclear. There is no clear evidence that mergers have increased or decreased the quality of care. Hence, this remains a gap in the current state of knowledge. This thesis will investigate the impact of hospital mergers on quality of care. This is a relevant question since the literature is divided regarding this topic and it is of importance for public health. Therefore, a broad research question is formulated: *What is the effect of hospital mergers on the quality of care?*

In this study, chapter 2 presents a literature review which gives an overview of the current state of knowledge on hospital mergers. After that, chapter 3 regards the methodology and narrows the study to a specific case with a more specific research question. Chapter 4 will discuss the results. Chapter 5 provides a discussion and concludes that the effects of hospital mergers on the quality of care remain unclear.

2. Literature review

2.1 Introduction

While it is controversial what effect hospital mergers have on quality of care (Westra et al. 2020, Batterink 2016, de Kam et al. 2020, Roos, 2018), it is also unclear what kind of effects hospital mergers have had overall on the merged hospitals. Impacts can be distinguished at the strategic, operational and organisational levels. First, the strategic structure regards the strategic response of hospitals to the quite recently introduced competition between hospitals. Secondly, the operational level concerns the microlevel within hospitals. This links to the culture on the working floor and the integration of practices that have probably changed due to mergers (de Kam et al., 2020). Finally, the organisational structure takes into account the efficiency (Brekke et al. 2017) of the merged hospitals. Therefore, this literature review aims to present the existing knowledge on this topic, with a focus on hospital mergers and quality of care.

In this chapter the following topics will be discussed: firstly, the drivers for hospital mergers will be discussed and the concept of quality of care will be defined. Subsequently, the concerns about the impact of mergers on quality of care while focusing respectively on the impact at the operational, strategic, and organisational level will be examined. Lastly, four hypotheses will be formulated.

2.2 Drivers for mergers

Hospitals could have multiple drivers for their mergers. As was mentioned in the introduction, hospitals aim for a better economic position and better quality of care through merging. Moreover, Schmid and Varkevisser (2016) found that “the main drivers of hospital mergers include financial pressures and ambitions to concentrate complex surgeries at fewer hospitals to improve quality.” This concentration of surgeries has been found to be a driver for mergers already in 2002 by Fulop et al. Additionally, hospitals might merge to make internal savings

(Fulop et al., 2002) which they can again use to invest in their provided services and staff training. Even more, the Organization for Economic Co-operation and Development (OECD, 2018) argues that rationale for a merger could be a bigger variety in procedures and products as mergers provide hospitals with more resources. Also, competition between hospitals has been found to be a reason for mergers (Schmid & Varkevisser, 2016), since merged hospitals are able to help each other through finances and gain a better market position. This even results in some small hospitals having to merge to survive as without the financial aid of another hospital they cannot compete in the healthcare market.

2.3 Defining quality of care

The World Health Organisation (WHO, 2021) defines quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes". Quality health services should be effective, people centred, safe, timely, equitable, integrated and efficient. Mant (2001) argues that when looking at quality of care it is important to consider the question whether the provided care contributes to improving the health outcomes of patients and whether this care meets the most current medical knowledge and insights. Health care organisations assess the quality of care through quality indicators (Federatie Medisch Specialisten, 2020). Registering such indicators can contribute to quality improvements, even more it can show an insight in the current quality provided as all indicators should be able to meet a certain norm. Every country has their own laws on registering the quality of care, mostly the performance indicators are used, these are process indicators, structure indicators and outcome indicators (Mainz, 2003). In the Netherlands hospitals are registering these performance indicators, the specifics within these indicators are decided on by the Federation of Medical Specialists, in Dutch: Federatie Medisch Specialisten, and the the Dutch inspection for health care and youth, the Inspectie Gezondheidszorg en Jeugd (IGJ). The structure-indicators are able to show more about the

way in which a hospital is organised, an example is whether a policy plan is available and whether hospitals perform certain procedures. Structure indicators overlap with the strategic structures of hospitals. Then, process indicators are a measure about the characteristics of the healthcare process. They say something about the number of patients which were included in a certain process and the amount of healthcare professionals. This could, for example, be the number of patients who receive their medication. The process indicators overlap with the operational level. Eventually, outcome indicators contain a measure about the result of the care process. This could for example be how many patients had to be admitted to a second surgery after the first surgery or how many patients died after their surgery (Ministerie van Volksgezondheid, Welzijn en Sport, 2020). The outcome indicators overlap with the organisational structure. For every type of care provided in every different department, other traits for these indicators can be used. It is expected that mergers can influence the quality of care, for example by changing processes or increasing the number of procedures performed. These changes can affect the quality indicators. For this literature review, all three quality indicators will be taken into account. For the entire study itself only the process and the outcome indicators will be used, structure indicators are left out since it was found by Mant (2001) that these do not tell much about the quality of care and it is better to only use process indicators and outcome indicators.

2.4 Search strategy

In order to find studies related to hospital mergers and their effects two types of search engines were used, Google Scholar and ScienceDirect. Together with this, the reference lists of relevant studies were checked to find other possible useful studies to include in this review. There were no extra limits set on the search except for a time limit, which is a maximum of 10 years as mergers older than this may be outdated in regard to the rapid changes in health care. Some keywords related to the topic were chosen to look for studies, these were: “hospital

mergers" and "effects". For "effect" different terms were taken into account. These terms were "quality of care", "changes", "effects", "structure", "competition", "efficiency" or "outcomes". Moreover, these keywords were also translated and used in Dutch, thus "kwaliteit van zorg", "effecten", "structuur", "competitie", "efficiëntie" and "uitkomsten". These keywords and their terms were used interchangeably on both of the databases. On both databases useful hits were found. Eventually there were approximately 50.000 hits. These hits were briefly examined through their titles. Titles that had no association with hospital mergers and effects were excluded immediately. From other articles the abstracts were examined on their relevance to the topic. Articles that had abstracts closely related to the effects of hospital mergers were selected. Articles that had unclear abstracts about the topic were further examined by their conclusion and included if they had relevant information about effects. Google Scholar was examined first and had approximately 250 useful hits, eventually 112 articles were selected and screened through their abstract. Out of these articles, 10 were selected. After observing the references lists, 3 other articles were found. Then, ScienceDirect was studied, which gave the same relevant hits as Google Scholar did. Thus, no extra articles were selected through ScienceDirect. Eventually 13 articles were used in this review.

2.5 Selection criteria

For this review, there were some selection criteria for including or excluding the found studies. Studies were eligible for inclusion if they concerned merged hospitals and the unit of observation was in fact the hospital. Therefore, studies which focussed on health insurers or other health institutions were left out. Also, if the studies examined any of the related topics, which are the strategic structure, the operational level, the organisational structure and the quality of care, they were included. Furthermore, articles only referring to unmerged hospitals were excluded.

2.6 Effects

All articles were examined based on their relevance to the different studied topics: strategic structure, operational level, organisational structure and quality of care. All these results can be found in Appendix 1: *Findings literature review* in the appendix. Multiple studies related to multiple topics; therefore, these articles were included for all the topics they related to in the table.

2.6.1 Strategic structure effects

Considering the strategic structure Brekke et al. (2017) found that mergers lead to an increased cost-efficiency in the market for the merged hospitals. Even more, hospitals tend to engage more in market competition due to the merger. This effect is backed up by the study of Dafny et al. (2019). They state that mergers can strengthen the economic position of the merged hospitals, which gives them a higher market power and therefore could result in hospitals engaging more in competition. But then, it was detected by Roos (2018) that mergers resulted in market concentration and made it harder for new competitors to enter this market. Even more, due to the market concentration fewer hospitals are available therefore patients have less choice as to where to go (Warren, 2019). Schmid and Varkevisser (2016) report that the Netherlands is accepting high levels of market concentration in comparison to Germany and Great Britain. It was also found that the hospital competition in the Netherlands is restricted to the neighbouring hospitals. Moreover, Dafny et al. (2019), noticed that mergers in the same geographical area can increase the prices in that area which is also detected by Warren (2019) and van Loghum (2012). Van Loghum (2012) found that due to hospital mergers, the costs of hip surgery increased in half of the merged hospitals but decreased in a quarter of those hospitals. The findings of Dafny et al. (2019), Warren (2019) and van Loghum (2012) are contradictory to the findings of Roos (2018) who stated that hospital mergers had a positive effect on prices of care, as prices were lowered.

2.6.2 Operational level effects

The operational level regards the culture on the working floor and the practices thereof. De Kam et al. (2020) and Roos (2018) found that personnel of merged hospitals often work at the different locations and that they provide multiple products and services at these different locations. Roos et al. (2019) detected that hospital mergers led to heterogeneous prices for different hospital products and hospital locations as well. Furthermore, Su (2017) and de Kam et al. (2020) found that processes change due to mergers. Su (2017) therefore argues that due to these changes delays are detected in the administrative structure and personnel is becoming confused because of the new procedures or medical technologies. This is backed up by de Kam et al. (2020). The changes and working of personnel at multiple locations can result in confusion and the making of mistakes while adapting to the changes. This is contradictory to the findings of Westra et al. (2020) as in this study it is argued that personnel have positive perceptions regarding mergers.

2.6.3 Organisational structure effects

The organisational structure takes into account the way in which the hospital is organised. Only positive effects of mergers were noticed on the organisational structure. Batterink et al. (2016) discovered that mergers have had positive effects on strengthening the educational status of the hospitals. This is because the mergers make sure that hospitals are able to perform enough surgeries to meet the national requirements. Westra et al. (2020) agree with this stating that mergers have a positive effect on providing hospitals with a higher availability of different services and products. Even more, due to mergers more training of staff is possible. However, van Hulst & Blank (2017) claim that these positive effects are only applicable to smaller hospitals and Dutch hospitals are becoming too big to have these advantages. Then, Su (2017) revealed that hospitals at severe financial risk were able to obtain the necessary infrastructure and staffing due to mergers.

