The procurement of clinical laboratory science services by a health insurance provider in The Netherlands

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Award date: 2014

Link to publication
The procurement of clinical laboratory science services by a health insurance provider in The Netherlands

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BSc Industrial Engineering — TU/e (2012)
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in partial fulfilment of the requirements for the degree of

Master of Science
in Innovation Management

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Abstract

Purpose:
This empirical research tries to answer how to reduce costs and create maximum value in the procurement of clinical laboratory science services, a healthcare service. A literature study was done to develop a conceptual model to measure and identify the criteria for value creation in the healthcare sector.

Design / Methodology / Approach
Data collection has been performed at a health insurance provider. Data mining of invoice data of several years of specific invoice codes was performed. Semi structured interviews with several (internal and external) stakeholders were done to get an understanding of which decision making criteria are important in the field and for triangulation of the research.

Findings:
Statistical analyses were conducted to identify significant patterns and relations. It was identified that 3 financial performance indicators can be used to address laboratory science service providers in the negotiations for a contract. These criteria are: ‘The average cost per order’, ‘The average amount of analyses per order’, ‘The percentage of orders that are home visits’. Besides financial indicators it was found that there is large difference in test requesting patterns between general practitioners. General practitioners request behavior should be addressed. Those GP’s, who request far more types of analyses than the average. Laboratories that perform these large requests should be addressed during the contracting process.

Redesign proposal:
Several solutions for the business problem have been developed based on the ‘tariff per analysis’ and the ‘volume per patient (volume per order)’. A detailed calculation and assessment of a tendering situation has been made as it was considered most beneficial in terms of cost reduction and value creation.

Limitations:
The biggest limitation is in the methodological approach. In this research it was impossible to make a clear distinction between medical microbiology invoice codes and clinical laboratory science invoice codes. Therefore a clear distinction between these laboratories couldn’t be made and consequently were treated equally while they deliver different types of services.
Management Summary
The setting for this study is one of the largest health insurers in the Netherlands. The case study of interest is CZ. CZ has 3.4 million insured customers, an estimated market share of 20%. CZ has a €7 billion turnover a year and 2500 employees. CZ provides health insurance policies with different labels. These labels are: ‘CZ’, ‘Delta Lloyd’ and ‘OHRA’.

Research objective
This study contributes to the existing literature of healthcare buying / procurement. The purchasing of healthcare has received scholarly attention, yet not from purchasing and supply management researchers (Raaij van e.a., 2013). Much of the research is focused on purchasing for healthcare, limited research is done on the purchasing of healthcare by health insurance providers. Within the scope of the research, the goal of this study is to study the relationship and impact of several indicators that are relevant in the procurement of healthcare services.
This project gives insight in the procurement of a particular health service and presents output performance indicators that can be used by buyers in their procurement of health services. It also offers several solution indications on what can be done to optimally procure health services.

Research question
Due to changing regulations, it is intended that a level playing field is established between various providers of clinical laboratory science services. This leads to the fact that in the current situation, the effectiveness in the contracting of clinical laboratory science services is unsatisfactory, as measured by the number and costs of contracted laboratories. The project aims to come up with a procurement solution / strategy for this problem. Therefore the research question is: How could CZ reduce costs and create maximum value for CZ insurants in the purchasing of clinical laboratory science services? The sub questions concern important contextual information such as, what stakeholders are currently present, what cost structures are used. What performance indicators are currently used and should be used in the future. These sub questions are intended to give an answer for the main research question.

Research model
A thorough literature study presented the value creation model that is presented below:

\[
\text{Value} = \frac{\text{Expedience} \times \text{Quality}}{\text{Price}}
\]

Research design
This research is divided in 3 separate studies in order to measure each of the three blocks that are presented in the research model. Expedience and Price are invoice data driven studies. Primarily invoice data of 2012 is used. A data mining tool called SAS was used. Besides data driven research, semi-structured interviews with various external stakeholders were held to get additional contextual information from the field. This approach is preferred as, even though it is very time consuming, because recommendations can be made with having a full understanding of each topic and their interrelations.
This is important to make a sound recommendation on the procurement strategy of clinical laboratory science services.

**Results and conclusions**
The results of both studies and the interviews show that there is a lot of potential to achieve savings. This can be achieved in a number of ways.

First of all, a reduction and harmonization of tariffs will lead to savings. The results show that there are major differences in the overall discount percentages that laboratories give. Some give 25%, others give hardly any discount.

Next to the tariffs, savings can be achieved by influencing the test request behaviour of the general practitioner (GP). GP’s that request excessive amounts of types of analyses should be addressed. Second, GP’s also indicate that they are willing to do test requests at ‘cheaper’ laboratories, if there isn’t a significant difference in quality. GP’s are however unable to do test requests at ‘cheaper’ laboratories because they have no cost awareness of the tests they request. Price transparency can therefore be helpful in giving a GP what a test request costs by different providers. Implementing this in a digital ordering mechanism might help.

Several quality indicators that are currently used in contracts are predominantly structural performance indicators and not output related indicators. Therefore hardly any difference can be found in the quality of clinical laboratory science services. External stakeholders also confirm that they don’t see much quality differences between different providers.

Next to quality indicators, financial performance indicators can be used to address laboratory science service providers in the negotiations for a contract. These criteria are: ‘The average cost per order’, ‘The average amount of analyses per order’, ‘The percentage of orders that are home visits’ The tariffs and the volume per patient (per order) are the main pillars for which solutions are considered.

**Redesign**
Several solution indications were considered. They are presented, along with their estimated savings potential in the figure below.

The more challenging and effort a solution requires, the more cost savings can be realized. One such solution is tendering. An early estimation stated that more than 25% of the current costs can be reduced when this option is considered. A detailed calculation of this solution confirms this. It can be concluded that the cut up in different regions has not led to a dramatic decrease in providers in regions leaving insurants without diagnostic care providers with acceptable travel times and distances.
Discussion – theoretical implications & recommendations

This study yielded several valuable insights with respect to the measures that were used. For the analysis focus should be on value creation in the healthcare sector, instead of volume and price discussions. However it is very difficult not to end up in discussions that are about volume and costs. Value should be judged on the entire package. That is the volume of care related to the quality of care related to the costs of care. This study attempted to use this approach for a practical case, which looks at all three of these aspects and made recommendations on that basis.

This study has shown that almost all quality criteria in laboratory science services are structural quality indicators, not output related indicators. Finance related performance indicators were built. These performance indicators can be used for other types of healthcare. It also would be recommended to see if these performance indicator hold in an equivalent study.

Future research recommendations are to investigate the implementation and validation of laboratory quality indicators. Thereafter the effect of a procurement policy based on these indicators would be interesting.

Another future research recommendation is the effect of price information on test request behavior. No studies have been done on what the effect is of having price information of multiple care providers and what the effect is on substitution (volume shifts) between the providers.

Discussion – practical implications & recommendations

Two pillars have been identified to achieve savings. This is on volume control and on tariff control.

To achieve volume control a more direct approach with GP’s and laboratories is necessary. Laboratories have an ‘education duty’. Data have shown that 10% of the GP’s are ordering many analyses than are deemed realistically necessary (though it isn’t impossible that these requests are legitimate). For this 10% group it is advised to organize a (group) session to address this. Contractual measures can be taken if this group is not performing any better over time. CZ must become a partner for the laboratories to undertake action. At the moment, laboratories have indicated that they do not see CZ as a partner in the organization of diagnostic test consultation sessions.

All GP’s must be stimulated to request on a ‘problem level’ not an analyses level. Performance feedback information from all other GP’s in the region may help as well as addressing this in diagnostic test consultation sessions. Stimulation for digital ordering will have a great impact as the LESA requesting guideline is used as requesting tool.

For a reduction in the tariffs the developed performance indicators as well as the discount percentages of other providers can be used in negotiations to bring down rates.

If this short term approach is not considered sufficient, a tendering approach can be considered as the savings potential seems higher. However this approach does consider a well-defined preparation. External stakeholders, especially GP’s must be aware which laboratories are contracted and which are not. Making this visible in the digital ordering environment makes this easier for the GP as other insurance providers may consider contracting different care providers.
Preface

This is the final masterpiece, the crown jewel of my industrial engineering education, especially of my master, Innovation Management. It has been written over a long period of time and personally difficult and challenging circumstances.

First, I would like to thank CZ for giving me the opportunity to conduct this research. Furthermore I would like to thank 4 people in particular. I want to thank Michel Rouss, for his guidance in this project. As a first class buyer of clinical laboratory science services, he was a great help and very supportive ‘to show me the system’ and tell me a lot about it. I want to thank Monique for her guidance in the entire process, from the first research proposals to this final thesis, she was always willing to help and make suggestions from other fields of healthcare buying so I could see whether or not something might be handy and steering me to the right people for data or medical questions. I want to thank Alexander for his support and guidance in the ‘execution phase’. I want to thank him for challenging me during the writing and reviewing process of this master thesis and also of giving tips for several presentation techniques. Finally I would like to thank Mark Lenssen; he was a great sparring partner during the project.

Second, I would like to thank my first supervisor from the University, Prof. dr. A.J. van Weele. With his extensive knowledge on procurement he was able to support me. His positive feedback and pep talks helped me to proceed whenever my research was getting stuck. Furthermore, I would also like to thank my second university supervisor dr. ing. J.P.M. Wouters for his help and the final reviewing of my thesis.

Third, I want to thank my friends and fellow students for their support and distracting me after long days. Having a drink and a talk in the evening was great in getting my mind somewhere else. Last but certainly not least I want to thank my family for their love and support, especially my mother and father. As ‘main sponsor’ of the last 7 years I dedicate this work to them. Not for merely the last 7 years but the last 25 years they have been a single constant in my life. Even during this difficult time they act as Chief Inspiring Officers and help my brother and I push on with our lives, despite our dread, our denials, our sudden constrictions of the heart. I admire their joy, and their capacity for wonder. I know that they are the kindest and most generous people I will ever know and that what is best in me I owe to them.

Jeroen Dasbach
Eindhoven, November 2014
# Table of Contents

Abstract ................................................................................................................................. ii

Management Summary ......................................................................................................... iii

Preface .................................................................................................................................. vi

List of figures ......................................................................................................................... x

List of tables ......................................................................................................................... xi

List of abbreviations ............................................................................................................ xii

1. Introduction ....................................................................................................................... 1
   1.1. The Dutch healthcare system ..................................................................................... 1
   1.2. CZ ................................................................................................................................. 2
   1.3. Problem statement ....................................................................................................... 2
   1.4. Research questions ..................................................................................................... 3
   1.5. Research structure ....................................................................................................... 4
   1.6. Report structure .......................................................................................................... 5

2. Current process of contracting of laboratory science services ............................................ 6
   2.1. Primary diagnostic healthcare services ...................................................................... 6
   2.2. Clinical laboratory science services .......................................................................... 6
   2.3. Stakeholders ................................................................................................................. 7
   2.4. Type of laboratories and contracted situation ............................................................ 7
   2.5. Invoice structure ......................................................................................................... 8
   2.6. Conclusion .................................................................................................................. 8

3. The contracting of healthcare services: literature review .................................................... 10
   3.1. Procurement process of services ................................................................................. 10
       3.1.1. Procurement of services ...................................................................................... 10
       3.1.2. Procurement of health services .......................................................................... 11
   3.2. Performance management in healthcare procurement ................................................ 13
       3.2.1. Definition of performance .................................................................................... 13
       3.2.2. Assessment of performance ................................................................................ 14
       3.2.3. Steering on performance ...................................................................................... 15
       3.2.4. Value-based purchasing ....................................................................................... 15
   3.3. Summary ...................................................................................................................... 16
   3.4. Conceptual model ........................................................................................................ 17

4. Research design and methodology ..................................................................................... 19
   4.1. Unit of analysis ............................................................................................................ 19
   4.2. Quality criteria ............................................................................................................ 19
Appendices

Appendix A: Healthcare Service Triad ................................................................. 53
Appendix B: Market costs for primary diagnostic health services in The Netherlands ........................................ 54
Appendix C: Contracted Hospitals .................................................................... 55
Appendix D: Contracted General Practitioner laboratories & Private treatment centers ............. 56
Appendix E: Detailed provider network in core area of CZ insurants ............... 57
Appendix F: Quality criteria CZ in the contracting of laboratories .................. 59
Appendix G: Questionnaire laboratories ......................................................... 61
Appendix H: Questionnaire General Practitioners ........................................... 62
Appendix I: List of analyses .......................................................................... 63
Appendix J: SAS data mining query code ............................................................ 73
Appendix K: List of participants interviews ....................................................... 74
Appendix L: Analysis group codes ..................................................................... 75
Appendix M: Statistical significant difference between laboratories ................ 76
Appendix N: Regional division of laboratories ................................................... 78
Appendix O: SAS data mining query code .......................................................... 80
List of figures
Figure 1: The reflective cycle for business problem solving (Aken e.a., 2012) .................................................. 5
Figure 2: Different service characteristics and resulting problems (Bals & Hartmann, 2008, p. 6)............... 10
Figure 3: Purchasing process and related definitions (Van Weele, 2009) .......................................................... 11
Figure 4: Schematic overview of the purchasing process (Figueras e.a., 2005, p. 143)................................. 11
Figure 5: The purchasing process model in healthcare literature............................................................... 12
Figure 6: Planning and contracting cycles (Figueras e.a., 2005, p. 206) ..................................................... 13
Figure 7: Conceptual model: Value based healthcare model (Porter, 2010)................................................. 17
Figure 8: Study focus on different relationships ....................................................................................... 19
Figure 9: Percentage of total costs related to researches with a certain number of analyses ..................... 24
Figure 10: Percentage of total costs in tests with more than 11 analyses................................................... 25
Figure 11: Percentage of total costs per GP with 12 or more analyses per test ...................................... 25
Figure 12: Tariff index 2012 - 2014 ............................................................................................................... 27
Figure 13: Discount percentages for care provider type and different care providers (2012).................. 28
Figure 14: Different suggestions for (partial) solutions of the business problem with savings potential estimation.............................................................................................................................. 35
Figure 15: Cost estimation with different tendering scenarios.................................................................. 38
Figure 16: Laboratories and their sphere of activity after tendering (West Brabant & Zeeland) ............... 38
Figure 17: Managerial recommendation strategy ..................................................................................... 42
Figure 18: Stakeholders in laboratory healthcare market ................................................................. 53
Figure 19: Market for primary diagnostic health services (SAN leden, z.d.) .......................................... 54
Figure 20: Burden of claims for primary diagnostic healthcare for CZ (CZ data, 2012) ...................... 54
Figure 21: Contracted hospitals in The Netherlands by CZ ................................................................. 55
Figure 22: Contracted GP laboratories and private treatment centers by CZ ........................................ 56
Figure 23: Venipuncture network of providers in Zuid-Holland that are contracted by CZ ................... 57
Figure 24: Venipuncture network of providers in Zeeland and West en Midden Brabant that are contracted by CZ .................................................................................................................................................. 57
Figure 25: Venipuncture network of providers in Zuid-Oost Brabant that are contracted by CZ ........... 58
Figure 26: Venipuncture network of providers in Limburg that are contracted by CZ ......................... 58
Figure 27: Group statistics between MMR and CLSR .......................................................................... 76
Figure 28: Independent sample T-test between MMR and CLSR .......................................................... 76
Figure 29: Group statistics between GP laboratories and Hospitals ................................................... 76
Figure 30: Independent sample T-test between GP laboratories and hospitals ........................................ 76
Figure 31: Group statistics GP laboratories after filtering of MMR laboratories .................................. 77
Figure 32: Independent sample T-test between GP laboratories and hospitals after filtering out MMR laboratories .............................................................................................................................................. 77
Figure 33: Analysis request form in alphabetical order ........................................................................ 81
Figure 34: Problem oriented analysis request form .............................................................................. 81

List of tables

Table 1: Invoice structure designed by NZa .......................................................................................... 8
Table 2: Type of quality specifications in contracts (Figueras e.a., 2005, p. 222) ................................. 14
Table 3: Quality criteria for research, adapted from Yin (2009) ............................................................. 20
Table 4: Descriptive statistics of the region Region_X ........................................................................... 23
Table 5: Descriptive statistics for 3 care providers ................................................................................ 23
Table 6: Descriptive statistics for 132 GP’s active in the Region_X region ............................................. 24
Table 7: Laboratory descriptive statistics on costs and volume over 2011 - 2013 ............................... 26
Table 8: Descriptive statistics of costs and number of order per type of care provider ....................... 27
Table 9: Performance benchmark hospitals and PDC’s and minimum, average and maximum findings (2012) .............................................................................................................................................. 29
Table 10: Performance of some PDC’s (2012).......................................................................................... 30
Table 11: Points of action per stakeholder .............................................................................................. 43
Table 12: List of laboratory specialists / managers .............................................................................. 74
Table 13: List of General Practitioners ................................................................................................. 74
Table 14: Analyses groups ..................................................................................................................... 75
List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGB</td>
<td>Algemeen Gegevens Beheer (General Data Control) is a unique identifying registration code of care providers to support different processes in healthcare, for example invoice and communication with health insurers.</td>
</tr>
<tr>
<td>CLB</td>
<td>Centraal Laboratorium Bloedtransfusiedienst. (Specialized Lab in Amsterdam)</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>HR</td>
<td>Human Resources</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>LESA</td>
<td>Landelijke Eerstelijns Samenwerkingsafspraken (National primary care partnership agreements)</td>
</tr>
<tr>
<td>NVKC</td>
<td>Nederlandse vereniging voor klinische chemie (Dutch association for clinical laboratory science)</td>
</tr>
<tr>
<td>NZa</td>
<td>Nederlandse Zorgautoriteit (Dutch healthcare authority)</td>
</tr>
<tr>
<td>PDC</td>
<td>Primary diagnostic care center</td>
</tr>
<tr>
<td>PTC</td>
<td>Private treatment center</td>
</tr>
<tr>
<td>SAN</td>
<td>Stichting artsenlaboratorium Nederland (Dutch trade organisation of PDC’s)</td>
</tr>
</tbody>
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1. Introduction

This chapter will provide an introduction of the research. First an introduction on the topic of the Dutch healthcare system will be given. Consequently the research environment, the research topic and research questions are given. Finally the research and report structure is given.

1.1. The Dutch healthcare system

There are many examples that make clear that the buying of business services is tricky business (van Weele & van der Valk, 2010). Van Weele & van der Valk (2010) make this particularly clear for cleaning services, though professional services like, IT services, HR services, Management Consultancy and Tax Consultancy are also mentioned. However the procurement of healthcare services is not mentioned.

In 2006, the Dutch healthcare system was radically reformed to strengthen competition among health insurers as purchasers of health services (Schut & van de Ven, 2011). These reforms created a health care purchasing market by separating the responsibility for providing health care from the responsibility for financing health care. (Raaij van, Schotanus, & Valk van der, 2013). In The Netherlands, the responsibility of financing health care is done by health insurance providers (Schut & van de Ven, 2011). Therefore the insurance providers have the responsibility to maintain efforts to control the ever-increasing health care costs. In 2012, The Netherlands had health care expenditures of 12,4% of its GDP, with annual growth percentages of 1,3% (“Health expenditure, total (% of GDP) | Data | Table”, z.d.). This healthcare reform has resulted in the emergence of healthcare purchasing markets. In these markets health insurance providers purchase healthcare from care providers.

The purchasing of healthcare has received scholarly attention, yet not from purchasing and supply management researchers (Raaij van e.a., 2013). Much of the research is focused on purchasing for healthcare, limited research is done on the purchasing of healthcare by health insurance providers.

Health insurance providers operate in a so called ‘Business Service triad’ (van de Valk & van Weele, 2011). Insurance providers buy component services as the services are delivered to the end customers (i.e. insurants) of the buying company (i.e. the health insurance provider) without transformation of the service by the buying company (Wynstra, Axelsson, & Valk, 2006). Health insurance providers are contracting care providers to take care of their insurants. The care providers deliver these business-to-business services directly to the insurants, without intervention of the buying organization. Simultaneous production and consumption of services thus occurs between the service provider and the customer, outside the direct control of the buying organization.

As purchasers of healthcare services, health insurance providers have attempted to channel insurants to preferred suppliers (Boonen & Schut, 2011; Boonen, Schut, & Koolman, 2008). These attempts are met by the public with skepticism as trust in the health insurance providers is low. Public perception is that insurance providers are focused more on cost savings than on quality of healthcare (Blendon e.a., 1998).
1.2. CZ
The setting for this study is one of the largest health insurers in the Netherlands. The case study of interest is CZ. CZ has 3.4 million insured customers, an estimated market share of 20%. CZ has a €7 billion turnover a year and 2500 employees. CZ has the largest market share in the south of the Netherlands and is therefore most active in the Dutch provinces of Zeeland, Noord-Brabant, Zuid-Holland and Limburg. CZ also has a large number of insurants in The Hague and its surrounding area. CZ has offices in Goes (Zeeland), Breda (Noord-Brabant), Tilburg (Noord-Brabant) and Sittard (Limburg). CZ provides health insurance policies with different labels. These labels are: ‘CZ’, ‘Delta Lloyd’ and ‘OHRA’.

One of the major responsibilities of health insurance providers is to provide insurants with accessible, affordable and high quality healthcare. CZ has an important role to ensure that the costs of healthcare remain controllable. CZ is looking at new (and innovative) ways to achieve this. For example CZ tries to remove the traditional ‘financing walls’ between various healthcare providing sectors, like General Practitioner care and medical care that is provided by specialists (hospital care). A major focus is on delivering adequate care for the right costs.

1.3. Problem statement
In the procurement of clinical laboratory science services, there is no direct problem from a commercial perspective. Every year the contracting of General Practitioner laboratories and hospitals has been successful and insurants pay their premiums. However, reports have given a €800 million savings potential by better organizing the (procurement of) primary diagnostic healthcare to enhance effectiveness (“Rapportage Business Case Eerstelijns diagnostiek - Rapport - Rijksoverheid.nl”, 2013). This €800 million is considered for all insurance providers throughout the Netherlands.

As a result, in December 2011 the NZa released a rapport on the revision of the financing systematics of the Primary Diagnostic healthcare sector (NZa, 2011). Primary diagnostic healthcare is an essential part of curative health treatment and influences 60%-70% of medical decision making. Primary diagnostic healthcare providers are predominantly: Hospitals, General practitioner’s laboratories and private treatment centers. Each has their own financing systematic. Because each ‘sector’ has its own financing mechanism it was too difficult to implement a specific buying strategy for primary diagnostic healthcare services.

The minister for Health, Well-being and Sport, has set a goal to strengthen the function of primary diagnostic care. Patients benefit from a strong primary diagnostic healthcare function that is of high quality, accessible and affordable. An independent diagnosis form a generalist point of view prevents unnecessary medicalization and / or unnecessary referrals to hospitals for treatment.

As of 2015 a more level playing field will be created as (it’s likely that) the financing systematics for primary diagnostic healthcare will become more function oriented than sector/organization oriented. With the introduction of a function oriented financing systematic it becomes more attractive to carefully purchase clinical laboratory services as it is likely to be overcapacity of laboratory research capacity and the amount of tests that can be done. It is estimated that The Netherlands has enough lab research
capacity to serve the entire European population. This leaves more than enough potential to contract the capacity needed for primary diagnostic purposes for a better price and quality.

In order to come up with a more specific buying strategy a number of issues need to be tackled. From the perspective of CZ it was difficult to implement a specific buying strategy for a number of reasons. First, because of the different financing systematics, there is no overall view on the costs. This makes it difficult to negotiate between different suppliers (laboratories).

Second, clinical laboratories were not ‘top of mind’ by health insurance providers, therefore not much attention was given to the test request behavior of General Practitioners, which strongly influence the cost of care. Third, because of the different financing systematics, there is no level playing field. This means different suppliers are contracted by different teams within the organization. This results, for example, in the fact that nearly all suppliers are contracted.

A potential risk of selectively contracting laboratory facilities for primary diagnostic purposes is that it may backlash as lab test providers will likely attempt to influence insurants / patients through their general practitioner (GP) as ‘freedom of choice for patients and GP’s is limited’.

Based on this information a problem definition for this project can now be formulated. According to van Aken e.a., (2012) an important requirement for a business problem is that it is performance-related. Business problem solving is not about knowledge problems but about unsatisfactory states of affairs within organizations. The problem should therefore be related to a strategically important performance indicator, be it financial or not. Furthermore, the problem should be feasible within the constraints of resources and time. Stated formally the problem statement is:

*In the current situation, the effectiveness and efficiency in the contracting of clinical laboratory science services is unsatisfactory, as measured by the number and costs of contracted laboratories.*

Therefore, CZ wants to know how clinical laboratory science services should be contracted in order to reduce cost and enhancing effectiveness of the service.

1.4. Research questions

The central role of a purchaser is to translate its population’s / insurants health needs and desires into the provision of a series of health services, taking into consideration both national health policy priorities and evidence on the cost-effectiveness of alternative interventions. Contracts are the main vehicle for purchasers to do so, to the extent that contracting is often considered synonymous with purchasing. The case presented in the previous paragraph(s) and the corresponding problem statement, leads to an interesting research question for this graduation research. This question can be formulated in the following way:

*How could CZ reduce costs and create maximum value for CZ insurants in the purchasing of clinical laboratory science services?*
In order to answer this question two phases for this research have been determined: (i) the explorative phase, and (ii) the in-depth phase. The sub-questions for these phases will now be stated.

- How does the current process of contracting look like? What are its benefits / pitfalls?
- How does CZ’s current value chain for clinical laboratory science services look like?
- What are the costs that CZ reimbursed to clinical laboratories? What does the cost structure look like?
- How can CZ build performance measures into contracts to ensure that contracts lead to improved health outcomes and increase effectiveness and efficiency?

After all improvement opportunities have been indicated the most advantageous opportunity will be selected which concludes the explorative phase of this research:

- What are the most interesting research areas to further investigate?

Finally the most beneficial research opportunity will be chosen to perform an in-depth study on:

- Does the chosen research opportunity reduce costs and create maximum value for CZ insurants?

Several sub-assignments can be defined which describe relevant output that is generated within the different phases of the regulative cycle (Aken e.a., 2012). These are augmented with an assignment for academic reflection at the end of the project. Note that these sub assignments are also translated into some of the research questions. The sub-assignments are:

- Validate the business problem and its causes.
- Analyze and diagnose causes and consequences of the business problem.
- Explore several directions for redesign.
- Choose and elaborate one solution into a solution design.
- If possible implement the solution for a pilot study.
- Reflect on the results to contribute to organization science and formulate design rules.

**1.5. Research structure**

The project has both an academic and a practical goal. At the academic level the goal of the project is to contribute to the existing body of scientific knowledge by generating knowledge related to the current gaps in the literature. At the practical level, the project must yield a solution to the business problem of the organization that is studied. To achieve these objectives, the project will be designed according to the reflective cycle, which is described by (Aken e.a., 2012) and is depicted in Figure 1. The reflective cycle consists of the regulative cycle for business problem solving combined with some steps in which reflection on the project’s results takes place. A project structured according to this cycle will therefore consist of two ‘layers’: first the regulative cycle in which problem solving on specific case takes place and second the layer of reflection in which the results are reflected upon and compared to other cases and literature in order to generate general knowledge.
1.6. **Report structure**

This report is structured in the following manner. In chapter 1, an introduction of the research topic is given. The problem statement and research questions are stated along with a research structure and a general overview of this thesis. In chapter 2, the current situation of contracting is stated, in which further contextual information will also be given. In chapter 3, a literature review is given on the contracting of healthcare services. This study produces a research model which will be used to analyze the business problem and will function as the basis on which solution(s) and recommendations will be made. In chapter 4, the empirical research will be introduced along with the methodology. In chapter 5, the results are presented and discussed. In chapter 6, a solution design of future ways of working is given and detailed. In chapter 7, a summary, conclusions and recommendations are given.
2. Current process of contracting of laboratory science services

This chapter will tell something about the current contracting process of clinical laboratory science services. The first section will describe what primary diagnostic healthcare services are. The second section will give a definition of clinical laboratory science services. The third section will describe who the stakeholders are and their relationship. The fourth section will describe which types of laboratories there are. In the fifth section, the invoice / cost structure is described. In the final section a conclusion is drawn.

2.1. Primary diagnostic healthcare services

One of the many types of healthcare services are primary diagnostic care is healthcare services. Primary diagnostic healthcare services are services that are requested by primary care health service providers. In almost all cases, these health service providers are general practitioners and obstetricians. Results of the primary diagnostic test, return to these care providers. Primary diagnostic health can be divided in laboratory research (laboratorium onderzoeken) (for example: blood analyses and urine analyses), diagnostic imaging services (beeldvormende onderzoeken) (for example: X-ray’s) and functional research (functieonderzoeken) (for example: electrocardiogram). Most of this primary diagnostic care research is done in hospitals or primary diagnostic care centers.

Cost estimates by the SAN show that clinical laboratory science research represent half of all the costs made in the primary diagnostic healthcare sector (see Appendix A). Therefore this graduation research will have a scope on the procurement of clinical laboratory science services.

2.2. Clinical laboratory science services

In clinical laboratories, clinical laboratory science, also called Medical Technology is conducted. Clinical laboratory science is the health profession that provides laboratory information and services needed for the diagnosis and treatment of disease. This is medical laboratory research of blood and other bodily fluids (“NVKC - Wat is klinische chemie?”, z.d.). Clinical Laboratory Scientists perform a variety of laboratory tests, ensure the quality of the test results, explain the significance of laboratory tests, evaluate new methods and study the effectiveness of laboratory tests. (“What is Clinical Laboratory Science?”, z.d.). Clinical laboratory science is an important part of primary diagnostic healthcare delivery and treatment, as 60%-70% of medical decision making is made on the basis of laboratory research (“Facts and Figures Klinische Chemie”, z.d.). Clinical laboratory science is classified as outpatient (or ambulatory) services, as laboratory science services are “medical procedures or tests that can be done in a medical center without an overnight stay. Many procedures and tests can be done in a few hours” (“Outpatient Services-Topic Overview”, z.d.). Examples of laboratory tests performed by Clinical Laboratory Scientists include:

- the detection of the abnormal cells that cause leukemia
- the analysis of cardiac enzyme activity released during a heart attack
- the identification of the type of bacteria causing an infection
- the detection of DNA markers for genetic diseases
• analysis of blood to check if organs are functioning correctly

Laboratory research is done on the request of a General Practitioner (GP) or medical specialist (Physician) (“NVKC - Wat is klinische chemie?”, z.d.). An average laboratory performs about 270 different routine test determinations. The NZa has documented about 450 test determinations that can be performed. Dependent on the size of the laboratory, a laboratory performs 1 to 3 million test determinations a year. (“Facts and Figures Klinische Chemie”, z.d.)

2.3. Stakeholders
All corresponding stakeholders are presented in appendix B. It defines the process and relationship between the different stakeholders. The insurer buys a health insurance plan from a health insurance provider and pays premium accordingly. When the insurer goes to his GP and the GP can’t set a proper diagnosis for certain complaints because he doesn’t have enough information, the GP can request a laboratory test request. The GP fills in a (hardcopy) form on what type of problem he wants to have more information on and fills in what (blood) values the GP needs. The insurer / patient will go with this lab form to the designated venipuncture location. There a sample of blood will be collected so it can be analyzed by the laboratory. The laboratory will analyze the blood and send the results of the blood test via information system back to the GP which will discuss the results with the insurer / patient.
If the laboratory is contracted by the insurance provider, the laboratory will state an invoice with the health insurance provider where the patient is insured. If the laboratory is not contracted by the health insurance provider, it differs whether the bill will come from the laboratory directly or via the health insurer. Most important is whether or not there are payment agreements between the insurer and the care provider.
The (contracted) GP will state and invoice to the health insurance provider for the consultation for the patient. If the insurer has not fully used his deductibles within the year, the insurance company will bill the insurer for the lab test to the maximum of the amount of deductibles the insurer has left. If the insurer has already used his deductibles, CZ will pay the bill.
The Nederlandse Zorgautoriteit (NZa), the Dutch health authority, yearly establishes maximum tariffs for the different analyses that can be invoiced by laboratories. These tariffs can be negotiated but can never be above the maximum tariff that is established by the NZa. More on the invoice structure can be found in paragraph 5.

2.4. Type of laboratories and contracted situation
There are 3 types of laboratories. General practitioner laboratories, hospital laboratories and private treatment centers. All these laboratories deliver the same type of primary diagnostic healthcare. In 2012, about 130 providers were contracted (See appendix C & D). In the delivery of clinical laboratory science services these providers differ in the venipuncture network they offer to insurants. For time technical reason, only a part of the Netherlands is further analyzed. The area that is further analyzed is the area where CZ has the most insurants (and therefore the largest bargaining power with the different care providers). This area dominates the south of The Netherlands. A detailed analysis of the provider networks, which are also contracted, in this area can be found in appendix E.
Within CZ there are 2 teams that contract the different care providers. About 10 purchasers are responsible for the hospital procurement, and therefore responsible for the contracting of the laboratories within hospitals. 1 person is responsible for the procurement of the GP laboratories.

### 2.5. Invoice structure

To determine the costs of clinical laboratory science services that are offered by the different care providers it is important to explain the invoice structure that is developed by the NZa. When a lab test request is done, a laboratory can invoice an order tariff. Hospital laboratories and private treatment center’s use NZa code 079991. General practitioner laboratories use code 190255. If a patient is physically incapable of going to a venipuncture center a laboratory is allowed to invoice a home visit tariff as a supplement. Various laboratory analyses can be invoiced if they are requested by the GP. Some special analyses can only be performed by one laboratory in The Netherlands. This laboratory is called Sanquin. If such a test is request by the GP, the laboratory can invoice a CLB reference tariff for sending the blood to Sanquin, the laboratory can also invoice the analyses that are done at Sanquin. The laboratory is responsible for reimbursing the costs that are made by Sanquin. Table 1 gives a summary of the invoice cost structure.

Price differences develop out of the different financing mechanisms that are used. In the negotiation with hospitals laboratory science is a very small piece of the budget that is negotiated. Therefore often the maximum tariffs established by the NZa remain standing. General Practitioner laboratories need to explain their budget with the insurance company purchasers. They need to explain their exploitation costs (staff, building etc.) and relate that to their income (volumes that they analyze and invoice at the insurance provider). Shortcomings that remain are transformed in the order tariff (190255) so that a General practitioner laboratory can be a non-profit organization.

<table>
<thead>
<tr>
<th>Name</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Order tariff</strong></td>
<td>079991 / 190255</td>
</tr>
<tr>
<td><strong>Home visit tariff</strong></td>
<td>079992</td>
</tr>
<tr>
<td><strong>Laboratory analyses</strong></td>
<td>Various NZa codes</td>
</tr>
<tr>
<td><strong>CLB reference tariff</strong></td>
<td>079993</td>
</tr>
<tr>
<td><strong>CLB laboratory analyses</strong></td>
<td>Various NZa codes</td>
</tr>
</tbody>
</table>

### 2.6. Conclusion

First, the current contracted situation results in the fact that many providers operating in the same area. This leads to competition between the different providers. In a perfect market structure this is a healthy process. Competition improves service quality as providers look at each other and try to make their service better than the other provider. It also means insurants can go to almost every provider they please and that GP’s have no restrictions on requesting a lab test by a certain provider. However, the contracted situation also leads that prices they invoice between various providers can differ substantially, while the quality between different providers, is estimated, to be negligible. This results in unnecessary high invoices if the insurant would (simply) go to a provider which has better tariff
agreements with CZ. This also benefits the insurant because as stated earlier primary diagnostic healthcare must be paid out of the insurants deductibles.

Looking at the test requesting process some issues come up. The GP asks for a lab test via a hardcopy form. This form is scanned at the laboratory. The results are communicated digitally to the GP. This leaves a lot of room for error and raises the question whether or not the professional guideline for clinical laboratory research is used when tests are requested. The use of hardcopy forms can result in the fact that more analyses are prescribed than might be deemed necessary to come to a diagnosis for the patient. The use of more analyses also means that more costs need to be reimbursed than may deemed necessary.

In this practical case of the procurement of clinical laboratory science services, shows that there is (potential) room for improvement in the contracting process as in the operational process of test requesting (and test delivery). However it is unclear, how quality, price and overall value in this healthcare process should be measured and interpreted. This is necessary to make good purchasing decisions and improving the operational process. To determine what value in healthcare is and how it should be measured a literature study will be performed and will be discussed in the next chapter.
3. The contracting of healthcare services: literature review

This chapter is a short abstract of the detailed literature review made by Dasbach (2014). This literature review focuses on two subjects. First, this review has a focus on the procurement process. Second, this review will look at how performance is measured within the healthcare sector. Finally, a summary is made. From the literature a conceptual model will be derived.

3.1. Procurement process of services

In this chapter we will focus on the procurement process of services. Research on procurement of health services from a purchasing a supply management research perspective is limited (Raaij van e.a., 2013; Schut & van de Ven, 2011). Therefore, the first section of this chapter will be devoted to the procurement of services in general; it will explain the differences between services and goods and will take aim at the process of buying services. The second section will have an application to the procurement of healthcare services.

3.1.1. Procurement of services

Services have become a substantial part of organizations’ acquisition of external resources. (van der Valk, Wynstra, & Axelsson, 2005). However most scholarly attention has been giving to the buying of goods (Axelsson & Wynstra, 2002). Four main factors differentiate services from goods (Bals & Hartmann, 2008). These factors are:

- Intangibility; services have to be seen as performances and not as tangible output. This is the inherent immaterial status attributed to services (Bals & Hartmann, 2008; Wolak, Kalafatis, & Harris, 1998, p. 25)
- Inseparability; this refers to the fact that services are produced and consumed at the same time (Bals & Hartmann, 2008; Wolak e.a., 1998, p. 26)
- Heterogeneity; this reflects the potential for high variability in service delivery (Bals & Hartmann, 2008; Wolak e.a., 1998, p. 26). For example because of the fact that the service is performed by different people and their performance can vary for day to day.
- Perishability; Services can’t be stored and carried forward to a future time period. Services are ‘time dependent’ and ‘time important’ (Bals & Hartmann, 2008; Wolak e.a., 1998, p. 27)

Bals and Hartmann (2008) translate the problems that arise with these characteristics and can be found in figure 2.

To tackle these problems of services a careful (buying) decision process must be maintained (Axelsson & Wynstra, 2002). Van Weele (2009) made a condensed

![Figure 2: Different service characteristics and resulting problems (Bals & Hartmann, 2008, p. 6)](image-url)
version of the industrial buying process which can be seen in figure 3.