2.6.4 Quality of care

Quality is a broad concept examined in different ways within the included studies. Multiple studies (Batterink et al. 2016, Roos 2018, de Kam et al. 2020, Warren 2019) state that there cannot be said anything about the effect of mergers on quality of care. Even though Batterink et al. (2016) argue that due to changes in processes the quality of care can be at risk. Westra et al. (2020) add to this by having no measured positive effect of mergers on quality of care. Furthermore, Brekke et al. (2017) state that mergers will lead to lower quality of care, unless hospitals show an altruistic approach to the quality competitions, therefore, not aiming for only cost containments. Then, Su (2017) found that all mortality rates increased, but all readmission rates decreased which is contradictory to the effect on quality of care.

2.7 Conclusion on literature review

Through this review it can be concluded for the strategic structure that mergers can strengthen the economic position of hospitals and thus provide better resources for competing with other hospitals (Brekke et al. 2017, Dafny et al. 2019). The merger results in market concentration (Roos, 2018), but it remains ambiguous whether prices of healthcare are increased (Dafny, Ho, K, & Lee 2019, Warren 2019, van Loghum 2012) or lowered (Roos 2018, van Loghum 2012). Furthermore, for the operational level it can be said that due to mergers the practices on the working floor change and personnel can become confused because of this (de Kam et al 2020, Su 2017). The possibility emerges of personnel making mistakes (de Kam et al., 2020). It remains unclear whether the impact of mergers is perceived positively or negatively by personnel. Subsequently, mergers overall have a positive effect on the organisation structure, helping with finances (Su, 2017) and providing more services, products and education (Batterink et al. 2016, Westra et al. 2020). Even though van Hulst & Blank (2017)

claim that these positive effects are only applicable to smaller hospitals. The literature review has shown that there is no consensus as to whether mergers have a positive or negative effect on quality of care (Westra et al. 2020, Batterink 2016, Schmid & Varkevisser 2016, de Kam et al. 2020, Roos 2018).

2.8 Hypotheses

According to the findings of this literature review, four hypotheses were formulated. The first one regards outcome indicators. It was found that hospitals are motivated to merge in order to improve quality of certain procedures and surgeries by being able to perform these procedures and surgeries more often (Varkevisser 2016, Fulop et al. 2002), therefore it is expected that there is an increase of outcome indicators in merged hospitals. Accordingly, the following hypothesis is formulated:

Hypothesis 1*: The merger has led to an improvement of quality of care outcome indicators over time.*

Considering the expected improvement of quality due to the expected increase of performance of procedures and surgeries, it is expected that the merged hospitals have better surgical outcomes than unmerged hospitals. Thus, the following hypothesis is formulated.

Hypothesis 2: *Merged hospitals have better quality of care outcome indicators over time than unmerged hospitals.*

Then, the scholars de Kam et al. (2020) describe a decrease in quality of care due to the changes of processes. It is expected that changes in processes have led to staff having to adjust and therefore being more prone to mistakes or poor performance. Hence, it is expected that during the merger the quality of processes decreased. Subsequently, the following hypothesis is formulated:

Hypothesis 3: *The quality of processes in merged hospitals decreased during the merger.*

However, after the staff was adjusted to the change of processes, the quality of these processes is expected to increase again. Therefore, the following hypothesis is formulated:

Hypothesis 4: *The quality of processes in merged hospitals increased in the years after the merger.*

2.9 Limitations of the literature review

This literature review has had some limitations. In the first place, the articles that are taken into account often have had the same authors which could have led to bias within the results. Thereafter, the included studies were from different countries with different governance regarding hospital mergers. This can influence the found effects of mergers as for example it might be the case that mergers in these different countries have different effects on healthcare prices. Subsequently, it was a small literature review. This means there are many more studies that could be examined and included in the review if there was more time and space to do so. Nevertheless, the literature review is able to show the gap in existing literature regarding the effects of hospital mergers on quality of care.

3. Methodology

3.1 Research aim

This study aims to examine the effects of mergers on quality of care by looking at certain quality performance indicators, namely process and outcome indicators, in a specific case. The case selected is suitable because it can help test the hypotheses formulated according to the literature review. This case is the merger of the Universitair Medisch Centrum Groningen (UMCG) and Ommelander Ziekenhuis Groningen (OZG). It is especially suitable for the purpose of this study because the UMCG and OZG aim to concentrate their specialized care to, among other things, improve the quality of care (ACM, 2015). However, the personnel in these hospitals works interchangeably at both locations, which could again lead to a lower quality of care according to literature (de Kam et al., 2020).

3.2 Case selection

The UMCG took over OZG in 2015 for multiple reasons. These reasons were concentrating the specialized care, helping OZG perform more surgeries and because the OZG and UMCG were already working closely together, merging could lower costs of healthcare (ACM, 2015). First, the merger aimed to concentrate the specialized care in the UMCG and help the OZG to be able to perform more surgeries (ACM, 2015). Subsequently, as Fulop (2002) and Varkevisser (2016) described, this increase of surgeries would eventually lead to an improvement of outcome indicators which makes this case suitable for this study. The authority for consumer and market, in Dutch ‘Autoriteit Consument en Markt’ (ACM, 2015) noted that an increase in surgeries was needed for the OZG as every hospital in the Netherlands should meet a certain ‘volume norm’. This means that every hospital should perform at least a certain amount of a specific type of surgery per year to be able to secure the process quality of this surgery. The OZG alone is not able to perform enough surgeries to

meet this norm (ACM, 2015). Following the merger, the personnel of multiple surgical teams in the UMCG and OZG works at both locations and performs most of the surgeries on both locations as of 2019 (UMCG, 2021).

Before the merger the OZG was in fact referring many of their patients to the UMCG and the Martini hospital for more specialized care, this slightly changed after the merger as the UMCG became the prioritized hospital. Even though the OZG continued to function on a separate location after the merger, the complex care is centred in the UMCG and the regular care is mostly centred within the OZG. Nevertheless, some types of care are provided in both locations such as cardiovascular surgeries, this thus requires the personnel to work at both locations (UMCG, 2021). According to de Kam et al. (2020) this could pose a risk to the quality of care here. It is unknown whether this is the case as the concentration of care could improve the quality (Schmid and Varkevisser 2016, Fulop et al. 2002).

3.3 Selected surgeries

The selected surgery type for this study are cardiovascular surgeries and more specifically the percutaneous coronary intervention (PCI) and the implementation of pacemakers and implantable cardioverter-defibrillators (ICD). The UMCG is highly specialized in cardiovascular surgeries and the same cardiovascular surgical team is working at both UMCG and OZG as of 2019 (UMCG, 2021). These surgeries also show clear process and outcome indicators. Additionally, the cardiovascular surgery department is one of the biggest specializations of the UMCG together with the neuro-oncology and pediatric neurology departments. The PCI procedures and implementations of pacemakers/ICD’s are often performed procedures and have lower health risks than most other cardiovascular surgeries.

PCI (Kristensen & Aboyans, 2018) is a procedure which is performed to treat the narrowing of coronary arteries. The procedure combines angioplasty with stenting. With

angioplasty a balloon is inserted into the coronary artery, this helps widen the artery after which a stent, which is a meshed tube, is placed into the artery and left there permanently. A PCI procedure is called primary when the PCI is used with patients who had an ST-segment elevation myocardial infarction (STEMI). The PCI is an alternative for Bypass surgery. The procedure is widely used and has a number of risks, even though major surgical complications are uncommon. The most serious risks are death, stroke, ventricular fibrillation, myocardial infarction and aortic dissection.

The pacemaker is a device which gives electrical pulses to the heart to help it pump at the right pace (Kristensen & Aboyans, 2018). The pacemaker is used for bradycardia and tachycardia. The ICD is a device which helps prevent cardiac arrest. The pacemaker needs to be replaced every eight to ten years. The implementation of a pacemaker or ICD is a small surgical procedure. The device is inserted under the skin, sometimes under the muscle, near the collarbone, subsequently the wires of the device are connected to the heart through a nearby artery. The implementation of a pacemaker or ICD has almost no complications. However, known complications are: a surgical site infection, blood loss, a collapsed lung, a shift of a wire in the first two weeks after implementation, a breakdown of a wires shift of the pacemaker itself and malfunction of the pacemakers which can cause palpitations. If there is a complication with the pacemaker or the wires, a follow-up surgery is needed to fix the problem.

3.4 Quality of care in cardiovascular surgeries

Quality of care within cardiovascular surgeries is defined through the quality of life and quality of recovery it provides the patient (Myles et al., 2014). Complications and the type of complications are argued to be important. A study by Chung et al. (2020) also looks at the hospitalization rate after a surgery while also assessing the mortality rate in connection to this. Then, Noyez et al. (2010) stated that the quality is best secured by the way the surgery is

performed and evaluated. Also, they use performance indicators such as structure, process and outcome indicators while stating the importance of registering the data properly. As this was more than ten years ago, this importance might be something that remained however in a different way as everything is becoming more and more digitized.

The structure, process and outcome indicators remain used as performance indicators to test the quality of care since according to the Dutch council for health research, Raad voor gezondheidsonderzoek (1990), quality can be measured by comparing the norm to the reality (Eindhoven et al., 2015). In essence, the performance indicators are able to highlight the difference between norm and reality which makes them useful in showing the outside world how a hospital is performing (Siregar & van Herwerden, 2012). Every healthcare procedure has different important measures. In the Netherlands all these different measures are set up by the Dutch Federation of Medical Specialists (Federatie Medisch Specialisten, 2020) and the Dutch inspection for health care and youth (IGJ, 2021) as was mentioned before.

The process indicators regard mostly the processes in hospitals and the execution thereof (Eindhoven et al., 2015). This is tested through multiple indicators such as the number of patients that went through a procedure. With this information it is possible to find whether hospitals were able to meet the required quality volume norms (NVVC, 2019). For PCI procedures the norm is to perform at least 600 surgeries annually and to have at least 4 cardiologists at a hospital performing these surgeries. Having a low annual volume of PCI's, which is between 200 and 400 per year, is related to hospitals having more complications and incidences in comparison to hospitals that are able to perform more PCI's (Aengevaeren et al., 2005). Also, for the PCI procedure the door-to-balloon time or door-to-needle time are measured through the process indicators (Eindhoven et al., 2015). The door-to-balloon time is a key performance quality metric in the treatment of heart attacks. The American Heart Association's guidelines recommends that the artery be reopened within 90 minutes for best

patient outcomes. Then, the door-to-needle time is the time from presentation of a patient with stroke-like symptoms at the hospital to the start of intravenous thrombolysis, this must be done in 270 minutes after the start of the symptoms. Another process indicator for PCI-procedures regards the number of patients that have been offered cardiac rehabilitation. A cardiac rehabilitation programme should be offered to every STEMI patient (Kristensen & Aboyans, 2018). Such a programme includes exercise training, risk factor modification, education, stress management, and psychological support.