![Diagram of purchasing process](image)

**Figure 3: Purchasing process and related definitions (Van Weele, 2009)**

This is a simplified model of a typical decision process for a certain purchase. It begins with specifying the requirements for the specific service for supplier quality and so on. The process ends with a performance review or after-care and evaluation. Van der Valk & Rozemeijer (2009) identify three main problem areas in the purchasing process for services. These are:

- Specifying the service
- Defining the specific content of an service level agreement
- Evaluating performance

### 3.1.2. Procurement of health services

The most basic procurement process model for health services is presented in figure 4 (Figueras, Robinson, & Jakubowski, 2005)

![Diagram of health service procurement process](image)

**Figure 4: Schematic overview of the purchasing process (Figueras e.a., 2005, p. 143)**

In the assessment of health needs strategic purchasers must be informed by the health needs of the populations for which they are responsible if they are to act effectively on their behalf. It is not sufficient to wait for all those in need of care to turn up at the door of a health facility. Instead it is necessary to take active steps to assess needs (Gillam, 1991), defined as the ability to benefit from healthcare and in particular where need is least likely to be voiced as demand. It is also important to look not only where need is not being met, but also where it is inappropriately met, for example where individuals are receiving interventions that are inappropriate for them and so do not gain health benefits. Assessing need is therefore inextricably linked with the issue of clinical effectiveness (Figueras e.a., 2005). Having assessed the health needs of the population on whose behalf care is being purchased, the next, and inextricably linked, step is to define the models of care that should be provided. This activity has its origins in the technology assessment and evidence-based health care movements. In the 1960s and 1970s it became clear that the effectiveness of many health interventions had been inadequately evaluated. Researchers identified numerous examples of variation in use of interventions that were attributed to uncertainty about the indications for using them. At the same time, the growth in medical technology and concerns about the safety of ever more powerful drugs were stimulating a reassessment of the ability of existing evaluative and regulatory regimes to both ensure safety and reduce unnecessary costs (Figueras e.a., 2005).
Having defined the health needs for which care is to be purchased and the models of care that are sought, the next step is to purchase it (Figueras e.a., 2005). An important issue affecting the ability of purchasers to focus on health gain is whether they are allowed to contract selectively. Purchasing is more easily defined as the contracting or commissioning of healthcare.

While appropriate structures and processes are important prerequisites for high quality care, it is also necessary for strategic purchasers to assure themselves that the care they are purchasing is leading to optimal outcomes (Figueras e.a., 2005). This task is extremely challenging and, at present, there are no perfect solutions. There are several fundamental problems. One is the difficulty in attributing health outcomes to specific health interventions. Outcomes reflect not only the technical quality of care but also the initial condition of the patient, the choices that the patient makes in relation to his or her treatment and, when small numbers of events are considered, the play of chance (McKee & Hunter, 1995). A second is the possibility that a focus on outcomes that are measurable may deflect attention from others that are less easily identifiable, but perhaps more important for the patient (Smith, 1995).

Based on earlier research, van Raaij e.a. (2013) makes an more elaborate process model (see figure 5). Note that this model contains the same steps as made in figure 4 but elaborates on detailed steps that must be taken in between. They also make a specific link to supplier relationship management and performance management literature.

![Figure 5: The purchasing process model in healthcare literature](image)

However Øvreveit (1993) takes a different approach. As “The central role of a purchaser is to translate its population’s / insurants health needs and desires into the provision of a series of health services, taking into consideration both national health policy priorities and evidence on the cost-effectiveness of alternative interventions. Contracts are the main vehicle for purchasers to do so, to the extent that
contracting is often considered synonymous with purchasing. “ (Figueras e.a., 2005, p. 59). As can be seen in figure 6, Øvreveit (1993) makes 2 cycles instead of just merely one.

The planning process begins with an assessment of the population health needs and the establishment of a set of health priorities. This forms the basis for developing a purchasing strategy and is followed by the establishment of a set of service requirements and targets to be achieved through contracting.

The contracting cycle starts with identifying and selecting providers. Some purchasers may have little choice of provider whereas others may have a choice or wish to create a choice by encouraging providers to come forward. Key issues are finding out provider costs and likely reliability in meeting contract requirements (Figueras e.a., 2005). The second step is negotiating and agreeing on a contract. Key issues at this stage are which type of contract to use, what measure of output and how to pay for it (Figueras e.a., 2005). The third stage of contracting is managing the contract, a central part of which is monitoring.

Often, purchasers do not have sufficient personnel for carrying out the many purchasing tasks and nowhere are the personnel constraints more apparent than when it comes to considering how to get and use information for monitoring contracts (Figueras e.a., 2005).

3.2. Performance management in healthcare procurement

Contracting is not a goal on its own. The goal of the contract is to reach certain objectives, for example: influence behavior, optimize service delivery, improve and create value etc. This chapter will discuss the overall topic of performance management in health care procurement. This includes the definition of performance (section 1), the assessment of performance (section 2), steering on performance (section 3) (Raaij van e.a., 2013). In section 4, value based purchasing will be discussed.

3.2.1. Definition of performance

Performance of healthcare providers can be defined in terms of cost, also defined as, price of service (Grimaldi, 1997; Porter, 2010). Not all performance indicators are based on costs but can be very diverse. The most used other performance indicator is quality. However, quality is interpreted on various different dimensions (Raaij van e.a., 2013). These indicators include clinical quality (Maxwell, Temin, & Watts, 2001), service quality (Rosenthal e.a., 2007), customer satisfaction (“Quality and service are paramount”, 2001) and accessibility (Fisher, Lindrooth, Norton, & Dicke, 1997). Proxies for quality are also used, such as experience of the provider (Fisher e.a., 1997). Schauffler & Rodriguez (1996) mention
quality indicators that should be used more widely such as the extent to which providers pay attention to health promotion and prevention.

3.2.2. Assessment of performance

In the assessment of health care provider performance, cost performance is first of all assessed by looking at the price charged for a specific intervention, diagnosis-related group (DRG), or care episode (Raaij van e.a., 2013). However, Birnbaum and Tang (1998) prefer that a total cost perspective should be taken. The cost of “adverse events” should also be taken into account. Low-price healthcare services may be of relatively low quality, leading to a higher incidence of remedial care, such as hospital recidivism and emergency room, physician and nurse visits.

Healthcare quality can be assessed using structure, process, and / or outcome measures (Figueras e.a., 2005; Raaij van e.a., 2013). Table 2 gives an overview example of specifications that could be used in contracts. Structure measures assess the setting in which health care services are provided. Structure measures assess the setting in which care services are provided (Figueras e.a., 2005; Raaij van e.a., 2013). Examples of structure measures to assess quality are accreditation of the care provider (Figueras e.a., 2005). Surveys among providers and patients are used to collect process and outcome measures (Raaij van e.a., 2013). Examples for process oriented measures are clinical protocols. The purchaser could mandate that the care it pays for is provided in a certain way (Figueras e.a., 2005). This approach could be used to decrease overuse and misuse of health services (Figueras e.a., 2005). Adherence to protocols of care can be measured with process indicators, usually expressed in rates of patients being given effective interventions. Examples are vaccination rates, screening rates, rates of eligible patients treated with effective drugs. The problem of mandating clinical protocols or guidelines is that providers may see a limitation of their professional autonomy, leading to opposition and difficult implementation (Figueras e.a., 2005; Raaij van e.a., 2013).

The goal of health care is to achieve desirable outcomes and, complementarily, to avoid undesirable outcomes, to the maximum extent possible. Contracts can reflect these goals by specifying outcome targets. Like process targets, outcome targets can be set as proportions of patients achieving desired outcomes or as increments (conversely as decrements for undesirable outcomes) (Figueras e.a., 2005).

Table 2: Type of quality specifications in contracts (Figueras e.a., 2005, p. 222)

<table>
<thead>
<tr>
<th>Requirements, specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structural</strong></td>
</tr>
<tr>
<td>implementation of systems of inhouse quality management</td>
</tr>
<tr>
<td>detailed structural requirements</td>
</tr>
<tr>
<td>implementation of systems of data collection</td>
</tr>
<tr>
<td><strong>Process</strong></td>
</tr>
<tr>
<td>mandating of evidence-based standards (clinical practice guidelines)</td>
</tr>
<tr>
<td>targets for indicators (for example, proportions of patients treated with ...)</td>
</tr>
<tr>
<td>minimum volume of service agreements</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
</tr>
<tr>
<td>targets for health outcomes (for example, proportion of patients with outcome ...)</td>
</tr>
<tr>
<td>targets for patient satisfaction</td>
</tr>
</tbody>
</table>

14
3.2.3. Steering on performance

Purchasers can steer on quality and value in five different ways (Raaij van e.a., 2013). First, quality, or better still, value, can be used as a criterion in supplier selection (Ginsberg & Sheridan, 2001; James, St Leger, & Rowse, 1996). Second, quality performance standards can be included in contracts to formalize purchaser expectations and vendor accountability (Ginsberg & Sheridan, 2001). These standards turn out to be more about service quality than clinical quality (Maxwell e.a., 2001; Rosenthal e.a., 2007). Third, pay can be made dependent on performance (Gonzalez, Penson, Kosiak, Dupree, & Clemens, 2007; McNamara, 2006). Though quality data are barely used and it’s not clear whether pay-for-performance improves quality of care. Fourth, purchasers can initiate quality improvement programs with providers and actively stimulate plans and providers to learn from each other’s “best practices” (Rosenthal e.a., 2007). Fifth, quality report cards are used to channel insurants to best value plans (Ginsberg & Sheridan, 2001; Schauffler & Rodriguez, 1996).

3.2.4. Value-based purchasing

The literature contains a significant trend in the movement from ‘cost-based’ purchasing to ‘value-based’ purchasing (Maio & Fund, 2003; Porter, 2010; Rosenthal e.a., 2007; VanLare & Conway, 2012). First of all the question arises what is value in healthcare? Porter (2010) defines:

“Value is neither an abstract idea nor a code word for cost reduction, but value should define the framework for performance improvement in healthcare. Rigorous, disciplined measurement and improvement of value is the best way to drive system progress.” (Porter, 2010, p. 2477)

Yet value in health care remains largely misunderstood. In any field, value should be defined around the customer, not the supplier. In health care, value is defined as patient health outcomes achieved relative to the costs of care. It is value for the patient that is the central goal, not value for other actors per se. In a well-functioning health care system, the creation of value for patients will determine rewards for all system actors (Porter, 2010).

Value is measured by outputs, not inputs. Hence value in health care depends on the actual patient health outcomes, not the volume of services delivered. More care is not always better care, and shifting focus from volume to value is a central challenge. Nor is value measured by the process of care utilized; process measurement and improvements are important tactics but no substitutes for measuring outcomes and costs. Value is based on the results achieved relative to the inputs (or cost) required, and as such it encompasses efficiency. Setting the goal as cost containment, rather than value improvement, has been devastating to health care reform efforts. Cost reduction, without regard to the outcomes achieved, is dangerous and self-defeating, leading to false “savings” and potentially limiting effective care. A focus on value, not just costs, avoids the fallacy of limiting treatments that are discretionary or expensive but truly effective (Porter, 2010).

Maio & Fund (2003) identify six key value-based purchasing strategies:

1) Collecting information and data on quality.
2) Selective contracting with high-quality plans or providers.
3) Partnering with plans or providers to improve quality.
4) Promoting Six-Sigma quality.
5) Educating consumers on quality issues.
6) Rewarding or penalizing plans or providers through use of incentives or disincentives.

Maio & Fund (2003) also identify barriers in the use of value-based purchasing. For example, purchasers report being overwhelmed by the multiplicity of measures available, we already defined that performance, with specific link to quality is hard to define. Moreover, purchasers sometimes question the reliability and validity of data, complaining for instance that performance data about plans published in different report cards often are inconsistent. The relatively high cost of engaging in quality improvement initiatives appears to be another important barrier. In fact, as purchasers become more proactive in pursuing quality, they may need significant organizational changes or increased resources. Finally, consumers’ preferences to select plans on the basis of cost rather than quality pose a significant challenge.

3.3. Summary
This chapter looks at the procurement process of services and takes a particular aim at the procurement of healthcare services. Van Weele (2009) makes a general overview of how to buy services. In the healthcare context this process is represented in cycle pattern. The basic process in the healthcare procurement process exists out of 4 steps. These steps are:
- The assessment of needs.
- The specification of care.
- The purchasing of care.
- The monitoring of outcomes.

Øvreveit (1993) identifies the procurement process of healthcare services with 2 cycles; the planning and contracting cycles. Problems that arise in the procurement of (health) services are:
- Specification of the service.
- Defining the specific content of a service level agreement.
- Estimating provider costs and likely reliability in meeting contract requirements.
- Evaluating performance.

Performance management is a large (literature) subject in the healthcare literature. First of all performance can be based on cost or quality, though quality has diverse interpretations. Where sometimes this is assessed by service quality, other times this is clinical quality. In quality specifications in contracts there are 3 types of specifications: structural, process and outcome measures. Purchasers have several mechanisms to steer on performance. A way to combine costs with quality is making a transition to value based purchasing.
3.4. Conceptual model

From this brief literature study and the extensive study by Dasbach (2014), a conceptual model can be derived from literature to analyze the business problem, comment on the results that are found and attempt to solve it. The developed conceptual model can be found in figure 7 and is based on the assessment of value in healthcare made by Porter (2010). This business problem is assessed by estimating the several blocks that influence value (expedience, quality and costs). In further analysis and solution design the results will be linked to the procurement process of health services. This is necessary as a health insurance provider contracts healthcare providers. This also means that it is an interacting process and not two independent models that have nothing to do with each other. Goal of this model is to assess what value aspects influence the procurement of clinical laboratory science services. After these aspects are assessed it can be linked to the procurement process in order to achieve maximum value for insurants of CZ.

![Value = Expedience Quality Price](Image)

Figure 7: Conceptual model: Value based healthcare model (Porter, 2010)

As stated earlier, value, is neither an abstract ideal nor a code word for cost reduction, it should define the framework for performance improvement in health care. Rigorous, disciplined measurement and improvement of value is the best way to drive system progress (Porter, 2010). In health care, value is defined as the patient health outcomes achieved per dollar spent. Value should be the preeminent goal in the health care system, because it is what ultimately matters for customers (patients) and unites the interests of all system actors. If value improves, patients, payers, providers, and suppliers can all benefit while the economic sustainability of the health care system improves. Value encompasses many of the other goals already embraced in healthcare, such as quality, safety, patient centeredness, and cost containment, and integrates them. It is also fundamental to achieving other important goals such as improving equity and expanding access at reasonable cost.

Quality in health care should refer to patient outcomes (Porter, 2010). Quality relative to cost then determines value. Quality, the numerator of the value equation, is inherently condition-specific and multidimensional. For any medical condition, no single outcome captures the results of care. Cost, the equation’s denominator, refers to the total costs of the full cycle of care for the patient’s medical condition, not the cost of individual services. To reduce cost, the best approach is often to spend more on some services to reduce the need for others.

Value is measured by outputs, not inputs. Hence value in health care depends on the actual patient health outcomes, not the volume of services delivered. More care is not always better care, and shifting focus from volume to value is a central challenge.
This has been leading in the development of the conceptual model defined in figure 7. Value is the quality of care that is delivered in relation to the (total) costs of care. However delivering too much care, as delivering not enough care doesn’t lead to better health outcomes. Therefore expedience is also important.

A gap in the literature presents itself as hardly any literature is available on the implementation (and validation) of this framework. Also it has been identified that the current organizational structure and information systems of health care delivery make it challenging to measure (and deliver) value. Thus, most providers fail to do so. Providers tend to measure only what they directly control in a particular intervention and what is easily measured, rather than what matters for outcomes. Measuring, reporting, and comparing outcomes are perhaps the most important steps toward rapidly improving outcomes and making good choices about reducing costs. Systematic, rigorous outcome measurement remains rare, but a growing number of examples of comprehensive outcome measurement provide evidence of its feasibility and impact. This presents two challenges, first using Porters framework for the implementation (and validation) in the practical case of clinical laboratory science services. Second, coming up with measurement criteria that relate to Porters framework and the procurement of clinical laboratory science services.
4. Research design and methodology
To perform an accurate study, in which the conceptual framework is used to analyze the problem, this research is divided in 2 parts. These studies focus on 2 processes. A general study is done on the test request process and feedback of the GP (green circle in figure 8). In this study a particular view is given on the request behavior and the quality of the laboratories. A in depth study is done on the contracting process between health insurer and laboratory (red circle in figure 8). The main reason for this division is that these are independent processes; they can have a large influence on each other. A change in the contracting process can have an effect on the test requesting process and vice versa. Changing one process opens doors in what you can do in another process and therefore adds more opportunities to solve the problem.

Figure 8: Study focus on different relationships

4.1. Unit of analysis
Before actually conducting the research, it is important to determine the unit of analysis. According to Yin (2009), the unit of analysis concerns the actual “case” of the case study. Such a case can be represented by an individual, event or entity. One can for instance also think of decisions made, program implementations, incidents or organizational change. In general, the unit of analysis is related to the research question or proposals (Yin, 2009). If the research question concerns the effective implementation of a management tool, the unit of analysis would be the actual event of implementing the tool. Although this relationship might seem obvious, one should still carefully consider the unit of analysis since a vague definition of it might eventually pose to be problematic in the research (Yin, 2009).

4.2. Quality criteria
To assure quality of the project’s results, controllability, reliability and validity must be explicitly addressed. Yin (2009) proposes a set of case study tactics that address these issues and which are shown in Table 3. Controllability is a perquisite for the evaluation of validity and reliability. In order to make research results controllable, researchers have to reveal how the executed a study. The methodology sections will explain how and what data are collected. Construct validity refers to the use of correct operational measures for the phenomena that are studied. In this project the use of multiple sources of
Evidence and the clear linking of data to conclusions are meant to ascertain construct validity. Furthermore, intermediate project results will be reviewed by key informants, especially the project principal. Internal validity refers to the validity of the causal inferences that are made in the analysis and diagnosis of the business problem. This type of validity is addressed by the use of pattern-matching logic and time-series analysis. In this study (of possible) multiple data sources of different years are used to do pattern-matching. External validity refers to generalizability of the study beyond the present case. While case studies have often been criticized for their supposed lack of external validity it should be kept in mind that case studies do not rely on statistical but on analytical generalization (Yin, 2009). In other words, the results from a case study should not be generalized to other cases but to a specific broader theory. The issue of external validity is dealt with in the reflection at the end of the project. Finally, reliability refers to the question whether an exact replication of the study would lead to the same results. While errors and bias may be impossible to avoid completely, working in a structured way and maintaining the chain of evidence by documenting (intermediate) results will increase reliability of the study.

Table 3: Quality criteria for research, adapted from Yin (2009)

<table>
<thead>
<tr>
<th>Quality Criterion</th>
<th>Case study tactic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct validity</td>
<td>Multiple sources of evidence</td>
</tr>
<tr>
<td></td>
<td>Establish chain of evidence</td>
</tr>
<tr>
<td></td>
<td>Use key informants to review report</td>
</tr>
<tr>
<td>Internal validity</td>
<td>Do pattern matching</td>
</tr>
<tr>
<td></td>
<td>Do explanation building</td>
</tr>
<tr>
<td></td>
<td>Do time series analysis</td>
</tr>
<tr>
<td>External validity</td>
<td>Use replication logic in multiple case studies</td>
</tr>
<tr>
<td>Reliability</td>
<td>Use case study protocol</td>
</tr>
<tr>
<td></td>
<td>Develop case study database</td>
</tr>
</tbody>
</table>

4.3. Data collection and analysis

To improve construct validity, data should be collected both qualitatively as well as quantitatively. (Yin, 2009) proposes six sources of evidence that provide the necessary information for case studies. These are:

- Documentation
- Archival records
- Interviews and surveys
- Direct observations
- Participant observation
- Physical artifacts

Since a research can become quite extensive if all of these sources have to be gathered, a selection will have to be made. (Yin, 2009) proposes to use multiple sources of data to improve construct validity, called triangulation. Triangulation helps to improve construct validity because it forces the researcher
not to rely on only a single source of information. In the selection of these sources, it should be taken into account that the sources include certain tradeoffs, such as between generalizability and accuracy.

4.4. Reflection
Students of social science are increasingly pressed to openly discuss and reflect upon the ontological and epistemological commitments that underlie their inquiries and choice of methods (Johnson & Duberley, 2000). Such openness makes good sense in a field where consensus on paradigm is lacking, especially for a project that has knowledge itself as its topic. Being design-oriented, the underlying philosophy for this project is that of pragmatism (Romme, 2003). The term pragmatism has been used to label a variety of epistemological positions, but here it refers to the variant that is described by Johnson & Duberley (2000). The goal of this project is not to add another narrative to existing discourse or to discover general social laws, but to develop a successful redesign for the case study organization and to formulate more general design rules to inform other design projects. Knowledge is seen as a social construction which can aid humans to improve the world they live in. In combining social constructivism with ontological realism, this conception of pragmatism is closely related to critical realism (Johnson & Duberley, 2000), which is the paradigmatic starting point of the methodology of Aken e.a. (2012) on which this project is largely based.

4.5. The test request process – study 1
In this case the unit of analysis is the order (test request) that is requested by the GP. To get a proper analysis on what GP’s request at laboratories several steps in the data mining process are taken. First, a selection is made on which NZa codes are used within clinical laboratory science services to extract data on. This is done with a medical advisor. This results in the list of analyses that can be found in appendix I.
Second, regions are made by approximating in which laboratories are active in a certain region. In ‘the region’ Region_X this is done with the AGB-code of the HLab_A, the HLab_B and the PDCLab_A. Data rules are extracted based on the laboratory name (AGB-code) and the NZa code. This produces a list of data rules which explain which code is invoiced by which laboratory, the number of times that code is declared, the costs of the invoiced code, the AGB code of the requestor (GP), a dummy variable for the patient and the date on which the analysis is performed (and invoiced). The apparatus to extract the data from the database is a software package called SAS. The exact SQL query code can be found in appendix J. Invoice data of the year 2012 is used to collect data.

4.6. The contracting of laboratories – study 2
In this case the unit of analysis is ‘the procurement process’. In the look at this process, the costs, quality and volumes of tests (and analyses) of laboratories will be taken into account. The data collection for this in depth study differs partially from the data collection procedure from the earlier study. In the collection of invoice data on costs of laboratories, the same declaration codes are used as described in appendix I. In the procedure of collecting data, all AGB-codes of laboratories are used which are active in The Netherlands. This results in a data table in which the following is represented: The AGB code of the laboratory, the name of this laboratory, the NZa invoice code of the analysis, the total number of unique insurants for which that NZa code is invoiced, the total number of times that NZa code is invoiced, and the total costs for that invoiced code for that laboratory.
The apparatus to extract the data from the database is a software package called SAS (also see appendix O for the exact code). In order to perform a time series analysis, invoice data over 2011, 2012 and 2013 were collected. NZa tariffs for the NZa codes in appendix I over 2012, 2013 and 2014 were analyzed.

Next to a cost data extraction from invoices, interviews are held with the major stakeholders in the test request process (GP’s and laboratories). When choosing for interviews a choice had to be made between a structured, semi structured and unstructured interviews and between open and closed questions. Semi structured interviews with open questions were chosen as method for the data collection from the merchants and experts. Semi-structured interviews with open questions are used if you want to learn about the research problem from the person who is been interviewed and to know his or her opinion about this topic. It leaves more space for respondents to give extra information. This can be really helpful in this study about Big Data. If the interview takes place with different companies it is better to have a guided semi-structured interview. Before the interviews would take place a list of questions was made. This questionnaire had many open questions and a few closed questions to determine some backgrounds and to scale certain answers. The semi-structured interview is also chosen because it leaves room for steering during the interviews. First the respondent will give their opinion but when a certain construct is missing in the answer it can specifically be targeted in additional questions. This is an advantage of doing interviews over online questionnaires. The developed questionnaires can be found in appendix G and H. Prior to the interview, the interviewee’s received the questions so that the interviewee’s could prepare the questions and properly answer the questions. The interviews researched the relationship between the laboratory and CZ and the relationship between the laboratory and the GP. A list of the interviewed laboratory (laboratory specialists) and GP’s can be found in Appendix K.
5. Results
In this chapter the results will be presented and discussed. In the first section the results of the test request process study, in which the volume element has a more important emphasis, will be discussed. In the second section, the results of the contracting of laboratories study, in which the cost element has a more important emphasis, will be discussed. In the final section the conclusion of these results will be drawn and will be used as input for the redesign.

5.1. Results the test request process – study 1

Data descriptive and transformation
On the raw dataset produced by the SQL query, some transformations are made. The assumption is made that analyses that are performed on the same date for the same patient (relation number) belong to one test request. Following this assumption, combinations of ‘complete’ test requests and their associated costs are made and calculated. It is possible that the same analysis can be executed multiple times. Therefore the emphasis is made not on the amount of analyses that are done for one research but on the number of types of analyses that are done for one research request.

In this analysis, the order tariffs and home visit tariffs are removed from the data, as we are only interested in the pure analyses data.

GP’s that requested less than €10.000 in 2012 were excluded from analysis as we are interested in the key accounts that request at these laboratories.

A reliability check is done by comparing the tariffs with the NZa maximum tariff list of 2012, if a tariff was above this maximum level these data rules were removed.

The descriptive results of this study can be found in table 4 and 5. In total 130 GP’s active in the Region_X region are the key account requestors at these laboratories. They requested 72.600 tests which have an invoice value of €2.800.000. These GP’s made approximately 20.000 unique requests.

In table 6, 130 GP’s made on average 556, test requests and made an overall average invoice total of €21.766. There is a large variation between GP’s as can also be found in table 6.

Table 4: Descriptive statistics of the region Region_X

<table>
<thead>
<tr>
<th>Region_X (what)</th>
<th>Region_X (result)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of data rules</td>
<td>492405</td>
</tr>
<tr>
<td>Number of unique research combinations of analyses</td>
<td>19169</td>
</tr>
<tr>
<td>Number of (key account) GP’s</td>
<td>130</td>
</tr>
<tr>
<td>Total amount spent in 2012 by key accounts</td>
<td>€2.841.151,47</td>
</tr>
<tr>
<td>Number of tests requested</td>
<td>72.600</td>
</tr>
</tbody>
</table>

Table 5: Descriptive statistics for 3 care providers

<table>
<thead>
<tr>
<th>Name care provider</th>
<th>Total costs invoiced</th>
<th>Amount of orders analyzed</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLab_A</td>
<td>€1.967.019</td>
<td>47.886</td>
</tr>
<tr>
<td>HLab_B</td>
<td>€749.111</td>
<td>19.016</td>
</tr>
<tr>
<td>PDCLab_A</td>
<td>€457.899</td>
<td>15.942</td>
</tr>
</tbody>
</table>
Table 6: Descriptive statistics for 130 GP’s active in the Region_X region

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>130</td>
<td>€10.040,60</td>
<td>€62.233,80</td>
<td>€21.765,98</td>
<td>€10.002,14</td>
</tr>
<tr>
<td>Amount of orders</td>
<td>130</td>
<td>111</td>
<td>1593</td>
<td>556</td>
<td>221,27</td>
</tr>
</tbody>
</table>

Costs and request behavior of general practitioners

In figure 9, it is visible that test requests were done varying from 1 analysis to 37 types of analyses per order. As can be seen in figure 9 75% of the costs that are invoiced are from small to a reasonable amount of types of analyses. 25% of the total costs that are reimbursed to these providers are from tests with 12 or more types of analyses per request.

In correspondence with a medical advisor, it was stated that 12 types of analyses or more per request, it was very likely that the LESA guideline is not (or poorly) used. Looking at the guideline self, on average 5 types of analyses per problem is about the average. Setting the norm at 12 types of analyses per request is very reasonable according to medical experts. Not following the LESA guideline could indicate that more types of analyses are requested than might actually be necessary.

Figure 9: Percentage of total costs related to researches with a certain number of types of analyses

From another perspective it’s important to stress out that over 19000 unique combinations of analyses were requested by GP’s who are operating in the Region_X region. This is at odds with the use of the LESA test request guidelines which are used on the request forms and is promoted and advised by the profession of clinical chemists. This guideline is supported by the NVKC, the SAN, the NHG and the NVMM. This guideline is used to support rational behavior for test requests and promotes ‘problem related’ requests instead of requests based on lists of analyses that can be requested. In ‘problem related’ requests, a problem is marked that the GP wants diagnosed and the corresponding tests (that are supported by the guideline) are then being performed.
Looking at the care providers themselves, it is visible in figure 10 that both hospitals have 20-25% of the total costs reimbursed that were in test requests with 12 or more types of analyses per request. Note that the Primary care diagnostic center had more than 35% of their costs reimbursed in the performance of test requests with 12 or more analyses.

![Figure 10](image.png)

Figure 10: Percentage of total costs in tests with 12 or more types of analyses that are reimbursed to care providers.

Looking at the GP’s (figure 11), there is a large difference between the 130 GP’s. On the x-axis the individual GP’s are listed. On the y-axis the percentage of total cost that is requested by the particular GP and that were reimbursed to the laboratory that were in test requests with 12 or more types of analyses is presented. The ‘worst performing’ GP, had over 60% of costs reimbursed to laboratories that contained 12 or more types of analyses. Therefore it is easy to state that this GP, if this GP requests, this GP requests very large number of analyses to be performed by laboratories. 10% of the GP’s who operate in the region of Region_X are GP’s that request a large number of types of analyses per request, as over 35% of the total costs that were reimbursed to laboratories on behalf of these GP’s were in tests with 12 or more types of analyses. 40% of the GP’s who operate in the region of Region_X are GP’s that operate above average cost level, as over 24% of the total costs that were reimbursed to laboratories on behalf of these GP’s were in tests with 12 or more types of analyses.

![Figure 11](image.png)

Figure 11: Percentage of total costs per GP with 12 or more types of analyses per test
5.2. Results of the contracting of laboratories – study 2

Data descriptive and transformation
On the raw dataset produced by the SQL query, some transformations are made. Based on the order tariff structure (see chapter 2) a clear distinction is made between the order tariffs (079991 & 190255), the amount of home visits made, CLB tests and other (regular) analysis is made. This resulted in 3 datasets, for each year, 2011, 2012 and 2013 respectively. The number of data rules for each dataset produced by the SQL data query were: 16607 for the 2011 dataset, 15752 for the 2012 dataset and 19612 for the 2013 dataset.

A reliability check is done by comparing the tariffs with the NZa maximum tariff list of 2011, 2012 and 2013. If a tariff was above this maximum level these data rules were removed. This resulted in the deletion of 15 rules in 2011, 11 rules in 2012 and 27 rules in 2013.

The analyses codes were divided in 3 groups: ‘regular’ analyses, ‘expensive’ analyses and CLB. This distinction is made to prevent potential bias towards specialized laboratories. De specific codes for each group can be found in appendix L. In table 7 the descriptive statistics over 2011 till 2013 can be found (€ = Euro, # = quantity). Please note that the number of orders that are performed over the year is the combination of both the order tariffs (OVP codes 079991 and 190255). So for example in 2011, 1,9 million orders were performed. For these 1,9 million orders 15 million analyses were performed.

Table 7: Laboratory descriptive statistics on costs and volume over 2011 - 2013

<table>
<thead>
<tr>
<th></th>
<th>2011 (€)</th>
<th>2011 (#)</th>
<th>2012 (€)</th>
<th>2012 (#)</th>
<th>2013 (€)</th>
<th>2013 (#)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order tariff (079991)</td>
<td>€ 15.141.944</td>
<td>1.181.382</td>
<td>€ 14.046.334</td>
<td>1.064.286</td>
<td>€ 14.792.098</td>
<td>1.134.742</td>
</tr>
<tr>
<td>Order tariff (190255)</td>
<td>€ 3.019.960</td>
<td>751.261</td>
<td>€ 2.897.706</td>
<td>777.959</td>
<td>€ 2.545.947</td>
<td>812.612</td>
</tr>
<tr>
<td>Home visit (079992)</td>
<td>€ 1.314.792</td>
<td>144.449</td>
<td>€ 1.479.089</td>
<td>161.897</td>
<td>€ 1.675.040</td>
<td>179.729</td>
</tr>
<tr>
<td>CLB</td>
<td>€ 1.500.706</td>
<td>49.281</td>
<td>€ 1.349.262</td>
<td>42.216</td>
<td>€ 1.236.979</td>
<td>74.362</td>
</tr>
<tr>
<td>Analysis</td>
<td>€ 72.933.448</td>
<td>15.010.054</td>
<td>€ 74.549.791</td>
<td>14.716.434</td>
<td>€ 77.233.844</td>
<td>28.945.505</td>
</tr>
<tr>
<td>Total</td>
<td>€ 93.910.850</td>
<td>15.010.054</td>
<td>€ 94.322.184</td>
<td>28.945.505</td>
<td>€ 97.483.911</td>
<td>28.945.505</td>
</tr>
</tbody>
</table>

As the first study was done with data from 2012, a more detailed review is done over the laboratories in 2012. A general oversight per care provider is made. Data that is invoiced from 132 different laboratories were collected. Data from care providers who do have a burden of claims but didn’t invoice any order tariffs were deleted. This resulted in the deletion of data from 13 laboratories. Only the laboratories with a burden of claims with more than € 10.000 were analyzed. This resulted in the deletion of another 17 laboratories. One laboratory performed more home visits than they had invoiced order tariffs which should not be possible and therefore also was deleted. Data from 101 laboratories with a combined burden of claims of €87.707.613,77 remained (the starting amount was € 94.322.184). The descriptive statistics per type of care provider can be found in table 8. The data consists out of 72 hospitals, 24 PDC’s and 4 PTC’s. Though there are less PDC’s the data shows that PDC’s perform more orders per institution than hospitals. However, the standard deviation is larger than mean, indicating that there is a large
variance between the amount of orders several institution analyze per year and the associated costs that are invoiced.

Table 8: Descriptive statistics of costs and number of order per type of care provider

<table>
<thead>
<tr>
<th>Type</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>St. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Costs</td>
<td>72</td>
<td>€ 12.039</td>
<td>€ 4.808.336</td>
<td>€ 682.867</td>
</tr>
<tr>
<td></td>
<td>Number of orders</td>
<td>72</td>
<td>167</td>
<td>81.927</td>
<td>13.119</td>
</tr>
<tr>
<td>PDC</td>
<td>Costs</td>
<td>24</td>
<td>€ 18.063</td>
<td>€ 10.930.257</td>
<td>€ 1.447.234</td>
</tr>
<tr>
<td></td>
<td>Number of orders</td>
<td>24</td>
<td>530</td>
<td>316.043</td>
<td>33.848</td>
</tr>
<tr>
<td>PTC</td>
<td>Costs</td>
<td>4</td>
<td>€ 58.632</td>
<td>€ 3.249.606</td>
<td>€ 951.886</td>
</tr>
<tr>
<td></td>
<td>Number of orders</td>
<td>4</td>
<td>291</td>
<td>68.449</td>
<td>19.300</td>
</tr>
</tbody>
</table>

The costs of laboratories over time

In table 7, an overview of the cost throughout time is given. Most important results is that 60% of the orders (test requests) are performed by hospitals, 40% is done by GP laboratories. The total amount of orders remains constant throughout the year. On average about 1.8 million test requests are done in the Netherlands, which are reimbursed by CZ. Most significant result is the 100% increase in the total number of analyses that are performed in 2013 in comparison to 2012. The indication is that the tariffs are split up in a cost part and a honorarium part and when counted by SAS could indicate that an analysis is performed twice, though in reality it is only performed once. The total amount of burden of claims is steadily growing throughout the years. The cost curve is rising from € 93.9 million in 2011 to € 97.4 million in 2013.

This growing cost curve is at odds with the maximum tariffs that are decided by the NZa and the discount percentages that are negotiated by CZ. As we can see in figure 12, The NZa maximum tariffs are declining throughout the years, the amount of discount CZ has negotiated on these tariffs also declines but tariffs have dropped with 15.3% in 2 years.

![Figure 12: Tariff index 2012 - 2014](image-url)
Looking at the individual institutions (in 2012) there are a couple of important patterns to remark when CZ is negotiating discounts. There are roughly 3 trends that can be seen. Hospitals are hardly giving any discount at all, this is due to the fact that in the negotiations with hospitals, the laboratory is not a point of negotiation as it only is a very small part of the total budget and therefore neglected. If some discount is given, large discounts are given on the order tariffs and home visit tariffs while no discount is given on the analyses themselves. Some laboratories, profoundly the primary care diagnostic centers give a ‘across the board discount’ giving a general percentage in discount on all codes. In figure 13 a general overview is given between different primary diagnostic care providers and hospitals. On overall, hospitals give 2.1% discount while primary care diagnostic centers give about 15.7% discount on average. However, this 15.7% has a large variance between different primary care providers. Microbiology laboratory like MBLab_B, MBLab_A and het MBLab_C, hardly give any discount while the PDCLAB_B and the PDCLAB_C (which have a more clinical laboratory profile) give around 25% discount across the board on all tariffs. PDCLAB_D is a primary care provider that doesn’t give any discount and ‘PDCLab_E’ and ‘PDCLab_F’ are providers that give a very large discount on their order tariffs and hardly give a discount on the analysis codes, but average out on 13.4% and 6.7% discount respectively.

![Discount percentages for care provider type and different care providers (2012)](image)

When comparing the primary diagnostic care centers and the hospitals with each other a weighted average (on order basis) can be made. Three performance indicators are made, these are: Average cost per order, average number of analyses per order and the percentage of orders that are home visits.

\[
\text{Average costs per order} = \frac{\text{Total costs} - \text{costs of home visits}}{\text{Total number of orders}}
\]

\[
\text{Average number of analyses per order} = \frac{\text{Total number of analyses}}{\text{Total number of orders}}
\]
Percentage of orders that are home visits = \( \frac{\text{Total number of home visits}}{\text{Total number of orders}} \times 100 \)

This benchmark is presented in table 9. This implicates that PDC’s on average do orders that are €13 cheaper than hospitals (this is also found statistically significant. Results of the independent t-test can be found in appendix M), they also tend to do 1 less analysis per order than hospitals. However it does seem that PDC’s tend to do more home visits than hospitals. In the same table the descriptive statistics of the 102 laboratories are shown for these performance indicators. On total, the best performing laboratory has an average cost per order of €31,99, the worst performing laboratory €224,74. On average laboratories operate at an average cost per order of €59,41. On total, the best performing laboratory analyzes 2,9 analyses per order, the worst performing does 34,5 analyses per order. On average a laboratory does 7,6 analyses per order. Note that these are independent performance indicators. This doesn’t mean that the laboratory that operates at an average cost of €31,99 also performs 2,9 analyses per order.