The implementation of pacemakers and ICD's has certain volume norms as well. For the implementation of pacemakers, the norm is to perform between 50 and 75 of these procedures annually whereas every surgeon should perform at least 25 of these procedures annually (NVVC, 2019). For the implementation of ICD's, the norm is to at least perform this procedure 60 times a year.

The outcome indicators then take into account the deaths and complications. Every hospital is required to register the total number of surgeries performed and the number of deaths and complications. With this information it is possible to calculate a percentage of deaths or complications by dividing the deaths and complications by the total number of patients undergoing the surgery.

3.5 Research question

As it is unclear what the eventual effect of the merger of the UMCG and OZG has been on the quality of care for one of the biggest departments in the UMCG, it is important to examine this. Thus, the specific research question is: *What is the impact of the UMCG/OZG hospital merger regarding the quality of care of cardiovascular surgeries over time when considering process and outcome indicators?*

Furthermore, the following sub-questions were formulated to help answer the research question:

- What were the main drivers for the UMCG/OZG merger?
- What are the differences in health outcomes of cardiovascular surgery patients over time for merged and unmerged hospitals?
- How did the quality of processes change for the UMCG/OZG merger before and after merging?

3.6 Control hospitals

For this study, two control hospitals were selected. These hospitals are not merged with any other hospital and are comparable to the merged hospitals. These selected control hospitals were the Martini hospital and the Universitair Medisch Centrum Utrecht UMCU. The Martini hospital was chosen as it is located in Groningen and therefore the patient population can be compared to the patient population of the UMCG and OZG. Even more, the Martini hospital performs the same surgeries as the OZG and the ACM (ACM, 2015) states that the Martini hospital is the biggest competitor for both of the examined hospitals. The UMCU is chosen as a control hospital for the UMCG due to its academic nature. Both the UMCG and UMCU are linked to a university which makes them more comparable to each other than the UMCG and the Martini hospital. However, the patient population might vary because of the geographical distance between the hospitals.

3.7 Data

For the abovementioned surgeries the process and outcome indicators were examined. All of this data was conducted from the Dutch inspection for health care and youth, the Inspectie Gezondheidszorg en Jeugd (IGJ). The IGJ annually collects certain quality data from hospitals and other healthcare institutions which it then presents in the ‘Basisset Medisch Specialistische Zorg’. This can be translated to the basic set of medical specialist care.

3.8 Case specific hypotheses

For this case, specific hypotheses were conducted to be able to test the outcomes of the research question.

As it was found that hospitals are motivated to merge in order to improve quality of certain procedures and surgeries by being able to perform these procedures and surgeries more often (Varkevisser 2016, Fulop et al. 2002) and the UMCG/OZG merger seeks to increase the number of surgeries (ACM, 2015) performed by the OZG to meet the national volume norm the following hypothesis is formulated:

Hypotheses 1: *The UMCG/OZG merger has led to an improvement of outcome indicators over time.*

Considering the expected improvement of quality due to the expected increase of performed surgery, it is assumed that the UMCG and OZG will have better surgical outcomes than the control hospitals. Thus, the following hypothesis was formulated.

Hypothesis 2: *The UMCG and OZG had better surgery outcomes over time for PCI procedures and cardiac pacemaker implementation than the Martini hospital and the UMCU.*

Together with hypothesis 1, this hypothesis seeks to answer the following sub-question: ‘What are the differences in health outcomes of cardiovascular surgery patients over time for merged and unmerged hospitals?’.

Then, de Kam et al. (2020) describe a decrease in quality of care due to the changes of processes. It was expected that the surgical team of the cardiovascular department of the UMCG and OZG will have to adjust during the merger and therefore might be prone to mistakes or poor performance. This makes it important to meet the annual volume norms and perform enough surgeries. It is expected that the quality of processes will temporarily decrease during the merger which is from 2015 until 2018 (OZG, 2018), but eventually will increase by performing enough surgeries. Hence, the following two hypotheses were composed.

Hypothesis 3: *The quality of processes of UMCG/OZG decreased during the merger.*

Hypothesis 4: *The quality of processes of the UMCG/OZG increased again after the merger.*

Together these hypotheses aim to answer the following sub-question: 'How did the quality of processes change for the UMCG/OZG merger before and after merging?'.

3.9 Research design

To answer the research question and test the hypotheses a retrospective quantitative study was conducted. Hospital data from 2012 to 2019 was used. This timeframe was chosen as the start of the merger is right in between this, in 2015 (ACM, 2015). The merger was fully completed in 2018 (OZG, 2018). The year 2020 was excluded due to it being influenced by the Covid-19 health crisis. The measured outcome of this study was quality of care of cardiovascular surgeries, more specifically the process and outcome indicators of PCI procedures, implementations of cardiac pacemakers and of ICD's.

3.10 Study population

The study population consisted of patients which have had PCI procedures done, cardiac pacemakers implemented, or ICD's implemented within one of these four hospitals in the years 2012 up to and including 2019 as the start of the merger was right in between this timeframe, in 2015. Patients who were operated on while already being in an emergency setting were excluded, as these patients already had a low chance of survival which cannot be linked to the care provided in the hospital.

3.11 Data collection

For the processes the study aimed to find the different steps within the surgical processes and the change in these steps due to the merger. However, this was difficult to do as the merger started six years ago and the current personnel might have no knowledge about the processes

pre-merger or have forgotten about this mostly. Even more, there was no data available regarding the specific steps in the surgical processes. Additionally, the COVID-19 health crisis made it difficult to contact hospitals. Therefore, another approach was sought to answer the research question. It was found that the Dutch Inspection of health and youth, the IGJ, has collected data on the quality of care in hospitals.

The IGJ datasets (Dhd, 2020) are available online through excel sheets and have information about structure, process and outcome indicators of all the procedures and surgeries performed in hospitals. The indicators from these datasets are nationally decided to be important quality measures and are collected by every Dutch hospital. As these datasets had information about the process indicators, these were deemed sufficient to examine further and test the hypotheses. Therefore, these datasets were used.

The IGJ datasets were also used for the outcome indicators as they show clear measures of outcomes. Subsequently, the relevant process and outcome surgery data was selected from the IGJ. The exact indicators which were used can be found in *Table 1: basic indicators for PCI procedures* and in *Table 2: Basic indicators for pacemakers/ICD's*. In these tables the indicator type can be seen for every used indicator, such as the number of surgeries where for the pacemakers the number of different pacemakers were added to each other and for the ICD's the number of ICD's were considered as well as the pacemakers and ICD's together. Even more, the number of cardiologists, number of PCI-patients referred to a PCI centre, number of patients who had an intake for cardiac rehabilitation and the door-to-needle/door-to-balloon time were used for the process indicators. For some of these, the percentages were calculated. Then, the percentage of deaths and complications were collected and calculated for the outcome indicators. Furthermore, two structure indicators important for the outcome indicators were collected. These regard whether a hospital uses in hospital deaths

or 30 day follow-up deaths for the number of patients that died after the surgery and whether hospitals use the door-to-balloon time or door-to-needle time.

Indicator type	**Indicator**	**Outcome measure**
Process	How many STEMI patients have been presented at the emergency department?	Number of patients
Process	How many of these patients have been transported to a PCI centre?	Number of patients
Process	Percentage of patients that have been transported to a PCI centre	Percentage
Process	How many PCI procedures were conducted on patients with an acute myocardial infarction?	Number of patients
Process	How many interventional cardiologists are participating in acute infarct care in the hospital?	Number of interventional cardiologists
Process	Average door-to-balloon or door-to-needle time	Minutes
Process	How many patients have had an intake for cardiac rehabilitation after being discharged from the hospital after a STEMI?	Number of patients
Process	Percentage of patients that have had an intake for cardiac rehabilitation after being discharged from the hospital after a STEMI?	Percentage
Process	How many patients with a STEMI were discharged from the hospital?	Total number
Outcome	How many patients died after the PCI procedure for st-elevation myocardial infarct STEMI (exclusive of patients which were in a reanimation setting)?	Total number of deaths during surgery or within 30 day follow-up
	How many patients had a PCI procedure for STEMI?	Total number
Outcome	Percentage of deaths	Percentage

Table 1: basic indicators for PCI procedures

Indicator type	**Indicator**	**Outcome measure**
Process	Number of conventional pacemakers	Number
Process	Number of biventricular pacemakers without ICD function	Number

Process	Number of biventricular pacemakers with ICD function	Number
Process	Number of ICD's without biventricular pacemaker function	Number
Process	Total number of pacemakers/ICD's	Total number
Outcome	How many times has there been a reintervention after the implementation of the pacemaker/ICD within 90 days to solve a problem of the device/procedure? Provide explanations of the problems.	Number of interventions within the 90 day follow-up
	Total number of pacemakers/ICD's implementations	Total number
Outcome	Percentage of reintervention after the implementation of the pacemaker/ICD within 90 days	Percentage

Table 2: basic indicators for pacemakers/ICD's

3.12 Data processing

As the datasets from the IGJ contained all the data from every Dutch hospital and every kind of hospital intervention, the sets were searched and only data regarding process and outcome indicators for PCI procedures and implementations of pacemakers and ICD's for the examined hospitals was selected from the data pool together with the two important structure indicators. Then the surgeries were split up, so every surgery was put together in a separate file and all years conducting this surgery were put together. This was done manually in Microsoft Excel.

3.13 Validity and reliability

Validity means that the data is measuring what it intends to measure. For these performance indicators, validity would therefore require a good methodological quality, taking into account potential differences in casemix of patients and random variation (Eindhoven et al., 2015). Regarding the outcome indicators, the casemix correction was just done in 2019 for the UMCG and the control hospital UMCU which are both tertiary referral hospitals, this means that the hospital is able to provide specialized consultative health care. Hospitals unable to do

this, often refer their patients to the tertiary hospitals changing the casemix of patients at these hospitals. Furthermore, the process indicators are not always able to show the relationship between indicator and quality of healthcare, which weakens its construct validity (Siregar, & van Herwerden, 2012). However, the scientific nature of these performance indicators does increase the overall validity (Eindhoven et al., 2015).

Reliability means that the performance indicators are able to provide the same result on repeated measures. Furthermore, the datasets should be as complete as possible and collected in a uniform way. Which is the case within the used data (Eindhoven et al., 2015). It must be noted however that the researchers depend on the honesty and accuracy of the hospitals which filled in the data. Hence, it might be the case that mistakes were made when filling in this data.

Taking these factors into account, it could be stated that the data is valid and reliable enough for this study, as it depends on scientific findings and has complete datasets collected in a uniform way. Be that as it may, the data is not perfect and can be biased in multiple ways, such as the casemix of patients.

3.14 Data analysis

After the data was processed, it was analysed testing the hypotheses. For the first hypothesis '*The UMCG/OZG merger has led to an improvement of outcome indicators over time.*' the different outcome indicators were taken into account. These were the percentage of deaths after a PCI procedure and the percentage of interventions after the implementation of a pacemaker/ICD. The percentage of complications/interventions was calculated dividing the number of complications/interventions by the total number of surgeries performed. This was done for all of the included years for both the UMCG and OZG. Eventually the percentages were examined to find a trend. Furthermore, these outcomes were compared to the average outcomes of all Dutch hospitals together which was calculated through Excel and set as a

benchmark which should not be exceeded. The hospitals were not taken together as the surgeries were performed at separate locations.

For the second hypothesis '*The UMCG and OZG had better surgery outcomes over time for PCI procedures and cardiac pacemaker implementation than the Martini hospital and the UMCU.'* the outcome percentages were again considered. The merged hospitals were compared to the unmerged control hospitals to see whether the merger has led to an improvement of outcomes over time. Thus, the UMCG was compared to the UMCU and the OZG to the Martini hospital. The outcomes were again compared to the average outcomes of all Dutch hospitals together, thus to the benchmark. The UMCG and OZG were analysed separately even after the merger because the surgeries were performed at different locations and the merger was not yet finalized fully until 2019.

The third hypothesis '*The quality of processes of UMCG/OZG decreased during the merger*.' considers the process indicators during the merger from 2015 up until 2018. For this hypothesis multiple indicators were used. The indicators: 'How many STEMI patients have been presented at the emergency department?' and 'How many of these patients have been transported to a PCI centre?' were considered for the OZG and its control, the Martini hospital. A percentage was calculated by dividing the patients that have been transported to a PCI centre by the total number of STEMI patients presented at the emergency department. A higher percentage is considered to be better than a low percentage. Moreover, the indicator 'How many PCI procedures were conducted on patients with an acute myocardial infarction?' was taken into account to see whether the hospitals are able to meet the volume norm, a higher number of PCI procedures is considered to be better with an aim of at least 600 PCI procedures annually. Furthermore, the indicator 'How many interventional cardiologists are participating in acute infarct care in the hospital?' is considered to find whether the hospitals have enough interventional cardiologists. For the pacemakers/ICD's the indicators: 'Total

number of pacemakers/ICD's' was used, again the volume norm should be met, and more surgeries are considered to be better. The numbers were calculated over the years and graphs were made to see whether the number of procedures performed decreased or increased, this was compared to the national volume norm which describes the minimal number of surgeries needed to be performed. Hospitals ought to at least meet this goal, even more it was found that a higher volume of surgeries results in higher quality of care (Aengevaeren et al., 2005). The UMCG and OZG were analysed separately as well as together, because the same surgical team started performing these surgeries due to the merger (UMCG, 2021).

The fourth hypothesis: *"The quality of processes of the UMCG/OZG increased again after the merger."* considered the same indicators as the third hypothesis, but only for the year 2019. It compared the process indicators during the merger from 2015 up until 2018 to the process indicators in 2019.

4. Results

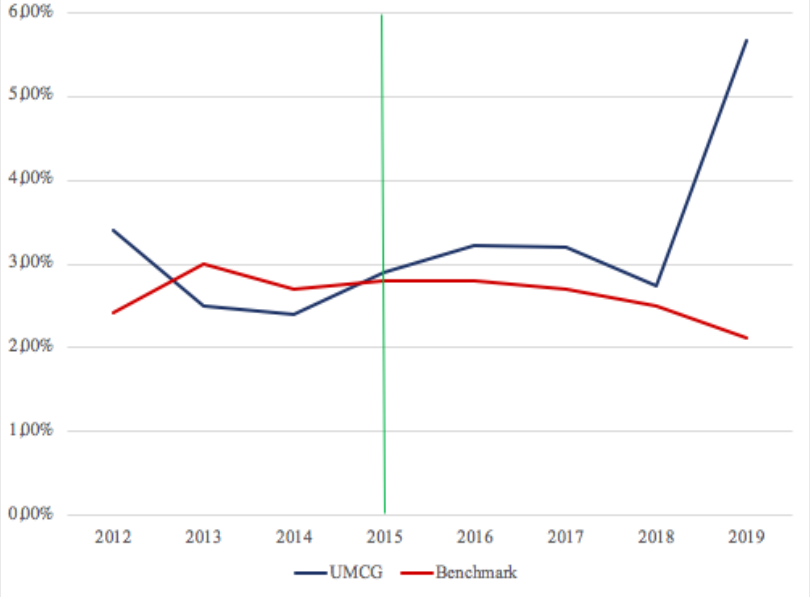
This study collected performance indicators of two merged hospitals and two unmerged control hospitals in the Netherlands, the merged hospitals were the UMCG and OZG, the unmerged control hospitals were the UMCU and the Martini hospital. In the Netherlands, merged hospitals often become separate locations of the same hospital organisation. The care services are divided between them and personnel might work on both locations or only at one location. Within the UMCG and OZG merger, the cardiovascular surgery personnel was required to work on both locations (ACM, 2015).

The data was collected over 2012 up until 2019 and was used to test four hypotheses. Eventually, a total of 5409 PCI-procedures and 9737 implementations of pacemakers/ICD's were performed over the years 2012 up until 2019 in the four studied hospitals. The UMCG was able to perform 3635 PCI-procedures during this timeframe and the control hospital, the UMCU performed 1774 PCI-procedures. Subsequently, the UMCG implemented 3367 pacemakers/ICD's from 2012 up until 2019, the control UMCU implemented 3458 pacemakers/ICD's. Then the OZG, which merged with the UMCG in 2015 up until 2018, implemented 690 pacemakers/ICD's at their own location, while its' control, the Martini hospital implemented 2222 pacemakers/ICD's. The type of pacemaker/ICD was registered until 2017. It was found that the OZG did not implement any ICD's which made it difficult to compare to the Martini hospital regarding the ICD's. However, as the registration of different types of pacemakers and ICD's stopped in 2016 and the distinction was not seen as necessary, for this analysis no distinction was made either.

4.1 Hypothesis 1: *'The UMCG/OZG merger has led to an improvement of outcome indicators over time'*

The first hypothesis regards the outcome indicators of the UMCG and OZG over time. When looking at the percentages of deaths after PCI procedures, it can be seen that the UMCG has an increase in deaths as can be seen in Figure 1: Percentage of deaths in the UMCG after a PCI procedure. The percentage of deaths in the UMCG is the highest in 2019 (5,67%) and the lowest in 2014 (2,40%).

Figure 1: Percentage of deaths in the UMCG after a PCI procedure

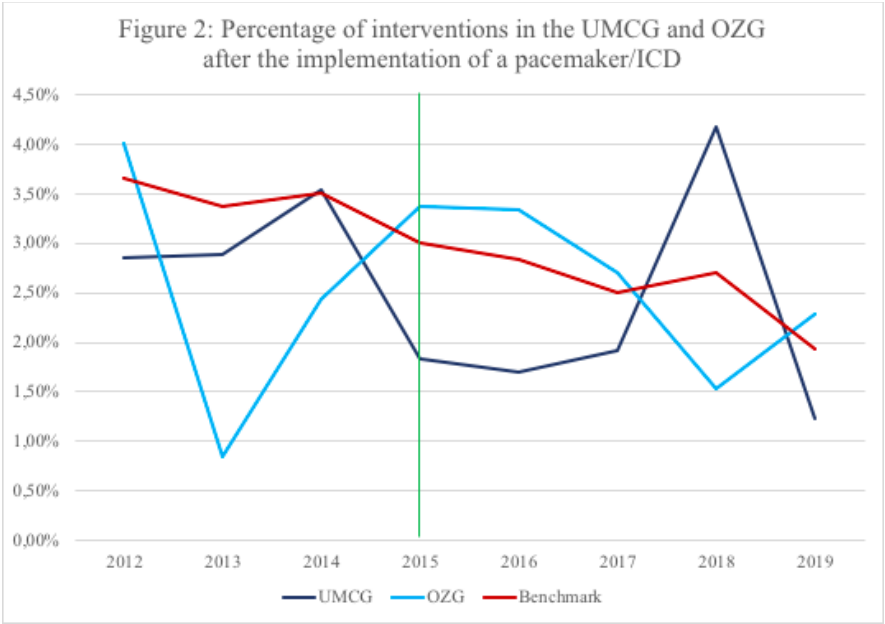


However, the UMCG stated that there were multiple reasons for this high mortality rate in 2019. Out of the 24 patients that died within 30 days after the PCI, 8 patients had another critical condition which was not related to the coronary arteries. These conditions influenced the prognosis after PCI. Furthermore, 5 patients had a severe cardiogenic shock which resulted in a low survival rate (Dhd, 2020). If these 13 patients are not considered, the percentage of deaths in the UMCG would be 2,60% which is still higher than the benchmark that year (2,12%). The benchmark is the average percentage of deaths over all Dutch hospitals performing the PCI procedures. Compared to this benchmark, the UMCG mostly has a higher percentage except in 2013 and 2014. In 2015, the year the merger started, the percentage of

deaths was 2,90%, which was close to the benchmark of 2,80%. Thus, according to these numbers there is no improvement over time of the outcome indicators regarding the PCI procedures.