Table 9: Performance benchmark hospitals and PDC’s and minimum, average and maximum findings (2012)

<table>
<thead>
<tr>
<th></th>
<th>Weighted average (ex CLB, ex expensive)</th>
<th>Weighted average (ex CLB)</th>
<th>Weighted average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Costs per order</td>
<td>Number of analyses per order</td>
<td>% of orders that are home visits</td>
</tr>
<tr>
<td>Hospitals</td>
<td>€47,41</td>
<td>8.22</td>
<td>8.1%</td>
</tr>
<tr>
<td>PDC</td>
<td>€34,05</td>
<td>7.30</td>
<td>9.7%</td>
</tr>
<tr>
<td>Case Min</td>
<td>€28,58</td>
<td>2.6</td>
<td>0.0%</td>
</tr>
<tr>
<td>Case Average</td>
<td>€47,03</td>
<td>7.4</td>
<td>6.7%</td>
</tr>
<tr>
<td>Case Max</td>
<td>€190,47</td>
<td>34,5</td>
<td>100%</td>
</tr>
</tbody>
</table>

In table 10, the performances of a sample of PDC’s in 2012 are presented. Looking at the complete overview some notable differences can be found. First PDCLAB_C seems to be the most efficiently operating laboratory in the terms of costs. On average they operate about 8 euro’s cheaper than other PDC’s. This is in line with their large discount of approximately 25% (see figure 13). However they are doing a lot more home visits compared to other PDC’s. Most noteworthy from this table is the difference between ‘PDCLab_F’ and the PDCLAB_B. From figure 13, it can be concluded that the PDCLAB_B gives far more discount than PDCLab_F. However PDCLab_F performs fewer analyses per order and also performs far less home visits, which in the end gives an average costs per order that is less than PDCLAB_B. Therefore it must be concluded that it is not always the case that the laboratory that gives the most discount is also the best performing, and the most efficient and effectively operating laboratory.
Table 10: Performance of some PDC’s (2012)

<table>
<thead>
<tr>
<th>Primary Diagnostic centers</th>
<th>‘Regular’ analyses (excluding expensive and CLB analyses)</th>
<th>All analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of analyses per order</td>
<td>Average costs per order (incl. order tariff)</td>
</tr>
<tr>
<td>PDCLAB_C</td>
<td>7.2</td>
<td>€ 28.58</td>
</tr>
<tr>
<td>PDCLAB_B</td>
<td>6.8</td>
<td>€ 34.70</td>
</tr>
<tr>
<td>PDCLab_E</td>
<td>7.1</td>
<td>€ 35.40</td>
</tr>
<tr>
<td>PDCLab_F</td>
<td>6.5</td>
<td>€ 34.10</td>
</tr>
<tr>
<td>PDC Benchmark</td>
<td>7.3</td>
<td>€ 34.05</td>
</tr>
</tbody>
</table>

5.3. Interview results

This paragraph gives the general results of the interview that were held among the different participants from the field, GP’s and laboratory specialists / managers (see appendix K). Ideally, special coding mechanisms would give a very clear analysis of what the results are. However, due to time constraints this is not done. Besides the time constraints the goal of this research is to come up with a redesign of the business problem. Therefore the interviews are used as ‘background’ information and are used as input to come up with the redesign. First the results from the interviews with the laboratories will be discussed (question by question). Then the results from the interviews with GP’s are discussed (question by question).

**Laboratory questions:**

“How do you look at your relationship with the Health Insurance Provider and CZ in particular? What are the obstacles (in the negotiations)?”

All laboratories view their relationship with CZ as positive. Negotiations are courteous and constructive. Problems in funding because of changes in regulations are solved properly. Some laboratories do point out the fact that CZ is not always on time in delivering documents. CZ makes has a specific team for the procurement of PDC’s. This also has an effect on the knowledge of primary care financing system and complement CZ for having this knowledge. Not all insurance providers have this knowledge which sometimes results in the fact that laboratories need to explain to the insurance provider how the financing system works. Some insurance providers have a different purchaser every year which has an effect on the consistency (of negotiations) and knowledge of the primary sector financing.

“CZ wants to have a larger impact in comparison with their current procurement policy (see also the procurement document 2014). What is your view on the current procurement policy?”
“With regard to the quality of clinical laboratory science research, what should be the criteria on which insurance provider should procure the service? Which quality criteria should have more focus from the insurance provider?”

In general, laboratories find the procurement policy of CZ (as well as other insurance providers) ok. Because quality is based on structural quality items, it has become more or less of a checklist. Therefore, the negotiations are more focused on the price. Having output criteria to assess the quality of a laboratory would be better. However the laboratories don’t know on what output criteria they should be assessed on. They do agree that quality criteria that are mentioned should be SMART (specific, measurable, achievable, realistic and timed). For example most notify that CZ want to have a waiting room that is descent and courteous, but what is exactly descent and courteous. Most profound quality criteria that are mentioned (and are generally embraced by all insurance providers) are:

- Accreditation (current CCKL, but must be ISO15189 for further quality improvement). This reassures that laboratory meet a specific quality level.
- Diagnostic test consultation, in this consultation test requesting GP’s behavior is discussed. GP’s that are excessively ordering more tests (with more analyses) will be addressed in why they are requesting these tests. Attempts are made to change their requesting behavior.
- Availability of test results, test results performed by one laboratory should be visible for other laboratories (hospitals) in case a patient is referred. This reduces the probability of double diagnostic services.
- Timeliness of test results. Test results should be available to the GP within one day after the venipuncture is performed.
- A clinical chemist should be available for consultancy.
- Patient expedience protocols should be used to prevent unnecessary analyses will be performed.
- The LESA guideline should be used in requesting tests.

“The first observation is that there is overcapacity. What is your view on this observation? What is your view on selective contracting as a means to effectively utilize this capacity?”

All interviewee’s assess that there is overcapacity. They even assess that there is a huge amount of overcapacity. Statements are made that in the Netherlands alone there is enough capacity to serve the entire European population. In the province of Noord-Brabant there is enough laboratory capacity to serve the entire population in The Netherlands. Most important reason for having this excess capacity (except for having many providers of care) is the fact that (hospital) laboratories are managed on peak demand. Hospitals for example get peak demands 2 times a day. The first time is on 10 o’clock as the laboratory must analyze blood samples from the hospital itself. It can’t be the case that the first blood test is analyzed and results are delivered in a couple of minutes while coincidently the last blood test is analyzed and results are delivered a few hours later. For some patients (especially critical patients) this is unacceptable. Around 2 o’clock in the afternoon another peak in demand is seen. During ‘down time’ a lot of primary care blood test can be analyzed. But this capacity is not (optimally) used.
Laboratories already expect that selective contracting will be used by insurers to effectively manage laboratory research science capacity. Some laboratories already managed combining laboratories of different institutions in order to effectively utilize capacity. This has effectively succeeded in the Region_X region between ‘het HLab_A, HLab_B and PDCLab_A’, they are now combined in ‘Combination X’. However ‘PDCLab_G also made attempts to combine laboratory capacity but failed as institutions (and clinical chemists) cling on to their laboratory. They expect that the influence of selective contracting by health insurers will be a start in attempts to combine laboratory research capacity.

“What effects are expected on price, quality and volume if health insurers and CZ in particular would selectively contract laboratories?”

On average the expected effect on price is that laboratories can reduce their tariffs with about 20%. This is due to the fact that demand from other laboratories will be transferred to their laboratory (economies of scale principle). This has no effect on quality as excess capacity will be utilized. Capacity isn’t a problem as most laboratories indicate that they could analyze at least double the amount of orders that they analyze at this moment, without changing their current analyzing process. Volume is dependent on what the GP requests.

“GP’s request clinical laboratory science research. Who is determining the supplier of this research? The patient or the GP?”

GP’s are choosing the supplier, as they choose the form with the name on the laboratory on it. 80% of the test request the supplier is determined by the GP. In 20% of the cases the patient chooses the supplier. However there is a trend that patients will have more influence in the selection of the supplier. As years ago 90% of the GP’s chose the supplier. The other 10% was chosen by the patient. Patient focus on costs is on the rise as it must be paid out of their deductibles and is frequently asked at laboratories what a test request is going to cost them.

**GP questions**

“How do you currently order laboratory science research? Are you using a digital application (like ZorgDomein?) Who selects the provider of primary diagnostic care services?”

All GP’s that were interviewed stated that they used a hardcopy form for a test request. Some were aware of a digital application to request tests, but are in the perception that a form is faster. In general, GP’s say they just give out a form and that the patient chooses the provider. However they do admit that the name of the provider is on the form and therefore they select the provider. One GP states that he does give out a form, but that the patient chooses the nearest venipuncture center that is close to their home which he has no influence on. Therefore this is often a different provider then the one stated on the form.
“Do patients ask what the costs of a supplier are, as the patient must pay this research as long as their deductibles aren’t fully used yet.”

Patient with an average to high income don’t ask about the costs of a test request. However patients with low/minimum incomes do ask about the costs of a test request. When they do, GP’s can’t tell what a test request is going to cost the patient. They would like to, but simply can’t as they don’t know anything about it. They try to give an indication as some have heard that the order tariff of a supplier is lower than that of another supplier.

“Say, a health insurer is willing to selectively contract primary diagnostic care services. What effect does this have on your service level. What are the advantages? What are the disadvantages?”

Most GP’s are skeptical to selectively contracting in general, as in their view quality criteria are not clear and arguable whether the quality standards insurers set are the right ones. However for the particular case of clinical laboratory science they are less fearful. They hardly see a difference in quality between one provider and the other. One GP cynically stated: “Health insurers already tell me what to do, so this wouldn’t be very different”. However they do note that they have no problem in doing test requests by contracted laboratories only, but they do wish to know which laboratories that are contracted. If this is different per insurer they can’t keep track and won’t keep track. Digital tools can be helpful. Most prominent advantage would be in the aspect of costs. GP’s would agree that laboratories would have a better utilization of their laboratory capacity. However they fear that such a policy would also have a significant downside. Disadvantages that are stated:

- Accessibility of venipuncture centers decreases, as patients are ‘not allowed’ to go to certain centers.
- Probability of double diagnostic tests increases if (when referred) hospitals have no view on what is already done.
- With the current competition, the analyses speed and the delivery of test results has increased substantially. Also GP’s are addressed with more sympathy and understanding in the situation when there is competition. GP’s are fearful of the return to a situation where service decreases and they are treated with less sympathy and respect by clinical chemists.

“If a digital tool would be available to state which suppliers are contracted and which are not (possible with the costs of suppliers). Would you use this tool? If this tool states that a supplier offers the same type of research but for a better price, would u choose this supplier?”

A digital tool would be a great help to get insight in the complex market that then exists. Especially if insurers choose to contract different laboratories. As long as they don’t see major quality differences. GP’s indicate that they have no problem advising patients to go to the more affordable supplier. “Having more affordable care is very important. It also incentivizes patients to do a test instead of avoiding the use of care. However we do need to know what a test costs so we can tell patients. At the moment, we can’t.”
5.4. Conclusion
The results of both studies and the interviews show that there is a lot of potential to achieve savings. This can be achieved in a number of ways. First of all, a reduction and harmonization of tariffs will lead to savings. The results show that there are major differences in the overall discount percentages that laboratories give. Some give 25%, others give hardly any discount. Though it must be said that the larger laboratories give larger discounts than the smaller laboratories. This is most likely due to economies of scale effect. However it does indicate that laboratories, that as of this moment, hardly give any discount in the future can give some discount.
Next to the tariffs, savings can be achieved by influencing the test request behaviour of the general practitioner. GP’s that request excessive amounts of types of analyses should be addressed.
Second, GP’s also indicate that they are willing to do test requests at ‘cheaper’ laboratories, if there isn’t a significant difference in quality. Laboratories indicate that quality doesn’t differ extremely. 95% are the same, however there are some insignificant differences (in for example: feedback performance etc.). GP’s are however unable to do test requests at ‘cheaper’ laboratories because they have no cost awareness of the tests they request. Price transparency can therefore be helpful in giving a GP what a test request costs by different providers. Implementing this in a digital ordering mechanism might help.
In the next chapter, in which the redesign is discussed, the tariffs and the volume per patient (per order) are the main pillars for which solutions are considered.
6. Redesign
In the regulative cycle, the ‘analysis and diagnosis’ step is followed by the ‘plan of action’ step, which involves solution design (which is discussed in this chapter) (Aken e.a., 2012). In this chapter several solution strategies are given to solve the business problem (and the research question). In the first section, solution designs are given with a savings potential estimate, following an argumentation which solution designs are worthwhile for further elaboration. The following section will give a detailed elaboration on one solution. The final section is a conclusion.

6.1. Suggestions for solution design
Several indications of (partial) solution designs are given in figure 14. An argumentation for each solution is given accordingly. In the development of these solutions 2 divisions are made. The costs per patient can be looked at, as well as the costs per insurant. When looking to the costs per patient, it can be concluded from the results (chapter 5) that 2 indicators are important; the tariffs per analysis and the volume per patient.

![Figure 14: Different suggestions for (partial) solutions of the business problem with savings potential estimation](image)

**Regular buying: Yardstick competition**
Yardstick competition is a regulatory instrument that can be used if direct competition between agents does not exist or does not lead to desirable outcomes. The regulator rewards the agents on the basis of their relative performance and therefore generates incentives for promoting efficiency. Agents are forced to compete with a 'shadow-firm' whose performance is determined by average or best practices in the industry. An important reason to use YC is the existence of market power due to regional monopolies. Examples are network industries and statutory monopolies such as hospitals (Planbureau, 2000).

In this solution, the rates of different suppliers (operating in the same region) are compared with each other. Tariffs are compared to price agreements with each other. Those who operate under average level will have the same price agreements. Those who operate above average level, must have tariffs that are below or equal to the average level through negotiations. In principle, all laboratories are still contracted. It is estimated that this approach would achieve savings between the 3% - 5%.
**Preferred providers**
Another approach is the preferred provider tactic. In this approach all laboratories are contracted. However, the price agreements that are made with laboratories will be leading in naming a laboratory preferred provider. Laboratories that give the highest discount (and have better quality) will be named preferred provider. GP’s will be contacted to do test requests at preferred provider(s) through several incentives. This solution is an attempt to steer volume away from more expensive laboratories to cheaper laboratories without reducing quality of the results of the test requests. As volume is send towards cheaper providers, it is estimated that between 5% - 10% of total costs can be saved.

**Tendering / Selective Contracting**
This option selects suppliers (laboratories) for a certain region which presents the best price (and quality) for insurants. The supplier that ‘wins’ the contract can serve GP’s (and insurants) by performing their test requests. Unlike the preferred provider option, not all suppliers are contracted. Results from several laboratory interviews suggest that extra discount can be given (approximately 20%) as they are the only provider in the region. Therefore it is estimated that approximately 25% of total costs can be saved.

**Investing in a laboratory**
This is the most extreme option. In this option CZ will buy a laboratory and run it. This way CZ has a very clear insight in what the exact operating costs are and what prices different analyses should have. When this is clear these tariffs can also be demanded from other laboratories. If laboratories are unwilling or unable to lower their tariffs, volume can be shifted to the CZ laboratory. As this is a more radical option, it is very difficult to calculate what percentage of total costs can be saved.

**Less analysis per order**
From the results section we can conclude that the LESA guideline is not used in the test requests. Therefore we can conclude that a lot of analyses are requested that are probably not necessary. More emphasis on the use of the LESA guideline by implementing digital ordering for example can help lower the amount of analyses that are performed and therefore save costs. A conservative estimation is that these cost savings are around 5% of total costs.

**Less orders per patient / Reduction of double diagnostics**
This option focusses on the reduction of unnecessary test requests, as for example these tests are already performed. When a patient is referred to a hospital it is the case that a patient already had a primary diagnostic test. The results of these tests can be used for further analysis and operation. However often hospitals do their own test, as results are either not available or (in their view) outdated. Costs can be saved by limiting the amount of double testing by letting hospitals have insight in the test results even if they are performed by a different laboratory. There are a number of obstacles in the estimation of savings of total cost. First (and foremost) it is very difficult to tell whether or not a test request is unnecessary as we don’t know the specific case. As the writer of this report is not a medical expert. It is undesirable that the writer should judge this. Second a report estimates that the amount of savings that can be achieved by limiting double diagnostics is limited (“Rapportage Business Case Eerstelijns diagnostiek - Rapport - Rijksoverheid.nl", 2013). Therefore it is impossible to calculate the amount savings that can be achieved (even though estimated that this is limited).
Less patients with test requests
Having fewer patients with test requests is an easy way to save costs. If test requests aren’t done, they can’t be invoiced by laboratories and therefore costs aren’t made. However like the less orders per patient is extremely difficult to assess whether or not a test should be requested as there is no information available on the specific case. Next to this, the writer of this report is not a medical expert and therefore it is undesirable that the writer should judge this. Therefore it is concluded that is impossible to calculate the amount of savings of total costs.

Conclusion
The tariffs per analysis option are easiest to calculate what amount of savings can be expected. The volume shift solutions are credible and viable solutions as well but are heavily dependent on the effect several solution policies have on GP’s. This makes it very difficult to calculate. A detailed solution calculation (justification) will be made, as tendering is estimated to be the option in which the largest amount of savings can be achieved.

6.2. Tendering – a detailed solution design
A detailed solution design and calculation is made on the following starting points:
1. The laboratories that are located where CZ has the largest sphere of influence are used. These laboratories (and their sphere of activity) are depicted in appendix E.
2. All laboratories with a medical microbiology profile are excluded. Main reason for this decision is that there aren’t many laboratories with a distinct medical microbiology profile. They also perform different types of analyses which result in different cost outcomes. A comparison (sourcing policy) based on cost (and quality) outcomes between laboratories would therefore not be fair and could result in the fact that medical microbiology isn’t contracted which would be unlawful.
3. Laboratories are allocated to a region / multiple regions based on their sphere of activity. This allocation can be found in appendix N. If a laboratory is active in multiple regions, it is assumed (for calculation purposes) that demand (amount of orders) is equally distributed between the different regions. The area in which CZ has the largest sphere of influence has been cut up in 21 regions.
4. The total average cost per research is used as a ‘price tag’ to determine which laboratory is most cost efficient. The assumption is made that demand pattern of GP’s per laboratory doesn’t differ significantly. Assuming that quality (as also indicated by laboratories) isn’t significantly different between the different providers.
5. Laboratories active in regions where is no competition will not give more discount, than that they currently do.
6. One laboratory is contracted for each region.
7. Only laboratories with an existing logistical network in a region will provide a bid.

As can be seen in figure 15, the total costs of the laboratories currently operating in the area where CZ has its largest sphere of influence is about €60 million. When taking tendering into account and giving the winning laboratories the amount of orders that is requested by that region this amount drops to €48 million without any additional discounts. Laboratories however stated that if they can perform more
tests than they currently do they can provide an additional discount of approximately 20% on their tariffs. When analyzing the different scenarios, different discount percentages are used. It can be concluded from the calculation that when a 20% additional discount is given, the costs drop to approximately €40 million.