After the merger, implementations of pacemakers/ICD's were still being performed at separate locations. For the percentage of interventions after the implementation of a pacemaker or ICD, for both the UMCG and OZG a decrease can be seen over time. This can be seen in Figure 2: Percentage of interventions in the UMCG and OZG after the implementation of a pacemaker/ICD.

Figure 2: Percentage of interventions in the UMCG and OZG after the implementation of a pacemaker/ICD



It must be noted that there are some outliers such as in 2013 for the OZG and in 2018 for the UMCG. In accordance with this, the UMCG itself stated in 2018: "as a tertiary referral hospital we perform interventions of which the primary implementation has been done in another hospital. Thus, our percentage is higher than that of a non-tertiary referral hospital." (Dhd, 2020). Considering this, this outlier for the UMCG could be connected to the lower percentage of interventions this year in the OZG. The OZG has 1,54% of interventions in

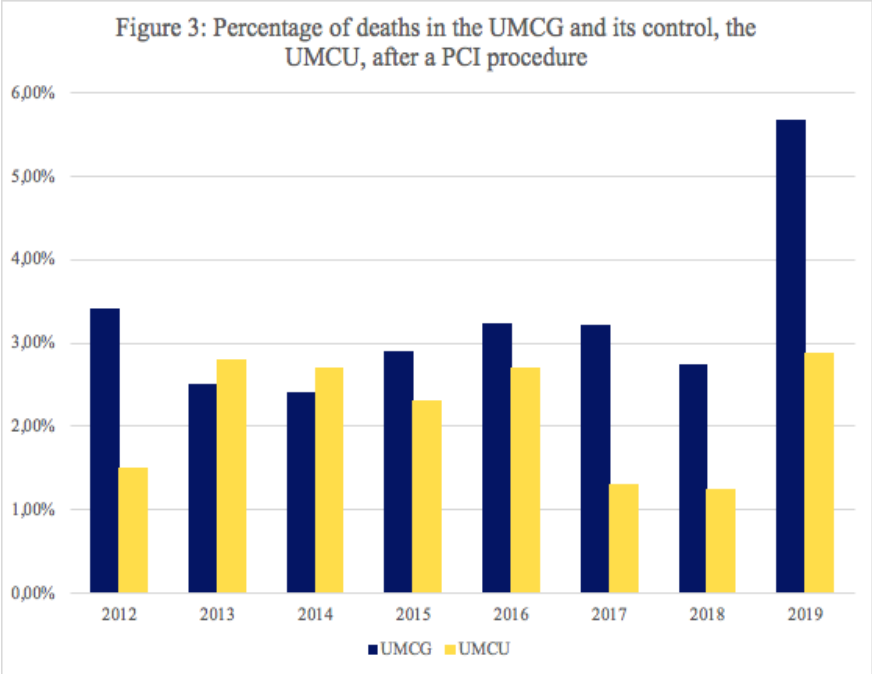
2018 compared to 2,70% in 2017 while the UMCG has 4,18% of interventions in 2018 compared to 1,92% in 2015.

The decrease in percentage of interventions after the implementation of a pacemaker or ICD is in accordance with the benchmark, which is also showing a decrease. Therefore, regarding the implementation of pacemakers and ICD's an improvement of outcome indicators can be found for the UMCG, for the OZG it seems there was no clear improvement when comparing the pre-merger period to the post-merger period.

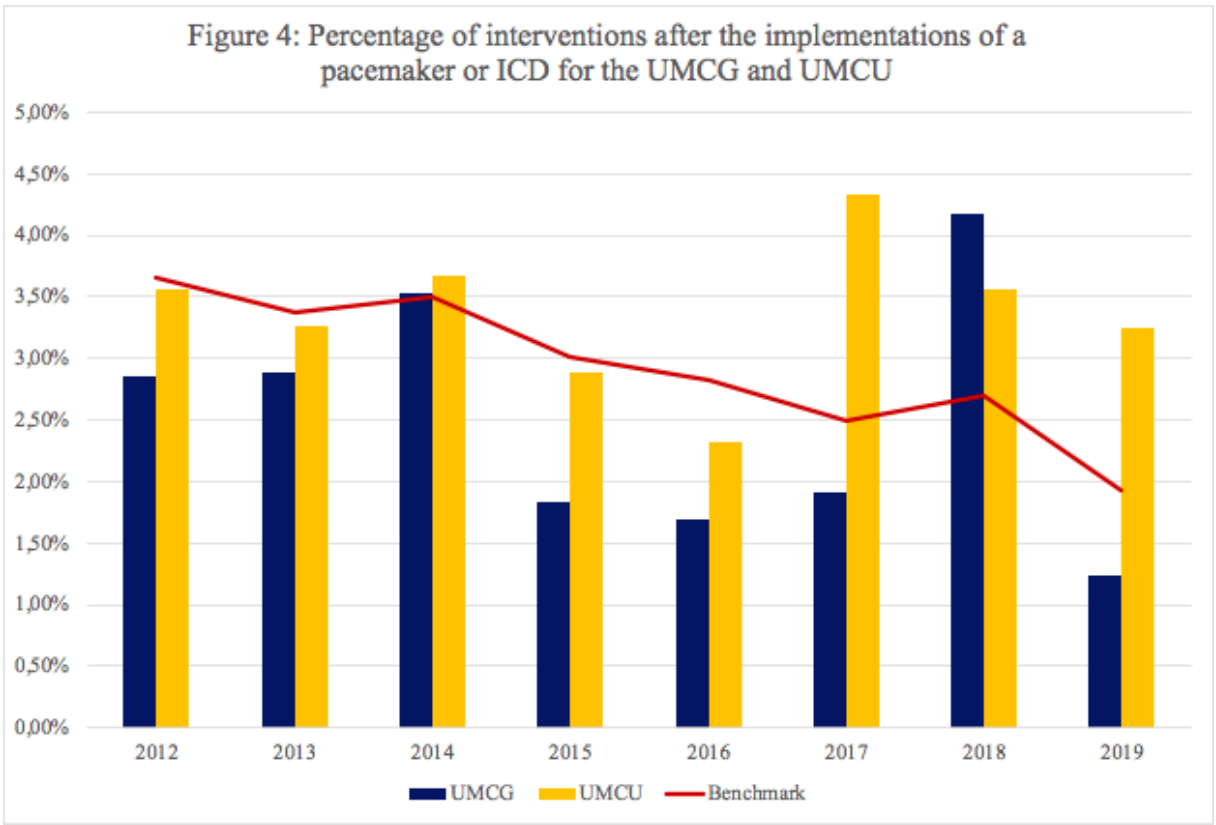
So, the overall conclusion on the hypothesis is: according to these numbers, there is no improvement of outcome indicators over time within the merged hospitals.

4.2 Hypothesis 2: '*The UMCG and OZG had better surgery outcomes over time for PCI procedures and cardiac pacemaker implementation than the Martini hospital and the UMCU'*

When comparing the PCI procedures, the UMCG is compared to its control, the UMCU. This can be seen in Figure 3: Percentage of deaths in the UMCG and its control, the UMCU, after a PCI procedure. It can be seen that the control hospital, UMCU, has better outcomes with a lower percentage of deaths than the UMCG. However, the control also has an increase in the percentage of deaths in 2019 (2,87%). Overall, regarding the PCI procedures the UMCG is not performing better than its control within the studied timeframe.

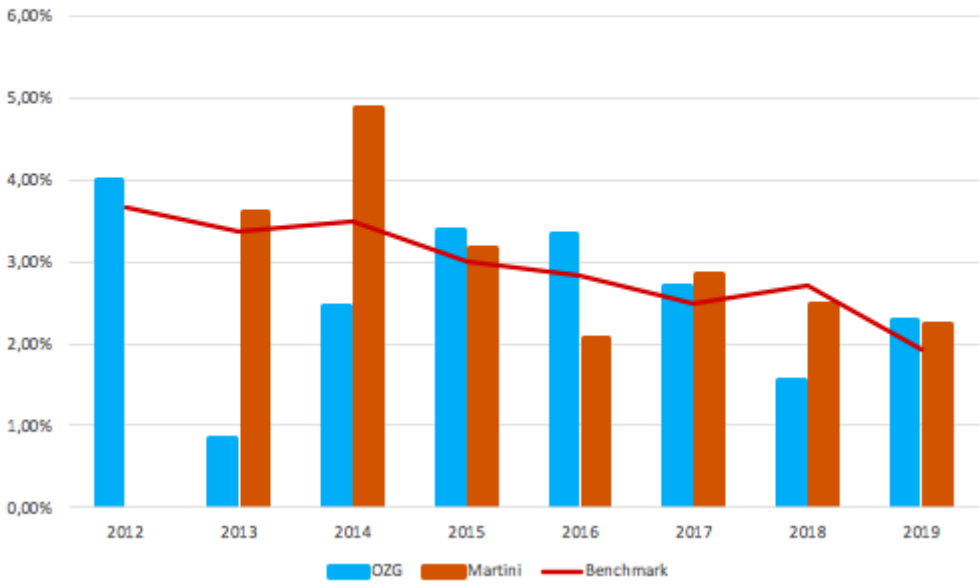


Subsequently, when looking at the implementation of pacemakers/ICD's, the UMCG is performing better than its control, UMCU. It can be seen (fig. 4) that the control, UMCU, has worse outcomes over time with an increase of the percentage of interventions, while the UMCG shows a decrease in the percentage of interventions.



The OZG is compared to the Martini hospital (fig. 5). Both hospitals show a decrease in the percentage of interventions and it can be seen that the OZG is mostly performing better than the Martini hospital, except in 2015, 2016 and 2019. Thus, it can be said that the UMCG and OZG merger according to the percentages of interventions has led to better surgical outcomes than the unmerged control hospitals had.

Figure 5: Percentage of interventions after the implementations of a pacemaker or ICD for the OZG and Martini hospital



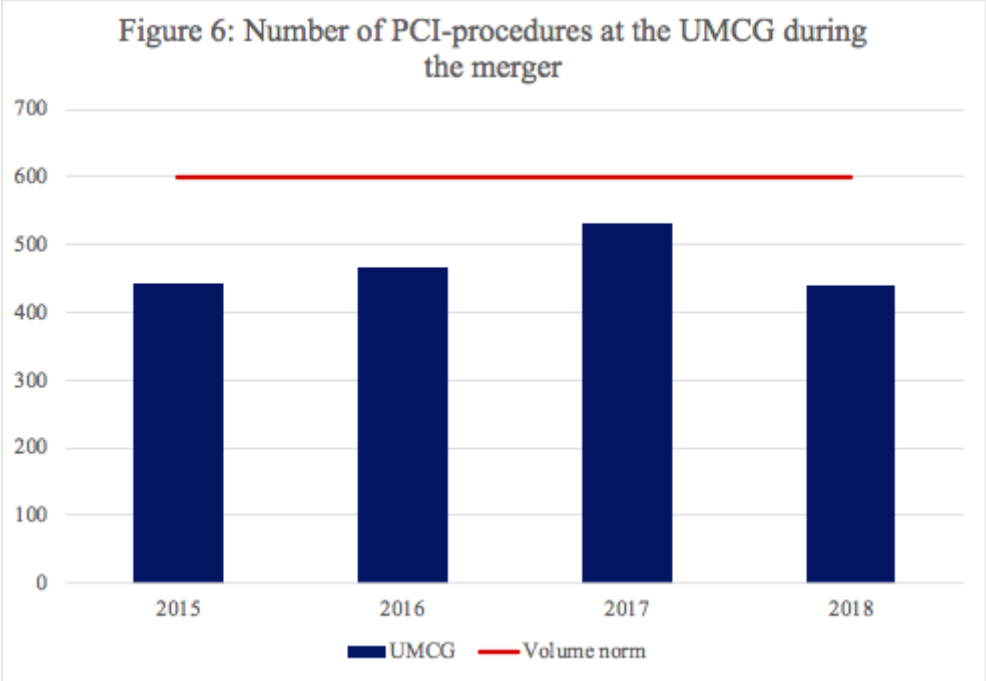
Ergo, the overall conclusion on this hypothesis is: the UMCG/OZG merger has had better surgical outcomes for the implementations of pacemakers/ICD's than the UMCU and OZG. However, this was not the case for the PCI-procedures, where the unmerged control hospital, the UMCU, has had better surgical outcomes than the UMCG.

4.3 Hypothesis 3: "*The quality of processes of UMCG/OZG decreased during the merger*"

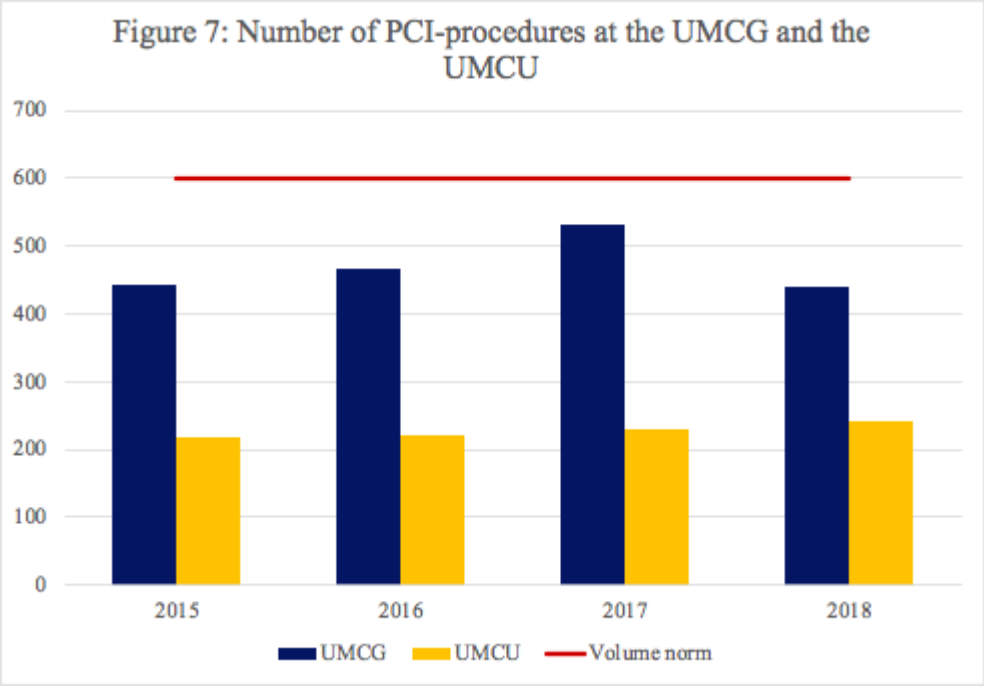
For the quality of processes, it was analysed whether the hospitals were able to meet the volume norms, whether they met the maximum door-to-needle or door-to-balloon time and whether there were enough interventional cardiologists performing surgeries. Another

indicator was the percentage of patients that have had cardiac rehabilitation and the number of STEMI patients that have been referred to a PCI centre. It was expected that the quality of processes decreased during the merger, thus from the start of the merger in 2015 until 2018 after the merger was finalized.

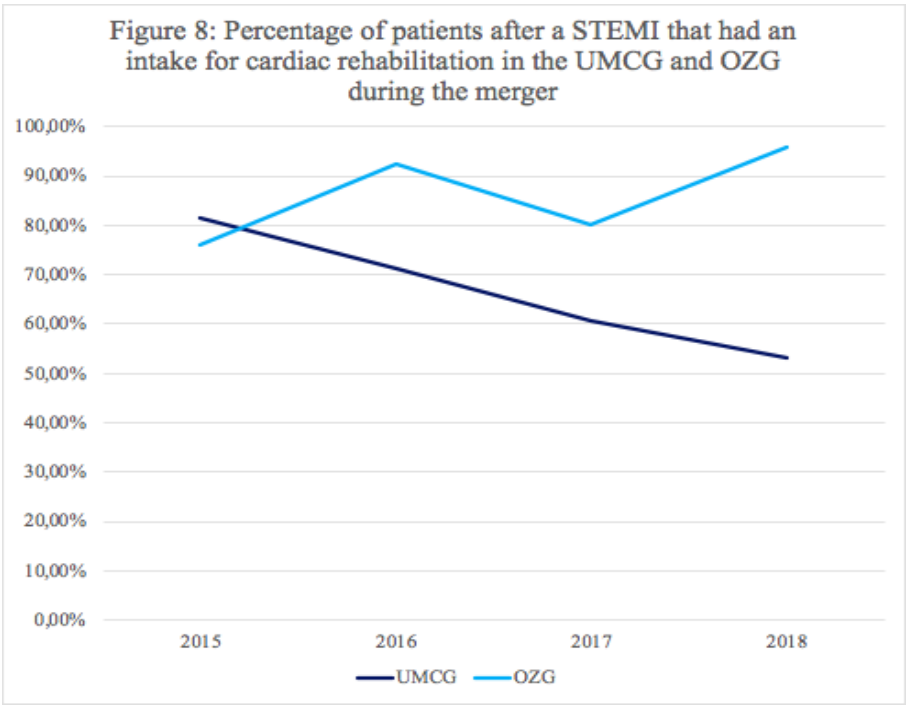
When looking at the number of PCI procedures for the UMCG (fig. 6), a slight increase can be found from 2015 (443) until 2017 (532). After this, a decrease in PCI procedures is seen again. The volume norm of at least 600 PCI procedures was not met during the time frame as can be seen in Figure 6: Number of PCI procedures at the UMCG during the merger.



However, when comparing the number of PCI procedures at the UMCG to its control, the UMCU. It can be seen (fig. 7) that the UMCU is also unable to reach the volume norm of 600 PCI procedures annually. Furthermore, the UMCU performs fewer surgeries than the UMCG does, with a maximum of 241 surgeries in 2018 and a minimum of 217 in 2015.



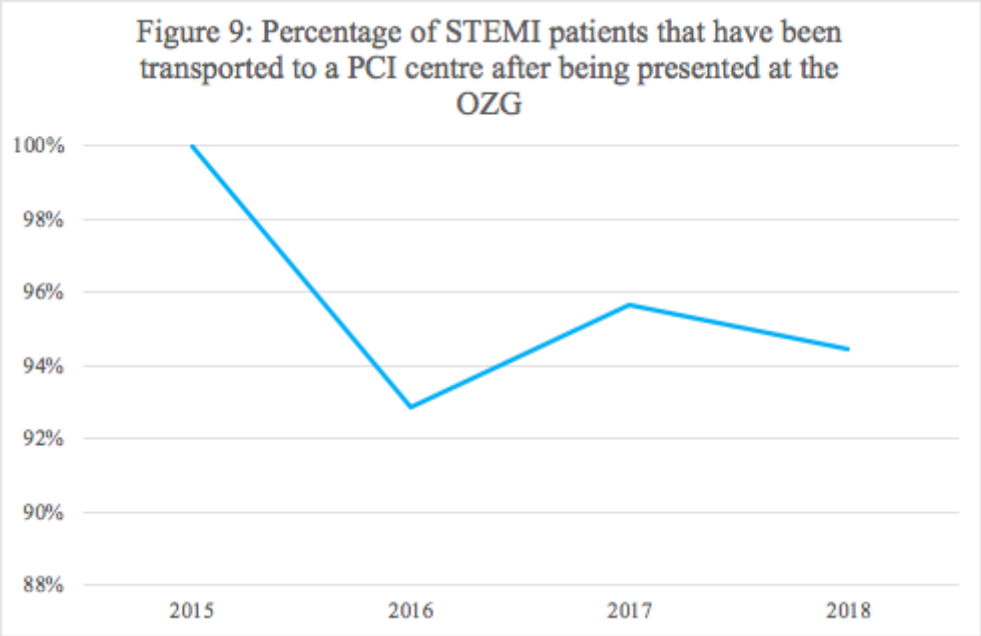
Furthermore, the door-to-balloon time, which is according to the guidelines set to a maximum of 90 minutes, decreased in 2017 from 41 minutes to 40 minutes, but increased in 2018 to almost 42 minutes. Subsequently, the percentage of patients that had cardiac rehabilitation in the UMCG decreased at the UMCG (fig. 8), which shows a decrease of the process quality.