![Cost estimates in tendering scenario](image1)

**Figure 15: Cost estimation with different tendering scenarios**

![Laboratories and their sphere of activity after tendering (West Brabant & Zeeland)](image2)

**Figure 16: Laboratories and their sphere of activity after tendering (West Brabant & Zeeland)**

Figure 16 is an example of a service level of different providers after tendering. It can be concluded that the cut up in different regions has not led to a dramatic decrease in providers in regions leaving insurants without diagnostic care providers with acceptable travel times and distances. Insurants are still possible to go to a local venipuncture point with acceptable travel times for diagnostic care, therefore also ensuring CZ’s legal obligation to provide ‘enough’ (diagnostic)care for their insurants.
6.3. Conclusion

From the results section it can be concluded that there are two drivers which can influence cost reduction: the tariffs per analysis and the volume per patient. Several solutions have been proposed some solution will require more effort to implement and are less challenging than others. However the more challenging and effort a solution requires, the more cost savings can be realized. One such solution is tendering. An early estimation stated that more than 25% of the current costs can be reduced when this option is considered. A detailed calculation of this solution confirms this. It can be concluded that the cut up in different regions has not led to a dramatic decrease in providers in regions leaving insurants without diagnostic care providers with acceptable travel times and distances. Insurants are still possible to go to a local venipuncture point with acceptable travel times for diagnostic care, therefore also ensuring CZ’s legal obligation to provide ‘enough’ (diagnostic)care for their insurants.
7. Conclusions, Recommendations and Reflection
The first section will assess the conclusions from this research. This is done by answering the research question and the different sub research questions. The second section assesses the managerial as well as the scientific recommendations of this research. The final section will detail a reflection on this research as well as the limitations of this research.

7.1. Conclusions
Before answering the main research question, the various sub questions are answered. These questions can be found in chapter 1.

- How does the current process of contracting look like? What are its benefits / pitfalls?

The current contracted situation results in the fact that often 2 or more providers are operating in the same area. This leads to competition between the different providers. Competition improves service quality as providers look at each other and try to make their service better than the other provider. It also means insurants can go to almost every provider they please and that GP’s have no restrictions on requesting a lab test by a certain provider. However, the contracted situation also leads that tariffs that various laboratories invoice, can differ substantially among each other, while the quality differences between different providers, is to be negligible. This results in (unnecessary) high invoices if the insurant wouldn’t go to a provider which has better tariff agreements with CZ. If an insurant would go to a provider with better tariff agreements, this would benefit the insurants as primary diagnostic healthcare must be paid out of the insurants deductibles.

- How does CZ’s current value chain for clinical laboratory science services look like?

CZ has various internal and external stakeholders that create value. As CZ contracts external healthcare providers a prominent focus has been on the role of these external providers. A depiction of the different stakeholders and their relationship can be found in appendix A. CZ contracts the different care providers for its insurants. Insurants pay a premium to CZ in return. When an insurant goes to its GP because he or she is ill and the GP needs more information to make a diagnosis, the GP can do a test request at a laboratory. The insurant (now patient) can go to a venipuncture point of a laboratory to sample blood or other bodily fluids on which the laboratory can perform various analyses that are requested by a GP. The results of the analyses are delivered to the GP on which the GP can make a diagnosis. The costs of the different analyses that are performed by the laboratory are reimbursed by CZ as is a consult from the GP. If the insurant hasn’t fully used its deductibles, CZ will bill the insurant for the costs of the laboratory analyses.

- What are the costs that CZ reimbursed to clinical laboratories? What does the cost structure look like?

The cost structure is defined by the NZa and can be found in table 1 (chapter 2). A test request that has been done by a GP by a laboratory always has (or should have) an order tariff. If a patient / insurant is
physically not able to go to a venipuncture point, the patient can have his blood sampled at home. This is added as a supplement on top of the order tariff. The different analyses that are requested by the GP and performed by the laboratory are invoiced consequently. In case specialized analyses are required a laboratory can forward the sample to a specialized laboratory in Amsterdam. The costs associated with this type of research is invoiced (and reimbursed) by the forwarding laboratory.

On a yearly basis CZ receives €180 million in invoices for primary diagnostic healthcare as a whole. 55%, approximately 100 million is invoiced for clinical laboratory science services. Yearly, approximately 1.9 million orders are requested and executed by laboratories. €17 million is spent on reimbursing the order tariffs. All other costs are reimbursed for analyses.

- How can CZ build performance measures into contracts to ensure that contracts lead to improved health outcomes and increase effectiveness and efficiency?

Literature makes a distinction in various performance measures. These are structural, process and outcome related performance measures. Various quality measures are already taken into account. However most of them are structural outcome measures, which make a difficult to make a distinction between the better performing laboratories on a quality merit. The following (structural) performance measures are indicated by laboratories:
  - Accreditation (current CCKL, but must be ISO15189 for further quality improvement). This reassures that laboratory meet a specific quality level.
  - Diagnostic test consultation, in this consultation test requesting GP’s behavior is discussed. GP’s that are excessively ordering more tests (with more analyses) will be addressed in why they are requesting these tests. Attempts are made to change their requesting behavior.
  - Availability of test results, test results performed by one laboratory should be visible for other laboratories (hospitals) in case a patient is referred. This reduces the probability of double diagnostic services.
  - Timeliness of test results. Test results should be available to the GP within one day after the blood or other bodily fluids are sampled.
  - A clinical chemist should be available for consultancy. This helps GP’s making better and accurate test requests.
  - Patient expedience protocols should be used to prevent unnecessary analyses will be performed.
  - The LESA guideline should be used in requesting tests.

In addition to these quality performance indicators, financial indicators have been developed. These are output performance indicators. These indicators are:
  - Average costs per order.
  - Average number of analyses per order.
  - Percentage of orders that are home visits.

These indicators are not performance predictors on their own, but must be judged in combination of several other indicators as well as the experience that buyers have with the institution that they are contracting.

- What are the most interesting research areas to further investigate?
Several solution directions have been developed after an analysis in which the ‘value creation framework’ developed by Porter has been used. These solution indications can be found in figure 14 (chapter 6). From the results section it can be concluded that there are two drivers which can influence cost reduction: the tariffs per analysis and the volume per patient. Several solutions have been proposed some solution will require more effort to implement and are less challenging than others. However the more challenging and effort a solution requires, the more cost savings can be realized.

- Does the chosen research opportunity reduce costs and create maximum value for CZ insurants?

A solution that is calculated is the tendering solution. An early estimation stated that more than 25% of the current costs can be reduced when this option is considered. A detailed calculation of this solution confirms this. It can be concluded that the cut up in different regions has not led to a dramatic decrease in providers in regions leaving insurants without diagnostic care providers with acceptable travel times and distances. Insurants are still possible to go to a local venipuncture point with acceptable travel times for diagnostic care, therefore also ensuring CZ’s legal obligation to provide ‘enough’ (diagnostic)care for their insurants.

7.2. Managerial recommendations

The results section identified 2 criteria on which the solutions are based. CZ has set the strategic goal of achieving €10 million in cost savings on clinical laboratory science services. Most advisable is a two-step plan. This plan is depicted in figure 17.

![Figure 17: Managerial recommendation strategy](image)

In the result section 2 criteria are identified on which potential savings can be achieved. Both these criteria can be addressed on rather short term notice. For a reduction in the tariffs an implementation of a ‘preferred provider’ policy is recommended. For a reduction in volume a focus on expedient test requests is recommended. The main reason for these recommendations is that they are less labor intensive and are less demanding of external parties especially the insurant or the requesting general practitioner. This recommendation doesn’t demand radical change.
Table 11: Points of action per stakeholder

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Point of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>- Negotiate tariff discounts that are at least 5%, otherwise take initiative to transfer volume to preferred providers. The current venipuncture logistical network determines how realistic this message of buyers towards the various providers is.</td>
</tr>
<tr>
<td></td>
<td>- Address and target laboratories who have excess behavior on the performance indicators (number of analyses per order)</td>
</tr>
<tr>
<td>General Practitioner</td>
<td>One time ‘lump sum’ reward for the stimulation of:</td>
</tr>
<tr>
<td></td>
<td>- Switching in request behavior at a preferred provider.</td>
</tr>
<tr>
<td></td>
<td>- Participation on regional diagnostic test consultation</td>
</tr>
<tr>
<td></td>
<td>- The use of digital ordering.</td>
</tr>
<tr>
<td></td>
<td>A consideration can be made to introduce price transparency in order to further incentivize GP’s (and inform insurants) to a preferred provider.</td>
</tr>
<tr>
<td>Insurant</td>
<td>- No proactive communication is required towards insurants (nothing changes as the current logistical venipuncture networks are considered)</td>
</tr>
<tr>
<td></td>
<td>- A ‘reactive’ message is necessary, if the providers that are not preferred seek media attention.</td>
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</table>

To achieve volume control a more direct approach with GP’s and laboratories is necessary. Laboratories have an ‘education duty’. Clinical chemists inform GP’s in the diagnostic test consultation sessions whether or not a request is a good request. Data have shown that 10% of the GP’s are ordering many analyses than are deemed realistically necessary (though it isn’t impossible that these requests are legitimate). For this 10% group it is advised to organize a (group) session to address this. Contractual measures can be taken if this group is not performing any better over time. CZ must become a partner for the laboratories to undertake action. At the moment, laboratories have indicated that they do not see CZ as a partner in the organization of diagnostic test consultation sessions. All GP’s must be stimulated to request on a ‘problem level’ not an analyses level. Performance feedback information from all other GP’s in the region may help as well as addressing this in diagnostic test consultation sessions. Stimulation for digital ordering will have a great impact as the LESA requesting guideline is used as requesting tool.

If this short term approach is not considered sufficient, a tendering approach can be considered as the savings potential seems higher. However this approach does consider a well-defined preparation. External stakeholders, especially GP’s must be aware which laboratories are contracted and which are not. Making this visible in the digital ordering environment makes this easier for the GP as other insurance providers may consider contracting different care providers.
Final recommendation is to use the developed performance indicators to address possible fraud. Laboratories with extreme high ‘scores’ should be investigated. This should be done in careful consideration with the buyers. As their ‘gut feeling’ is also important of a certain laboratory.

7.3. Scientific conclusion and recommendations

The procurement of healthcare services in The Netherlands is very young research subject, particularly in The Netherlands. For the analysis of this research the conceptual framework that has been developed by Porter (2010) has been used. This framework has been a proper framework to assess the business problem. However measurement criteria remain scarce and must be case specific.

First of all an expedience measurement has been defined: “more than x types of analyses per order”. From a cost perspective, Porter (2010) states, to truly understand costs, they must be aggregated around the patient rather than for discrete services, just as is the case with outcomes. It is the total costs of providing care for the patient’s medical condition (or bundle of primary and preventive care services), not the cost of any individual service or intervention, that matters for value. If all the costs involved in a patient’s care for a medical condition — inpatient, outpatient, rehabilitation, drugs, physician services, equipment, facilities — are brought together, it is then possible to compare the costs with the outcomes achieved.

In this study, finance related performance indicators were built. These were built in relation to the order that is done for the patient. These performance indicators can be used for other types of healthcare. It also would be recommended to see if these performance indicator hold in an equivalent study. However if a patient needs further care, these costs are not accounted for. The approach that Porter presents is look at the full cycle is desirable however not applicable. As it demands focus on individual patients, it is not done to track individual patients from a workload point of view, as of privacy point of view.

Porter rightfully indicates that, “value depends on results, not inputs, value in health care is measured by the outcomes achieved” (Porter, 2010, p. 2477). This study has shown that almost all quality criteria in laboratory science services are structural quality indicators, not output related indicators. Process and structural quality measurement is useful and should continue. Every provider should aim to adhere to evidence-based guidelines as appropriate and should track the best available health indicators. Codifying processes and tracking adherence can also foster the teamwork and integration needed to truly improve outcomes. Existing process-measurement efforts need to be supplemented with systemic measurement of patients’ compliance with care, to fully understand the link between processes and outcomes. However, process measurement should largely be an internal effort. All good organizations should track their processes and work in order to improve them. However, adherence to guidelines is too low a standard for health care providers and should not be the primary means of external measurement and reporting of quality and value. Process or structural quality measurement, though a natural step in the progression of measurement, should not become a sticking point or even a justification for not moving to outcome measurement.

This study has had some focus on quality of laboratory science services but it wasn’t the focus to create a quality norm for laboratory science services. Though concluding that most quality indicators are
structural and process indicators, there is a desire to make a movement to output indicators so a better distinction in quality between different laboratories can be found. There are recent studies available who propose several output quality indicators (Elder, Hickner, & Graham, 2008; Nevalainen e.a., 2000; Ricós, García-Victoria, & Fuente, 2005; Sciacovelli e.a., 2011; Shahangian & Snyder, 2009). However none of them are implemented and used. The implementation and validation of these quality indicators should be made. Thereafter a study on the effect of a procurement policy based on these indicators would be interesting.

Porter clearly states that the focus should be on value creation in the healthcare sector, instead of volume and price discussions. However it is very difficult not to end up in discussions that are about volume and costs as no major differences in quality can be found. A focus on healthcare quality is good, but no solution is given on what to do if quality is not substantially different between the different providers. If a certain quality level is met, or quality doesn’t differ substantially, the discussion moves back to volume and cost drivers. Value should be judged on the entire package. That is the volume of care related to the quality of care related to the costs of care. This study attempted to use this approach for a practical case, which looks at all three of these aspects and made recommendations on that basis. Not just merely from a scientific viewpoint it is interesting whether this approach is also applicable for other healthcare cases.

It should also be stressed that the framework developed by Porter (2010) is not a one size fits all framework and approach. Each practical case may differ and put more focus on one aspect than the other.

There are a few research studies which examine the effect of price information on test request behavior. However this information is shown for one care provider. The results of these studies were often a drop in requests, though results were mixed. No studies have been done on what the effect is of having price information of multiple care providers and what the effect is on substitution (volume shifts) between the providers. As the future is likely to bring more selective contracting and tendering initiatives within the Dutch healthcare sector, it would be highly recommended to perform such a study and see what its effects are.

Today, value in healthcare is measured incompletely, if at all. The absence of comprehensive and rigorous outcome and cost measurement is arguably the biggest weakness standing in the way of health care improvement. The fact that value is not measured means that the most powerful tool for care improvement is lacking. The fact that healthcare delivery is not organized around value works against excellent healthcare and drives up cost. The fact that reimbursement is not aligned with value cripples the process of innovation while rendering the profit motive a destructive force rather than a value driver. Proper measurement of outcomes and cost is the single most powerful lever for improving health care delivery. Although current measurement efforts are highly imperfect, at least the process of measurement has begun. Current organizational structures, practice standards, and reimbursement create obstacles to value measurement, but there are promising efforts under way to overcome them. Health plans, providers, employers, and government policy can all contribute to making the measurement of value in health care a reality. If all actors in health care were to embrace value as the
central goal and measure value universally, the resulting improvements in health care delivery would be enormous.

7.4. Reflection

This study has a number of limitations. First of all, all OVP ‘07’ NZa codes are used (see appendix L). This also includes codes that are possibly not directly related to clinical laboratory science services or medical microbiological research. Also it was nearly impossible to make a distinction between what are the more clinical laboratory science related codes and what are the medical microbiological related codes. A clear distinction would have made a better analysis. A distinction is now based primarily on a price gap between different codes and the comments of several buyers that the more expensive codes were also related to medical microbiology and not clinical science. Consultations with CZ medical experts couldn’t give a clear indication. Consultation with a clinical chemist would likely be more helpful to make this distinction and perform a better analysis. Codes that are not applicable to either medical microbiology or clinical science can then also be removed.

Laboratories institutions (or at least the PDC’s) tend to offer more primary care services (such as diagnostic imagining services) than only clinical laboratory science. In the judgment of financial performance with the developed indicators, these services are left out of the discussion. However laboratories which offer large discounts on these types of services may be tempting to contract even if sometimes the laboratory science is more expensive compared to other care providers. In the contracting of laboratories the overall package of delivered services should be taken into account not just one aspect.

It also very difficult to make an expectation of what cost savings results can be achieved. The data that were used were primarily from 2012 and can be considered ‘outdated’ in negotiations with care providers. The effects of actual cost savings are also dependable on the tariff decisions of the NZa but largely on the negotiation efforts of buyers.

Another limitation is not using a coding scheme for the interviews, better and more accurate results would be presented with the coding scheme. However the interviews were used as a supportive measure to get a better under of how and why tests are requested. In deliberation with the guiding professor, it has been decided not to use a coding mechanism, as this research is primarily data driven, time considerations also led to the decision not to use a coding mechanism.
8. References


Dasbach, J.D. (2014), The procurement of clinical laboratory science services.


Appendices

Appendix A  Healthcare Service Triad

![Healthcare Service Triad Diagram]

Figure 18: Stakeholders in laboratory healthcare market
Appendix B  Market costs for primary diagnostic health services in The Netherlands

Bijlage A: Markt voor eerstelijnsdiagnostiek en trombosezorg in 2010
Door de SAN gemaakte uitgaven voor eerstelijnsdiagnostiek en trombosezorg in 2010

<table>
<thead>
<tr>
<th>Service</th>
<th>Totaal</th>
<th>Per fte huisarts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Klinische chemie en medische microbiologie</td>
<td>€ 330.000.000</td>
<td>€ 46.479</td>
</tr>
<tr>
<td>2. Pathologie</td>
<td>€ 10.000.000</td>
<td>€ 1.408</td>
</tr>
<tr>
<td>3. Röntgendiagnostiek</td>
<td>€ 89.460.000</td>
<td>€ 12.600</td>
</tr>
<tr>
<td>4. Diagnostiek Zwangerenecho's</td>
<td>€ 47.520.000</td>
<td>€ 6.693</td>
</tr>
<tr>
<td>5. Echo's huisartsen</td>
<td>€ 46.150.000</td>
<td>€ 6.500</td>
</tr>
<tr>
<td>6. Long Functie</td>
<td>€ 45.440.000</td>
<td>€ 6.400</td>
</tr>
<tr>
<td>7. Fundus foto's</td>
<td>€ 19.880.000</td>
<td>€ 2.800</td>
</tr>
<tr>
<td>8. ECC</td>
<td>€ 17.750.000</td>
<td>€ 2.500</td>
</tr>
<tr>
<td>9. Holter, Event holter, 24 u bloeddrukmeting</td>
<td>€ 14.200.000</td>
<td>€ 2.000</td>
</tr>
<tr>
<td>10. Inspannings ECG</td>
<td>€ 2.641.200</td>
<td>€ 372</td>
</tr>
<tr>
<td>11. Audimetrisch onderzoek</td>
<td>€ 5.680.000</td>
<td>€ 800</td>
</tr>
<tr>
<td>12. Dexa (osteoporose)</td>
<td>€ 7.810.000</td>
<td>€ 1.100</td>
</tr>
<tr>
<td>13. MRI</td>
<td>€ 9.230.000</td>
<td>€ 1.300</td>
</tr>
<tr>
<td>14. Trombose dienst</td>
<td>€ 53.250.000</td>
<td>€ 7.500</td>
</tr>
<tr>
<td>15. Selmeting trombose dienst</td>
<td>€ 28.350.000</td>
<td>€ 3.993</td>
</tr>
<tr>
<td>16. Gastroscopie</td>
<td>€ 21.300.000</td>
<td>€ 3.000</td>
</tr>
<tr>
<td>17. Divers/overig</td>
<td>€ 12.000.000</td>
<td>€ 1.690</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Totaal</th>
<th>Per fte huisarts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>€ 760.661.200</td>
<td>€ 107.185</td>
</tr>
</tbody>
</table>

Bron Nivel: aantal fte huisartsen 1 jan. 2009 = 7055 fte
aantal fte huisartsen 2010 = 7.100 fte (SAN ranking)
aantal inwoners, aug. 2010, bron CBS = 16.600.000

Figure 19: Market for primary diagnostic health services (SAN leden, z.d.)

Figure 20: Burden of claims for primary diagnostic healthcare for CZ (CZ data, 2012)
Appendix C  Contracted Hospitals

Figure 21: Contracted hospitals in The Netherlands by CZ
Appendix D  Contracted General Practitioner laboratories & Private treatment centers

Figure 22: Contracted GP laboratories and private treatment centers by CZ
Appendix E  Detailed provider network in core area of CZ insurants

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Due to confidentiality this appendix is made blank
Appendix F: Quality criteria CZ in the contracting of laboratories

a) Algemeen
- De instelling is gecertificeerd (CCKL/HKZ/ISO/NIAZ) voor onderstaande deelgebieden:
  ° laboratoriumonderzoek
  ° functieonderzoek
  ° beeldvormend onderzoek
- De instelling werkt volgens de laatste versie van de Landelijke Eerstelijns Samenwerkingsafspraak, Rationeel aanvragen van laboratoriumdiagnostiek.*
- De instelling beschikt over een kwaliteitsbeleid*.
- 24 uurs bereikbaarheid medisch specialist* (klinisch chemicus/medisch microbioloog/radioloog/patholoog)
- Stimuleren van digitaal aanvragen (mogelijk via Zorgdomein)

b) Wachttijden, Bereikbaarheid, toegankelijkheid en patiënttevredenheid

Wachttijden:
- goede responsetijd inzake spoedaanvragen
  - (norm: uiterlijk binnen 1 uur na de aanvraag)
- goede wijze van rapporteren bij kritische waarden
  - (norm: huisarts dezelfde dag informeren)
- goede responsetijd diagnostiek huisartsen
  - (norm: 90% binnen 24 uur, maximaal 5 dagen, exclusief spoedaanvragen)
- acceptabele wachttijd voor de patiënt
  - (norm: maximaal 1 dag, dit is de tijd tussen het maken van de afspraak en het plaatsvinden van de afspraak)

Bereikbaarheid en toegankelijkheid:
- goede telefonische en fysieke bereikbaarheid en toegankelijkheid
- avond openstelling (bij voldoende vraag)
- voldoende parkeerplaatsen voor bezoekers
- goed geoutilleerde wachtruimte

Patiënttevredenheid
- Patiëntenraadpleging* (o.a. klanttevredenheidsonderzoek minimaal 1 maal per jaar)
- Goede informatievoorziening richting patiënt (folders/internet)

*graag met document onderbouwen hoe de instelling hieraan voldoet danwel welke activiteiten (met tijdspad) worden ondernomen hieraan te gaan voldoen.

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c)  (Samenwerkings)Afspraken

- Actieve ondersteuning van eerstelijns hulpverleners door het organiseren van een consultfunctie.
- Verstrekken van communicatieve feedback en/of terugkoppelingsinformatie aan de aanvragers. Dit dient mede als input voor regionale DTO's, georganiseerd door de instelling. Het DTO behelst onder andere:
  - Aanleveren en bespreken van productiecijfers over de 1e lijns diagnostiek op populatieniveau en op individueel huisartsenniveau, minimaal 2 maal per jaar;
- Aanvraagformulier en rapportage geënt op de aanbevelingen in de LESA/NHG-standaarden en op behoefte vanuit de 1e lijn, inclusief probleemgeöriënteerd aanvraagformulier voor lab en functieonderzoeken;
- Rapportage op wijze die aanvragers in hun professioneel handelen ondersteunt;
- Electronische rapportage in HIS;
- Pro-actief advies richting aanvrager (gebaseerd op LESA/NHG richtlijnen).
- De instelling stimuleert het digitaal orderen. Doelstelling is om uiteindelijk de papieren aanvraagformulieren tot een minimum terug te brengen*
- Voorkomen dubbel en/of oneigenlijke diagnostiek bij patiënten*. Welke afspraken zijn gemaakt/welke activiteiten worden uitgevoerd om dit te voorkomen?
- Samenwerkingsafspraken met andere zorgverleners/instellingen met betrekking tot de uitwisseling en acceptatie van de uitgevoerde diagnostiek (informatieuitwisseling)*.

Due to confidentiality this appendix is made blank
Appendix G: Questionnaire laboratories

**Personalia:**

Naam:  
Bedrijf:  
Functie:  
Sinds:

**Relatie met zorgverzekeraar:**

Hoe kijkt u naar de relatie met de zorgverzekeraar en CZ in het bijzonder? Wat zijn de struikelblokken (in de onderhandelingen)?

CZ wil graag stappen maken ten aanzien van het huidige inkoopbeleid (inkoopdocument 2014). Hoe kijkt u tegen het huidige inkoopbeleid aan?

Ten opzichte van de kwaliteit van de dienstverlening, waar zou strenger op gelet en getoetst moeten worden bij het inkopen van Eerstelijns Diagnostiek? (KCL)

De eerste constatering is dat er overcapaciteit is. Deelt u dit?  

Hoe kijkt u aan tegen selectief inkopen van KCL, als middel om effectiever met deze capaciteit om te gaan?

Welke effecten verwacht u op de prijzen, kwaliteit en volume als zorgverzekeraars (CZ) selectief zou gaan inkopen?

Wat is uw visie op het aanvraaggedrag van zorgverleners.

Gezien het toekomstig beleid van zorgverzekeraars
- Hoe kijkt u naar de rol van het lab
- Hoe speelt u in op de veranderende omgeving

**Relatie met huisarts / patiënt:**

Huisartsen (en verloskundigen) vragen ELD aan. Wie is volgens u het beslisorgaan hierin. De patiënt of de huisarts? Waar blijkt dat uit?

Zijn huisartsen (en patiënten) tevreden over de dienstverlening? Waar zijn de huisartsen tevreden over? Waar zijn de patiënten tevreden over? Wat maakt hen zo tevreden? Welke gebieden kunnen bij uw organisatie (en algemeen) verbeteren?
Appendix H: Questionnaire General Practitioners

Personalia:

Naam: 
Bedrijf: 
Functie: 
Sinds: 

Personalia:

Hoe verloopt het huidige laboratorium diagnostiek aanvraagproces?
- Gebruikt u hierbij een digitale applicatie? (zoals ZorgDomein?)
- Wie kiest hierbij de aanbieder van de diagnostiek?
  Is dat (hoofdzakelijk) de huisarts?
  Is dat (hoofdzakelijk) de patiënt?
  Beiden? (besluitvorming vindt in overleg met elkaar plaats)

Vragen patienten naar de kosten van een aanbieder gezien het ten koste gaat van hun eigen risico?
Kunt u patienten vertellen wat de kosten van een onderzoek zijn? (Zo ja: hoe dan? Is dit op basis van een schatting?)

Welke laboratorium diagnostiek aanbieder bent u mee bekend?
- Wat is de reden dat u bij deze aanbieder diagnostiek aanvraagt?
- Bent u bekend met andere aanbieders?

Stel CZ gaat diagnostiek selectief contracteren.
- Wat voor effect heeft dit op uw dienstverlening (wat is uw eerste reactie?)
  - Wat zijn de voordelen?
  - Wat zijn de nadelen?

Welke kwaliteitsindicatoren zou CZ rekening moeten houden in haar inkoopbeleid?

Als CZ een module zou voorstellen waardoor het voor u inzichtelijk wordt welke aanbieders er zijn, wat de kosten zijn en of deze aanbieder wel of niet gecontracteerd is. Hoe staat u hier dan tegenover?

Indien hieruit blijkt dat een andere aanbieder hetzelfde onderzoek goedkoper kan aanbieden. Zou u dan (samen met uw patient) deze diagnostiek aanbieder overwegen? (Indien nee: hoezo niet, zijn er andere bezwaren?)
**Appendix I: List of analyses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>70001</td>
<td>hybridisatie, geautomatiseerd</td>
</tr>
<tr>
<td>70002</td>
<td>hybridisatie, handmatig</td>
</tr>
<tr>
<td>70003</td>
<td>dna-amplificatie, kwalitatief, geautomatiseerd</td>
</tr>
<tr>
<td>70004</td>
<td>dna-amplificatie, kwalitatief, handmatig</td>
</tr>
<tr>
<td>70005</td>
<td>rna-amplificatie, kwalitatief</td>
</tr>
<tr>
<td>70006</td>
<td>dna/rna-amplificatie, kwantitatief</td>
</tr>
<tr>
<td>70007</td>
<td>dna/rna-analyse (bv. sequentie-bepaling of sub-typering)</td>
</tr>
<tr>
<td>70027</td>
<td>doelgerichte consultatie van een ondersteunend specialist do</td>
</tr>
<tr>
<td>70028</td>
<td>consult bij patient op verzoek van een ondersteunend special</td>
</tr>
<tr>
<td>70100</td>
<td>urine screening kwalitatief zonder sediment aceton bilirubin</td>
</tr>
<tr>
<td>70108</td>
<td>diaceetzuur</td>
</tr>
<tr>
<td>70110</td>
<td>indican</td>
</tr>
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<td>70114</td>
<td>aminolevulinezuur, delta-, kwantitatief</td>
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<td>70115</td>
<td>concentratie- en verdunningsproef, elk</td>
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<tr>
<td>70116</td>
<td>ureum</td>
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<tr>
<td>70119</td>
<td>chloride</td>
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<td>galactoseproef</td>
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<td>hippuurzuurproef</td>
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<td>70123</td>
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<td>70125</td>
<td>ketosteroiden, 17-, gefractioneerd</td>
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<td>porfyrines, uro-, copro-, proto-kwantitatief, elk</td>
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<td>urinezuur</td>
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<td>antistoffen tegen elk micro-organisme m.b.v. immunoblot</td>
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<td>gistproef</td>
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<td>vertering, kwalitatief</td>
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<tr>
<td>70208</td>
<td>amylase</td>
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<tr>
<td>70209</td>
<td>lipase</td>
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<td>melkzuur, kwantitatief</td>
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<tr>
<td>70220</td>
<td>osmolariteit in faeces</td>
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<td>chymotrypsine in faeces</td>
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galzure zouten in faeces
alfa-i-antitrypsine in faeces
porfyines, kwantitatief
porfyines uro-, copro-, proto- in faeces
sediment
ademanalyse
amylase
morfologisch onderzoek van sputum, algemeen
bloed (occult) in diverse materialen
glucose galactose-tolerantietest (i.v. belasting) lactose-to
kreatinine klaring (of andere klaring)
methemoglobine, sulfhemoglobine, elk
vitamine c
kreatinine
fosfaat
fosfatase (zure)
alkali reserve
cholesterol, totaal
calcium
angiotensine converting enzym
vitamine a
ijzer
vitamine e
lipoiden, totaal
vitamine d (dihydroxycholeciferol)
natrium
kalium
ijzerbindingscapaciteit
aminozurechromatogram
transferrine
koolhydraat defic´ent transferrine (cdt)
cholinesterase
pyrodruivenzuur
triglyceriden
melkzuur
magnesium
vetzuren, vrij (ffa, nefa)
immunoglobuline, elk
fenylalanine
cellen tellen in liquor
ammoniak
fibrinogeen
asat, sgot, transaminase
cryoglobuline, kwalitatief
osmolariteit
microscopisch onderzoek (ongekleurd of gekleurd), elk
microscopisch onderzoek (spirochten in donker veld)
kweekproef op tuberculose
resistentiebepaling kwalitatief m.b.v. diffusie-methode, bac
resistentiebepaling kwantitatief m.b.v. mrc/etest per antibi
resistentiebepaling tbc kwantitatief m.b.v. mrc per antibiot
mrc + mbc-bepaling per antibioticum
interactie mrc van twee antibiotica
beta lactamase test
microscopisch onderzoek (gekleurd of ongekleurd), elk, mycol
resistentiebepaling kwantitatief d.m.v. mrc/etest per antibi
microscopisch onderzoek op tuberculose (ziehl-neelsen of gel
agglutinatiereactie volgens widal, voor elk micro-organisme
bloedgroep abo + rhesusfactor rhesusfactor (d+ of d-) buisje
paul en bunnell, reactie van
antistoffen, gebonden, tegen erytrocyten met behulp van poly
antistoffen, vrije, tegen erytrocyten met behulp van poly-sp
cde genotypering (rhesusfactor, subtypering)
agglutinatie, koude
anti-sterptolyse titer / anti-dnase b titer of stapholysin
rose-test
l-agglutinatie
ra-test (latex-agglutinatie)
treponema pallidum haemagglutinatietest (tpha)
fluorescerende treponemale anti-stoffenreactie (met toepassi
vdrl-reactie (kwantitatief)
precipitatie reactie
immunodiffusie reactie
immunochemolytische bepaling van complement gehalte (ch 50)
complement component (kwantitatieve bepaling)
t-rose-test
membraan immunofluorescentie (ter bepaling van het b-lymfocy
c-reactive proteinen (crp)
ant-nucleaire factor (anf)
ant-perinucleaire factor (pnf)
cellulaire immuniteit door middel van lymfocyten transformat
hemoglobine [is inclusief (eventueel) hematocriet en celindi
bezinkingssnelheid
bloedingstijd
protrombinetijd bij orale antistolling
protrombinetijd
erytrocyten, resistentie
plasmacellen tellen
microscopie van sternumpunctaat, standaardkleuring en beoord
eosinofielen tellen
trombocyten tellen
reticulocyten tellen
differentiele telling (hand)
differentiele telling (machinaal)
le-cellen
bloedkoek retractie, kwantitatief
heparine-tolerantie test
hemoglobine (foetaal) kwalitatief
hemoglobine foetaal (hbf), kwantitatief
hemoglobine scheiding kwantitatief
bloedstollingsfactor ii
bloedstollingsfactor v
bloedstollingsfactor vii
bloedstollingsfactor viii
bloedstollingsfactor ix
bloedstollingsfactor x
tromboplastinietijd, partieel
trombinetijd
trombocyten aggregatie, per aggregerende substantie
alkalische fosfatase, kwantitatief, in leucocyten
plasminogeen activiteit
glucose-6-fosfaat-dehydrogenase (g 6 pd) in erytrocyten
transketolase: in erytrocyten
transketolase: voor en na toevoeging tpp (tpp effect), totaal
circulerend anticoagulans (lupus anticoagulans, antitrombopl
antiplasmine activiteit, alfa-2
heparine bepaling (anti xa activiteit)
sperma-analyse, eenvoudig
concremenen (zoals stenen), instrumentele methode
chromatografische analyse (kwalitatief, 2-dimensionaal)
zuurstof- en koolzuurgehalte van uitademingslucht, kwantitat
natrium en chloride in zweet (kwantitatief)
bpnt-probn
levensduur erytrocyten, 51-chromium
zink
microscopisch onderzoek op parasieten (uitstrijkje, dikke dr
wormeieren (concentratie)
protozoaire cysten (concentratie)
entamoeba histolytica (zinksulfaat concentratie)
schistosoma (zoutzuur-ether concentratie)
strongyloides (baemann concentratie)
schistosoma (na concentratie d.m.v. centrifugeren)
virologisch onderzoek door middel van celkweek < 2 media
virologisch onderzoek door middel van celkweek 2 - 3 media
virologisch onderzoek door middel van celkweek > 3 media
typering van geisoleerd virusstam
hbs antigeen
virusdetectie in kweek met specifieke antisera
antistoffen, igt, igg of iga tegen elk micro-organisme m.b.v
antistoffen tegen elk micro-organisme m.b.v. cbr of har per
antistoffilterstijging met behulp van neutralisatie (2 bepali
antistoffen, igm tegen elk micro-organisme m.b.v. if
antistoffen, igt, igg of iga tegen elk micro-organisme m.b.v
antistoffen, igm tegen elk micro-organisme m.b.v. immunoassa
microbieel antigeen of toxine direct in patientenmateriaal m
microbieel antigeen of toxine direct in patientenmateriaal m
microbieel antigeen of toxine direct in patientenmateriaal m
microbieel antigeen of toxine direct in patientenmateriaal m
hydroxy-indolazijnzuur, 5-, kwantitatief
hydroxytryptamine, 5-hydroxytryptamine (serotonine)
vitamine b1, thiamine
vitamine b6, pyridoxine
vitamine h, biotine
porfobilinogeen, kwalitatief
electroforetisch diagram, na concentratie, in diverse media, micro-albumine in urine
vanillyl-amandelzuur (vma)
homovanilline (hva)
aminozurencromatogram via kolomchromatografie
cystine, kwalitatief
fenylpyrodruivenzuur, kwalitatief
bloed, kwalitatief (tablet test)
pregnaandiol + pregnaantriol in cyclusurine
hydroxyproline
myoglobine, kwalitatief
oxaalzuur
everzadiging van het arteriele bloed
bloedgassen: ph, pco2, po2 en/of standaardbicarbonaat van he
gamma-glutamyl-transpeptidase
igg subklassen
esteraseremmeractiviteit
viscositeit
apolipoproteine a, b, c, e
cortisol
cortisol, vrij
desoxytocortisol, 9
desoxytocortisol, 11
aldosteron
hydroxyprogesteron, 17
progesteron
testosteron
testosteron, vrij
androstanolon (dihydrotestosteron)
androstendion
dehydro-epi-androsteron (dhea)
dehydro-epi-androsteronsulfaat (dhea-s)
sex hormone binding globulin (shbg)
somatomedine
somatostatine
pregnenolon
oestriol bij gravidae
oestron, oestradiol, elk
glucagon
insuline
insuline-antistoffen
c-peptide
acth, corticotrofine
luteiniserend hormoon (lh)
follikelstimulerend hormoon (fsh)
subunits, alfa-, van lh, tsh, tsh, elk
thyrotrofine (tsh) binding inhibitor
thyrotrofine (tsh) stimulating immuunglobuline
hcg, humaan choriongonadotrofine, intact molecuul
hcg, beta-humaan choriongonadotrofine
hcg, betavrij-humaan choriongonadodrofine
hcs, hpl, humaan chorionsomatotrofine
groelhormoon, hgh, somatropine
rh-fsh belastingtest (=fsh op 0-30-60 min)
vasopressine (antidiuretisch hormoon, adh)
prolactine (prl)
thyroxine (vrij t4)
trijoodthyronine (vrij t3)
trijoodthyronine (reverse t3)
thyrotrofine (tsh)
thyroxinebindend globuline (tbg)
thyroxine (t4)
trijoodthyronine (t3)
foliumzuur
vitamine b12, cyanocobalamine
osteocalcine
transcortine (corticosteroidbindend globuline, cbg)
antistoffen tegen specifiek humaan weefsel
allergenen, (specifiek ige antistof tegen, rast)
allergenen, screening op inhalatie-allergie
bloedgroep bepalingen niet vallende onder abo, rhesus (duffy)
prostaat zure fosfatase (antigeen)
prostaatspecifiek antigeen (psa)
neuronspecifiek enolase (nse)
carcinoom antigeen (ca), elk
trypsine-like inhibitor
thyreoglobuline
carcino-embryonaal antigeen (cea)
alfa-foetoproteine (afp)
beta-2-microglobuline
calcitonine
gastrine
inhibine
oestrogeen receptoren in cytosol
parathormoon (pth)
renine
dna-antistoffen (kwantitatief)
ferritine
slaapmiddelen, identificatie en/of kwantificatie
benzodiazepinen, identificatie en/of kwantificatie
antidepressiva, identificatie en/of kwantificatie
opiumwet, identificatie middel vallende onder de opiumwet, c
opiumwet, identificatie middel vallende onder de opiumwet m.
opiumwet, identificatie middel vallende onder de opiumwet m.
opiumwet, kwantificatie middel vallende onder de opiumwet, c
laxantia, screening
diuretica, screening
alcohol, kwantitatief met identificatie
koolmonoxide, kwantitatief met identificatie in bloed
metalen (zwaar) kwalitatief en/of kwantitatief per element
metalen (zwaar) kwalitatief en/of kwantitatief per element,
anti-epileptica, m.b.v immunoassay, elk
anti-epileptica, m.b.v. chromatografie, elk
aluminium
analgetica/antirheuma, m.b.v. immunoassay
analgetica/antirheuma, chromatografisch
analgetica/antirheuma, spectrofotometrisch
h2-receptorblokherende antihistaminica, kwantitatief
nicotine/cotinine m.b.v. immunoassay
nicotine/cotinine, chromatografisch
cyanide
fluoride
lood, kwantitatief m.b.v. aas in bloed
cytostatica m.b.v. aas
immunomodulantia / immunosuppressiva m.b.v. immunoassay
immunomodulantia / immunosuppressiva m.b.v. chromatografie
betablokker, identificatie en/of kwantificatie, m.b.v. immun
betablokker, identificatie en/of kwantificatie, m.b.v. chroma
theofylline, kwantitatief, chromatografisch
antipsychotica (neuroleptica), identificatie en/of kwantific
cardiaca, identificatie en/of kwantificatie, m.b.v. chromato
cardiaca, identificatie en/of kwantificatie, m.b.v. immunoas
methotrexaat met immunoassay, inclusief eventuele herbepalin
cytostatica, chromatografisch
antimicrobiele middelen, mengsel, microbiologische bepaling
antimicrobiele middelen, m.b.v. immunoassay
antimicrobiele middelen, m.b.v. chromatografie
anticoagulantia, m.b.v. chromatografie
lithium
theofylline, m.b.v. immunoassay
geneesmiddel, eiwitvrije fractie (naast een ander nummer in
geneesmiddel (functietest met) waarvan kwantitatieve bepalin
toxicologisch onderzoek (algemeen) ter vaststelling of uitsl
toxicologisch onderzoek (algemeen) ter vaststelling of uitsl
toxicologisch onderzoek (algemeen) ter vaststelling of uitsl
toxicologisch onderzoek (algemeen) ter vaststelling of uitsl
landbouwgiften, chromatografisch
organische oplosmiddelen, chromatografisch
fructosamine
geglyceerde hemoglobine
hb alc
methemalbumine
sikkelcel test
bilirubine, kwantitatief totaal of direct, elk
lipase
cholesterol, hdl
antitrypsine typering, alfa-i
electroforetisch diagram in diverse media, eventueel met spe
immuno-electroforese met antiserum, inclusief eventuele dete
glucose-insuline tolerantietest (inclusief urine porties)
koper
bence jones eiwit
albumine-igg ratio (in serum en liquor cerebrospinalis)
kwantitatieve bepaling van een immunoglobuline, nefelometris
prealbumine
albumine in liquor cerebrospinalis
kappa ketens, vrij of gebonden, elk
lambda ketens, vrij of gebonden, elk
glutamine
eiwit
albumine
myoglobine
glycoproteine, alfa-i-zure
antitrypsine, alfa-i
alat, sgpt, transaminase
melkzuur dehydrogenase (ldh)
fructose-i,6-difosfaat-aldolase
kreatine-fosfokinase
alkalische fosfatase
ck-mb, kreatine-fosfokinase iso-enzym
hydroxyboterzuur.dehydrogenase (hbdh)
troponine, cardiale isovorm
ceruloplasmine
cryoglobuline, kwantitatief
colloid osmolaliteit (colloid osmotische druk)
kweekproef < 2 media, bacteriologisch
kweekproef 2 - 3 media, bacteriologisch
kweekproef > 3 media, bacteriologisch
bloedkweek (aeroob + anaeroob)
determinatie micro-organismen, bacteriologisch
kweekproef < 2 media, mycologisch
kweekproef 2 - 3 media, mycologisch
kweekproef > 3 media, mycologisch
determinatie micro-organismen, mycologisch
circulerende immuuncomplexen, per component
kruisproef in zout-albumine-milieu
test
kruisproef, volledig (3 methoden)
erytrocyten, osmotische resistentie
lymfcyten subpopulatie, eerste antistof
lymfcyten subpopulatie, tweede en elke volgende antistof
hla-a, b, c, typering
hla-b27
microscopie van punctaten (anders dan sternumpunctaat), stan
microscopie van punctaten, aanvullende specifieke kleuring: leucocyten, enkelvoudige bepaling
trombelastogram, eerste onderzoek
trombelastogram, herhalingen haptoglobin
bloedstollingsfactor viii stol activiteit
bloedstollingsfactor viii, von willebrand factor, ristocetine
bloedstollingsfactor viii related antigeen
bloedstollingsfactor xi
bloedstollingsfactor xii
aptt, geactiveerde partiele tromboplastinetijd
fibrinogeen splitsingsprodukten, kwantitatief
fibrine/fibrinogeen degradatie produkten (fdp) d-dimeertest,
fibrine/fibrinogeen degradatie produkten, kwantitatief
fibrinopeptide-a
antitrombine iii activiteit
antitrombine iii antigeen
plasminogeen antigeen
porfyines uro-, copro-, proto-, in erytrocyten, kwantitatie
proteine c activiteit
proteine c antigeen
proteine s totaal antigeen
proteine s vrij antigeen
hcg kwantitatief uit serum
baarmoederslijmonderzoek op: aspect, ph, varentest en aanwez
sperma onderzoek (uitgebreid), tenminste omvattende bepaling
ijs(je(plas(je-turnover (pit), bepaling van de erytrocyt
acetylglucoseaminidase, n
kinkhoest-serologie (igm + igg)
allergie-onderzoeken, bijzonder (clb-b/clb-c)
antistoffen tegen weefselantigenen, bijzonder (clb-b)
reumafactoren (elisa) (clb-b)
auto-immuunziekten, overige, bijzonder (clb-c)
bloedcelchemie, rood, bijzonder (clb-b)
bloedcelchemie, rood, bijzonder (clb-c)
bloedcelchemie, wit, bijzonder (clb-c)
bloedstollingsfactoren, bijzonder (clb-c)
bloedgroep erytrocytenserologie, bijzonder (clb-b)
bloedgroep erytrocytenserologie, bijzonder (clb-c)
hsa-b27 bevestiging (clb-b)
hla-overnige bijzondere onderzoeken (clb-c)
complementfactoren-immunochemie, bijzonder (clb-c)
imunochemische onderzoeken, bijzonder (clb-b)
imunochemische onderzoeken, bijzonder (clb-c)
imunocytologie onderzoeken, bijzonder (clb-b)
imunocytologie onderzoeken, bijzonder (clb-c)
klinische viro immunologie, bijzonder (clb-b)
79020 klinische viro immunologie, bijzonder (clb-c)
79021 viro immunologie, klinisch, biologische fenotype (clb-c)
79022 immunogenetica, bijzonder (clb-b)
79023 immunogenetica, bijzonder (clb-c)
79024 leucocyten-/trombocytenserologie, bijzonder (clb-c)
79991 ordertarief klinisch-chemische en microbiologische laborator
79992 huisbezoektarief
79993 clb-referentietarief
190255 ordertarief huisartsenlaboratoria
### Appendix J: SAS data mining query code