In 2015, 81,50% of the patients that had a PCI procedure had cardiac rehabilitation, while in 2018 this percentage was 53,05%. At the OZG this percentage increased, from 75,90% in 2015 to 95,65% in 2018. It could therefore be assumed that patients with a STEMI at the UMCG are offered cardiac rehabilitation at the OZG.

Moreover, the number of interventional cardiologists is important. According to the norm (NVVC, 2019) there should be at least 4 interventional cardiologists. The number of interventional cardiologists participating in the UMCG is constant. There is a maximum of 7 interventional cardiologists in 2014 up until 2019 in contrast to 2012 and 2013 with a minimum of 6. Thus, an increase in interventional cardiologists.

Eventually the percentage of patients that were presented with a STEMI at the OZG and then transported to a PCI centre is an important process indicator. It is desired to transport as many STEMI patients as possible to a PCI centre in time. Thus, a high percentage is seen as a measure of good process quality for the OZG. This indicator is not applicable for the UMCG as this is a PCI centre itself. Figure 9: Percentage of STEMI patients that have been transported to a PCI centre after being presented at the OZG, shows that there was a decrease from 2015 (100%) to 2016 (92,86%) of STEMI patients that have been transported to a PCI centre in the OZG. After that, a small increase can be seen again in 2017 (95,65%), this remains rather constant with 2018 (94,44%). When comparing this to the control, the Martini hospital it was found that the Martini hospital had a percentage of 100% for the years 2015 up until 2017, in 2018 the percentage was 91,67% at the Martini hospital.

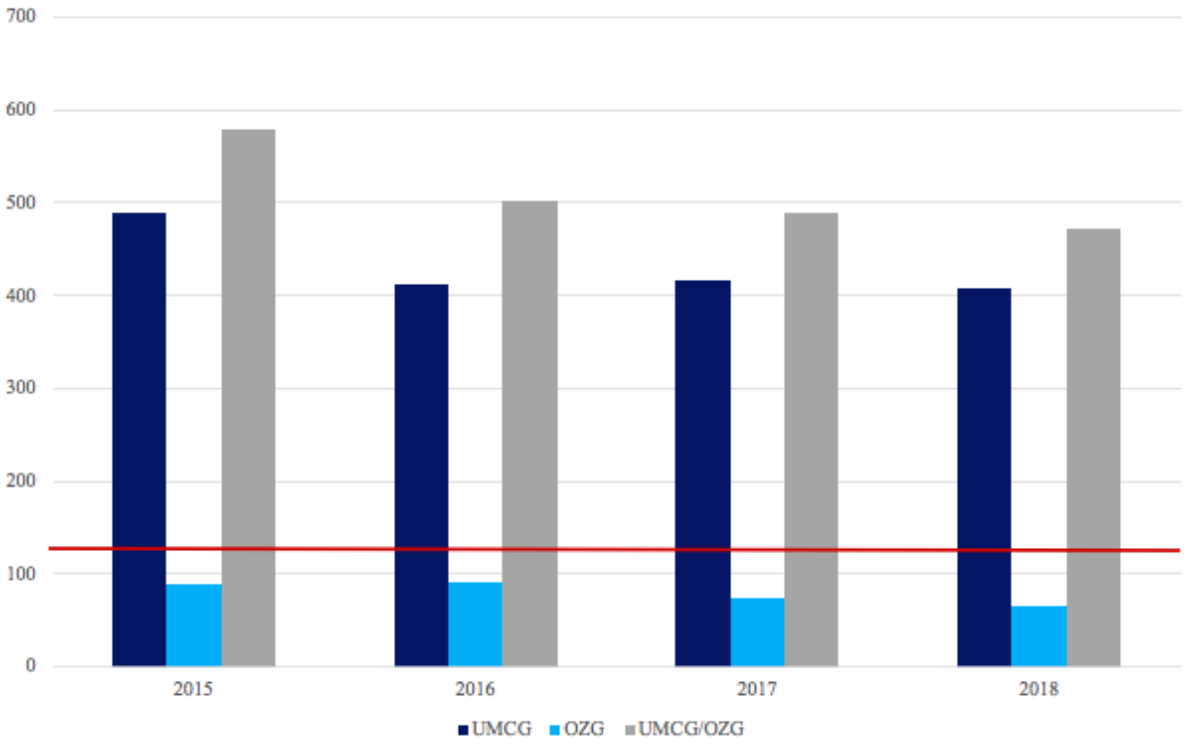


Taking into account that the volume norms are not met at the UMCG, even though the UMCG does perform more surgeries than the UMCU, and there is no decrease or increase in number of PCI procedures, the door-to-balloon time increased, the percentage of patients that enrolled in cardiac rehabilitation decreased for the UMCG even though it increased at the OZG and the percentage of STEMI patients that were transported to a PCI centre decreased, it could be said that the quality of processes for the PCI procedures in the UMCG decreased during the merger when only looking at these numbers.

Then for the implementation of pacemakers/ICD's the volume norm is considered again. From 2015 up until 2018 a decrease in implementations can be found for the UMCG, with 490 implementations in 2015 and 407 in 2018. The same is the case for the OZG, with 89 implementations in 2015 and 65 in 2018. The volume norm is to have at least 120 implementations, the OZG alone is not able to reach this norm, however because of the merger they should be able to do so as the UMCG should refer patients to the OZG. Together with the UMCG, the OZG is able to reach the volume norm but the surgeries are done at separate locations. This can be seen in Figure 10: Number of pacemaker/ICD

implementations at the UMCG and OZG during the merger, where the UMCG and OZG can be seen separately as well as together. Again, when considering these numbers, it could be said that the quality of processes decreased for the implementations of pacemakers/ICD's during the merger.

Figure 10: Number of pacemaker/ICD implementations at the UMCG and OZG during the merger,



Thus, the overall conclusion on this hypothesis is that the quality of processes did decrease during the merger for the UMCG as well as the OZG.

4.4: Hypothesis 4: *"The quality of processes of the UMCG/OZG increased again after the merger."*

For the fourth hypothesis, the year 2019 was considered and it was examined whether after the merger was finalized, there was an increase in the number of surgeries, whether the door-to-balloon time decreased and whether there was an increase in patients that had cardiac rehabilitation. As mentioned before, the years 2020 and 2021 were left out entirely because they are affected by the Covid-19 health crisis.

The number of PCI procedures did not increase in 2019 but decreased even more from 440 to 423. Again, the volume norm of 600 was not met. The door-to-balloon time increased from almost 42 minutes to 45 minutes, which is the highest average door-to-balloon time the UMCG has had during the studied time period. Thus, both indicators show no increase in the quality of processes. However, a slight increase in percentage of patients that had cardiac rehabilitation in the UMCG can be seen. In 2018 this percentage was 53,05% and in 2019 this was 55,92%. This is in contrast to the OZG which had a decrease, with 95,65% in 2018 and 63,46% in 2019. The percentage of STEMI patients that were transported to a PCI centre, increased slightly from 94,44% in 2018 to 94,74% in 2019. According to these numbers, it does not seem that there was an increase in the quality of processes in 2019, one year after the merger was finalized.

In 2019 the UMCG implemented 408 pacemakers/ICD's, the OZG implemented 71. Together, this was 479. In 2018, this number was 472. Thus, there is a small increase here. Also, because of the merger with the UMCG the OZG is able to meet the national volume norm of 120 implementations if the surgeries at both hospitals are taken together.

So, the conclusion on this hypothesis is: there is no registered increase in the quality of processes at the UMCG and OZG one year after the finalization of the merger.

5. Discussion and conclusion

This study aimed to examine the effect of hospital mergers on the quality of care. In order to do this, a case was selected which is the cardiovascular surgery department of the UMCG and OZG merger. For the quality of care performance indicators were used, these were the outcome and process indicators. The case-specific research question was: *What is the impact of the UMCG/OZG hospital merger regarding the quality of care of cardiovascular surgeries over time when considering process and outcome indicators?*

This question was answered through three sub-questions which were again related to four hypotheses. The sub-questions were:

- What were the main drivers for the UMCG/OZG merger?
- What are the differences in health outcomes of cardiovascular surgery patients over time for merged and unmerged hospitals?
- How did the quality of processes change for the UMCG/OZG merger before and after merging?

In this chapter these three questions will be answered, furthermore it will be analysed whether the UMCG/OZG merger reached its goals. After this, the performance indicators as measures of quality of care will be discussed, a broad conclusion will be given about the effects of mergers on quality of care in the light of this study and eventually the strengths and limitations of the study will be discussed.

5.1 What were the main drivers for the UMCG/OZG merger?

Important drivers for hospital mergers that were found in literature show that hospitals aim for a better economic position and better quality of care through merging (Schmid & Varkevisser, 2016). A better economic position and better quality of care was also an important driver for

the UMCG and OZG to merge (ACM, 2015). With merging, it was possible to concentrate the specialized care. This means that the UMCG would perform difficult surgeries, such as the PCI procedures and the OZG could implement more pacemakers/ICD's. Additionally, this would help the OZG meet the national volume norms of 120 implementations annually for the pacemakers/ICD's (ACM, 2015). Eventually, the merger should also help the economic position of the OZG, as according to the ACM (2015) the hospital needed the financial aid from the UMCG to be able to survive.

5.2 What are the differences in health outcomes of cardiovascular surgery patients over time for merged and unmerged hospitals?

This question was answered through Hypothesis 1: *The merger has led to an improvement of quality of care outcome indicators over time* and Hypothesis 2: *Merged hospitals have better quality of care outcome indicators over time than unmerged hospitals.*

Looking at the specific case, the first hypothesis was denied, the merger has not led to an improvement of outcome indicators over time. There is no trend showing this for the PCI procedure. Moreover, for the implementation of pacemakers/ICD's there seems to be an improvement over time, however when comparing this to the national average, it is in accordance with a trend of improvement.

The second hypothesis compared the UMCG/OZG to the UMCU hospital in Utrecht and the Martini hospital in Groningen. Regarding the PCI procedures the UMCG was not performing better than its control, the UMCU. But then, when looking at the implementations of the pacemakers/ICD's it can be seen that the UMCG and OZG show better outcomes than the UMCU and Martini hospital do.

Thus, when answering the question, it cannot be said what exactly the differences in outcomes were over time for merged and unmerged hospitals. It does seem that there is a decreasing trend in the percentage of interventions after the implementation of a

pacemaker/ICD for the merged hospitals, this trend is not spotted for the unmerged hospitals. However, this could be a coincidence and needs further research.

5.3 How did the quality of processes change for the UMCG/OZG merger before and after merging?

To answer this question, Hypothesis 3: *The quality of processes in merged hospitals decreased during the merger* and Hypothesis 4: *The quality of processes in merged hospitals increased in the years after the merger* were considered.

It was found for this specific case that the quality of processes decreased during the years of the merger, thus from 2015 up until 2018. This same trend was not found for the control hospitals, the UMCU and the Martini hospital. Thus, the third hypothesis is accepted.

Then, the fourth hypothesis only took the year 2019 into consideration. For both the PCI procedures and implementations of pacemakers/ICD there does not appear to be an increase in process quality. However, more research is needed and multiple years after the merger should be studied in order to find whether the merger has had any effects.

When answering the third sub-question, it can be said that the merger from the UMCG/OZG impacted the process quality negatively during 2015 up until 2018. To find whether the merger eventually has had a positive effect, more research is needed.

5.4 Did the UMCG/OZG merger reach its goals?

The merger aimed to concentrate the specialized care at the UMCG and concentrate the regular care at the OZG. It is unclear whether this was achieved when taking the specific case into account.

Moreover, the UMCG/OZG merger wanted to increase the quality of care through the merger, it was found that the merged hospitals did not perform better over the years than the control hospitals, or the national average of hospitals. Also, during the merger the quality of

processes decreased, surprisingly this did not lead to a decrease in the quality of outcomes within the studied years.

Eventually, the UMCG/OZG merger was driven by the need of the OZG to reach the volume norms. As was seen through the number of implementations of pacemakers/ICD's, this was not accomplished within the separate location of the OZG. However, together with the UMCG it was. Furthermore, the UMCG itself was not able to reach the national volume norm for the PCI procedures, nor was its control hospital.

5.5 The performance indicators

For this study, performance indicators were used as a measure of the quality of care, these were chosen as the IGJ (Ministerie van Volksgezondheid, Welzijn en Sport, 2020) uses these indicators as well. Performance indicators are not only a measure showing quality of care in hospitals to the outside world, but they are also helping the hospitals in having an overview of their performance (Siregar & van Herwerden, 2012). Thus, they can also help improve the quality, which has already happened in cardiac surgery (Hannan et al. 2003, O'Connor et al. 1996). However, registering such performance indicators can result in hospitals denying difficult patients and procedures in order to not risk poor results (Siregar & van Herwerden, 2012). Moreover, there are some limitations to these indicators. One important limitation which prevents the hospitals from being able to be properly compared, is the casemix of patients (Siregar & van Herwerden, 2012). As was mentioned already, the UMCG states that it is a tertiary referral hospital (Dhd, 2020) which makes its casemix of patients different from the casemix of a regular hospital. Therefore, a correction in the casemix is needed, however this was just done in 2019 for the UMCG. In this study, this was taken into account and the control hospitals that were chosen were hospitals with a similar casemix to the UMCG and the OZG. Nevertheless, the data could still be biased as the administration within the hospitals themselves might have made mistakes (Siregar & van Herwerden, 2012). Siregar and van

Herwerden (2012) emphasize the importance of coincidences in the registered data as not every change in the data shows a change in the quality of care. This is especially true for the outcome indicators.

Hence, performance indicators might not be the best measure for the quality of care. Outcome indicators are able to show the relevant outcomes of the delivered care but often do not take into account importance of the casemix of patients. This means that most hospitals cannot be compared to each other and even more, should not be compared to each other. Besides, the process indicators do not clearly show the exact processes in hospitals and are therefore a difficult measure for the quality of processes. Also, the outcome indicators cannot be directly linked to the process indicators (Siregar & van Herwerden, 2012). Yet, these performance indicators also seem to show positive effects on quality of care and should not be cancelled entirely, it is necessary for hospitals to keep track of these performance indicators, especially structure indicators and process indicators are important for the administration within hospitals. Nevertheless, hospitals and scholars should take into account that there is more to quality of care than can be found in the performance indicators and hospitals cannot be easily compared to each other.

5.6 Effect of hospital mergers on the quality of care

Within the specific case, there does not seem to be a clear effect of hospital mergers on the quality of care. When taking into account the performance indicators, it seems that during the merger the quality of processes decreased, however as was discussed previously performance indicators might not be the best measure for the quality of care and thus this cannot be given as a fact (Siregar & van Herwerden, 2012). Other scholars (Westra 2020, de Kam et al. 2020, Roos 2018, Warren 2019) were also unable to find clear effects of hospital mergers on the quality of care. Nevertheless, it was found that hospital mergers did affect other aspects of

hospitals such as the operational, strategic and organisational level and could probably also affect the quality of care through these levels.

This study contributes to the existing literature by showing that performance indicators are not able to provide all answers in this field of research of quality of care even though performance indicators remain important indicators to register (Siregar & van Herwerden, 2012). It also remains important to study the effects of hospital mergers on quality. Hence, further research is needed with more hospital data on patient outcomes and patient satisfaction. Quality of care needs to be properly defined as well.

5.7 Strengths and limitations

This study has had some strengths and limitations which will be discussed below beginning with the strengths and then the limitations.

First, within this study, hospital data was used through performance indicators (Dhd, 2020). Therefore, all relevant patient data was taken into account and findings could be generalised to other hospitals. Second, the data was relatively easy to analyse and could be easily repeated. Third, the overall validity of the data is another strength. This is increased by the scientific nature of the used performance indicators (Eindhoven et al., 2015). Fourth, as there is no further patient information used within the study and only the processes and outcomes are registered, this study is ethically safe and requires no assessment by an ethical committee. Fifth, controls are used for the studied hospitals, the UMCG and OZG. These control hospitals were chosen carefully to match the studied hospitals as much as possible. Sixth, there were no extra costs connected for the execution of this study as there was no compensation for the study population and the only programme that was used for the analysis was Microsoft Excel.

Next to these strengths, this study has also had some limitations. First of all, the used data has a weak construct validity because the process indicators are not always able to show the relationship between indicator and quality of healthcare (Siregar, & van Herwerden, 2012). Second, the studied hospitals might have made mistakes in registering data which could weaken the reliability of the used data. Third, related secondary data is not available. Only the data that is provided within the datasets (Dhd, 2020) can be used to analyse. Thus, some results might be affected by secondary factors. Fourth, the data that is used only considers one year after the merger, hence it is difficult to say something about the impact of the merger after the merger was fully finalized.

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Appendix

Appendix 1: Findings literature review

Topic	Article	Findings
Strategic structure	Brekke et al. (2017)	Mergers lead to an increased cost-efficiency in the market for the merged hospitals. The hospitals tend to engage in quality competition even more due to mergers.
	Roos (2018)	It was found that mergers resulted in market concentration and made it harder for new competitors to enter this market. The mergers had a positive effect on prices of care, as prices were lowered.
	van Loghum (2012)	Hospital mergers led to an increase in hip surgeries for half of the merged hospitals, a quarter of the hospitals had a decrease in costs.
	Dafny et al. (2019)	Mergers can strengthen the economic position of the merged hospitals. It gives them a higher market power. Mergers in the same area can increase prices in that area. It poses a risk on the competition in health care markets.
	Kemp et al. (2012)	The study examined the effects of mergers on prices of hip surgery and changes in travelling behaviour of patients. They found no significant effects.
	Schmid & Varkevisser (2016)	The Netherlands accept high levels of market concentration compared to Germany and Great Britain. It was also found that the hospital competition in the Netherlands is restricted to the neighbouring hospitals.
	Warren (2019)	Due to the market concentration, there are less hospitals available and patients have less choice as to where to go to. Even more, it seems that the merging of hospitals causes an increase in prices.
Operational level	Roos (2018)	This study found that merged hospitals often continue to operate at different locations and provide multiple products and services.

	de Kam et al. (2020)	Due to mergers the processes in hospitals change. This can cause employees to make mistakes while adapting to the changes. Employees also often work at both hospitals where processes are slightly different which causes confusion and again increases the chance of mistakes.
	Su (2017)	Delays were found due to changes in the administrative structure and staff confusion because of the new procedures or medical technologies.
	Roos et al. (2019)	Hospital mergers led to heterogeneous prices for different hospital products and hospital locations.
	Westra et al. (2020)	Staff has positive perceptions regarding mergers.
Organisational structure	Batterink et al. (2016)	It was found that mergers mostly affect the processes and structures in the hospital. Thus, mergers have had positive effects on strengthening the educational status of the hospitals. The mergers make sure that hospitals are able to perform enough surgeries to meet the national requirements.
	Su (2017)	Due to mergers, hospitals at severe financial risk were able to obtain the necessary infrastructure and staffing.
	Westra et al. (2020)	Mergers have a positive effect on providing hospitals with a higher availability of different services and products. Also, more training for staff is possible.
	van Hulst & Blank (2017)	Dutch hospitals are becoming too big, thus will most probably not have the advantages of a higher availability of different services and products.
Quality of care	Brekke et al. (2017)	Mergers will lead to lower quality of care, unless hospitals show an altruistic approach to the quality competitions. Therefore, not aiming for only cost containments.
	Batterink et al. (2016)	Within this study it was not possible to say anything about the effects of mergers on quality of care.

	Roos (2018)	There is no evidence that hospital mergers have had an impact on the quality of care.
	de Kam et al. (2020)	The effect of mergers on quality of care remains unclear. Due to process changes it can pose a risk on the quality of care but this is not proven.
	Su (2017)	It was found that all mortality rates increased, but all readmission rates decreased.
	Warren (2019)	The study states that it is not possible yet to say something about the effects of mergers on patient care.
	Westra et al. (2020)	There is no positive effect measured on hospital mergers on quality of care.