**Step 1:**

```
PROC SQL;
CREATE TABLE WORK.QUERY_FOR_FACT_CVZ_06_ZKH_MEDSPE AS
SELECT t1.Rubriek_verantwoording_CVZ_code,
      t1.KDE_VRT,
      t1.Soort_Verrichting_Subsoort_Desc,
      t1.AGB_instelling,
      t1.NAM_ZVL,
      t1.AGB_aanvrager,
      t1.Relatienr,
      t1.SAS_DTM_IGG_VRT,
      /* SUM_of_Aantal_vrt */
        (SUM(t1.Aantal_vrt)) FORMAT = COMMAX10.
      AS SUM_of_Aantal_vrt,
      /* SUM_of_Zorgkosten */
        (SUM(t1.Zorgkosten)) FORMAT = COMMAX15.2
      AS SUM_of_Zorgkosten,
      t1.Maand_vrt,
      t1.Kwartaal_vrt
FROM ANA_SLB.FACT_CVZ_06_ZKH_MEDSPEC_2012 AS t1
INNER JOIN WORK.LIJST_VERRICHTINGEN AS t2
ON (t1.KDE_VRT = t2.F1)
GROUP BY t1.Rubriek_verantwoording_CVZ_code, t1.KDE_VRT,
        t1.Soort_Verrichting_Subsoort_Desc, t1.AGB_instelling,
        t1.NAM_ZVL, t1.AGB_aanvrager, t1.Relatienr, t1.SAS_DTM_IGG_VRT,
        t1.Maand_vrt, t1.Kwartaal_vrt;
QUIT;
```

**Step 2:**

```
PROC SQL;
CREATE TABLE WORK.Sint_Elisabeth AS
SELECT DISTINCT t1.Rubriek_verantwoording_CVZ_code,
      t1.KDE_VRT,
      t1.Soort_Verrichting_Subsoort_Desc,
      t1.AGB_instelling,
      t1.NAM_ZVL,
      t1.AGB_aanvrager,
      t1.Relatienr,
      t1.SAS_DTM_IGG_VRT,
      t1.SUM_of_Aantal_vrt,
      t1.SUM_of_Zorgkosten
FROM WORK.QUERY_FOR_FACT_CVZ_06_ZKH_MEDSPE AS t1
INNER JOIN WORK.REGIO_INDELING_ELD AS t2
ON (t1.AGB_instelling = t2.'AGB Nieuw'n)
WHERE t2.Instellingen = 'Sint Elisabeth';
QUIT;
```

Due to confidentiality this appendix is made blank.
Appendix K: List of participants interviews

Laboratories

Table 12: List of laboratory specialists / managers

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drs. F.J.C.M. Bressers</td>
<td>SHL</td>
<td>Concern controller</td>
</tr>
<tr>
<td>Dr. J. J. Keyzer</td>
<td>Diagnostiek voor U</td>
<td>President Board of directors</td>
</tr>
<tr>
<td>Prof. dr. G.C.M. Kusters</td>
<td>Jeroen Bosch Ziekenhuis</td>
<td>Clinical chemist / manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>clinical laboratory</td>
</tr>
<tr>
<td>Dr. L.W.J.J.M. Westerhuis</td>
<td>St. Elisabeth Ziekenhuis</td>
<td>Clinical chemist / manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>clinical laboratory</td>
</tr>
<tr>
<td>T. van Rooij</td>
<td>Bernhoven diagnostisch centrum</td>
<td>Manager</td>
</tr>
<tr>
<td>Dr. H. Russcher</td>
<td>Erasmus MC</td>
<td>Clinical laboratory specialist</td>
</tr>
<tr>
<td>I. van Leeuwen</td>
<td>Mitralis</td>
<td>Manager</td>
</tr>
</tbody>
</table>

General Practitioner

Table 13: List of General Practitioners

<table>
<thead>
<tr>
<th>Name</th>
<th>Place of residency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. S. van Manen</td>
<td>’s Hertogenbosch</td>
</tr>
<tr>
<td>Dr. W.D. Blom</td>
<td>Barendrecht</td>
</tr>
<tr>
<td>Dr. H. Geboers</td>
<td>’s Hertogenbosch</td>
</tr>
<tr>
<td>Dr. G.A.F. Saes</td>
<td>Breda</td>
</tr>
<tr>
<td>Dr. Lombarts</td>
<td>Tilburg</td>
</tr>
</tbody>
</table>
Appendix L: Analysis group codes.
Starting point is the complete list of codes that is presented in appendix L. A division is made in the following 3 groups: ‘Regular’, ‘CLB’ and ‘Expensive’. All NZa codes (in appendix L) that are not mentioned in table 14, are defined in the group ‘Regular’.

Table 14: Analyses groups

<table>
<thead>
<tr>
<th>CLB</th>
<th>Expensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>079001</td>
<td>070001</td>
</tr>
<tr>
<td>079003</td>
<td>070002</td>
</tr>
<tr>
<td>079004</td>
<td>070003</td>
</tr>
<tr>
<td>079005</td>
<td>070004</td>
</tr>
<tr>
<td>079006</td>
<td>070005</td>
</tr>
<tr>
<td>079007</td>
<td>070006</td>
</tr>
<tr>
<td>079008</td>
<td>070007</td>
</tr>
<tr>
<td>079009</td>
<td>071102</td>
</tr>
<tr>
<td>079010</td>
<td>072905</td>
</tr>
<tr>
<td>079011</td>
<td>077093</td>
</tr>
<tr>
<td>079012</td>
<td>079000</td>
</tr>
<tr>
<td>079013</td>
<td></td>
</tr>
<tr>
<td>079014</td>
<td></td>
</tr>
<tr>
<td>079015</td>
<td></td>
</tr>
<tr>
<td>079016</td>
<td></td>
</tr>
<tr>
<td>079017</td>
<td></td>
</tr>
<tr>
<td>079018</td>
<td></td>
</tr>
<tr>
<td>079019</td>
<td></td>
</tr>
<tr>
<td>079020</td>
<td></td>
</tr>
<tr>
<td>079021</td>
<td></td>
</tr>
<tr>
<td>079022</td>
<td></td>
</tr>
<tr>
<td>079023</td>
<td></td>
</tr>
<tr>
<td>079024</td>
<td></td>
</tr>
</tbody>
</table>
Appendix M: Statistical significant difference between laboratories

Statistical difference between Medical Microbiology Research and Clinical laboratory science research

<table>
<thead>
<tr>
<th></th>
<th>MMB</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total_Costs_per_research</td>
<td>1.00</td>
<td>8</td>
<td>132,253</td>
<td>41,6249</td>
<td>14,7166</td>
</tr>
<tr>
<td></td>
<td>.00</td>
<td>92</td>
<td>53,074</td>
<td>24,3261</td>
<td>2,5362</td>
</tr>
</tbody>
</table>

**Figure 27:** Group statistics between MMR and CLSR

### Independent Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variances</th>
<th>t-Test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Total_Costs_per_research</td>
<td>4.190</td>
<td>.043</td>
<td>9.200</td>
</tr>
</tbody>
</table>

**Figure 28:** Independent sample T-test between MMR and CLSR

Statistical difference between GP laboratories and Hospitals

<table>
<thead>
<tr>
<th></th>
<th>GP lab</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total_Costs_per_research</td>
<td>1.00</td>
<td>24</td>
<td>60,938</td>
<td>34,5468</td>
<td>7,0723</td>
</tr>
<tr>
<td></td>
<td>.00</td>
<td>76</td>
<td>58,926</td>
<td>33,5556</td>
<td>3,8491</td>
</tr>
</tbody>
</table>

**Figure 29:** Group statistics between GP laboratories and Hospitals

### Independent Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variances</th>
<th>t-Test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Total_Costs_per_research</td>
<td>2.400</td>
<td>.121</td>
<td>.354</td>
</tr>
</tbody>
</table>

**Figure 30:** Independent sample T-test between GP laboratories and hospitals
**Statistical difference between GP laboratories and Hospitals after filtering out Medical Microbiology laboratories**

### Group Statistics

<table>
<thead>
<tr>
<th>GP lab</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total_Costs_per_research</td>
<td>18</td>
<td>42,538</td>
<td>8,5151</td>
<td>2,0070</td>
</tr>
<tr>
<td>.00</td>
<td>74</td>
<td>55,636</td>
<td>26,2061</td>
<td>3,0464</td>
</tr>
</tbody>
</table>

Figure 31: Group statistics GP laboratories after filtering of MMR laboratories

### Independent Samples Test

<table>
<thead>
<tr>
<th>Levene's Test for Equality of Variances</th>
<th>Hotelling Test for Equality of Means</th>
<th>95% Confidence Interval of the Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Total_Costs_per_research</td>
<td>Equal variances assumed</td>
<td>1.850</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-5.904</td>
<td>82,667</td>
</tr>
</tbody>
</table>

Figure 32: Independent sample T-test between GP laboratories and hospitals after filtering out MMR laboratories

**Explanation different tests**

In the first table the descriptive statistics of the independent t-test statistics of the 2 groups are given. For example in the top row 8 laboratories with a more Medical Microbiological profile had an average cost of €132,26 per research. These 8 laboratories had an standard deviation of 41,62 and a standard error mean of 14,7. The same information is given for laboratories who have a more clinical laboratories in the bottom row (see figure 27).

In the next table (figure 28). You first look at Levene’s test. This test tells if there is an equal variance between these 2 groups. It can be assumed that there is NO equal variance (so variances differ) if Levene’s test is significant (P < 0,05). In this case (figure 28) Levene’s test is significant (P = 0,043) so equal variances can NOT be assumed. We assume that the variances differ and therefore look at the bottom row.

In the bottom row we would like to tell if there is a difference between the average total costs of research performed by MMR laboratories and CLSR laboratories. The difference between the two can be found in de column ‘mean difference’. To determine whether this is a significant difference we want to determine with 95% assurance that this is the case. In this case the independent t-test is significant (P = 0.01). So we can state that there is a significant difference between the (average) costs of a MMR research and that of CLSR.
Appendix N: Regional division of laboratories

Due to confidentiality this appendix is made blank
Appendix O: SAS data mining query code

PROC SQL;
   CREATE TABLE WORK.OVP2012_uitschr_1t1 AS
   SELECT DISTINCT /* uniekeCode */
       (t1.AGB_uitschrijver || t1.Relatienr || t2.'SAN categorie'n || t1.Deel_kdevrt || put(
           t1.SAS_DTM_IGG_VRT, 8.) || put(t1.SAS_DTM_EDE_VRT, 8.)) AS uniekecode,
       t1.AGB_uitschrijver,
       t3.Naam_zvl AS Naam_zvl,
       t3.Naam_Rubriek_Combi,
       t1.Relatienr,
       t2.'SAN categorie'n,
       t2.'Match met ELD lijst Nza 2013'n,
       t1.Deel_kdevrt,
       t2.Soort_Verrichting_Subsoort_Desc LABEL=''
       t1.SAS_DTM_IGG_VRT,
       t1.SAS_DTM_EDE_VRT,
       t1.PDR,
       t1.KDE_KTS,
       t1.Kostenhonorarium_nw,
       /* SUM_of_Aantal_vrt */
       (SUM(t1.Aantal_vrt)) FORMAT=COMMAX10. AS SUM_of_Aantal_vrt,
       /* SUM_of_Zorgkosten */
       (SUM(t1.Zorgkosten)) FORMAT=COMMAX15.2 AS SUM_of_Zorgkosten
   FROM WORK.OVP2012_UITSCHR_EXCORRECTIES AS t1
   INNER JOIN
   WORK.INPUT_ELD_OVP_VERRICHTINGEN__ANA AS t2
   (t1.Deel_kdevrt = t2.Deel_kdevrt) LEFT JOIN
   ANASCH.FACT_ZORGVERLENER_ZVL AS t3
   (t1.AGB_uitschrijver =
       t3.AGB_code)
   WHERE t1.Relatienr NOT = '000000000'
   GROUP BY (CALCULATED uniekecode), t1.AGB_uitschrijver, t3.Naam_zvl,
       'SAN categorie'n, t2.'Match met ELD lijst Nza 2013'n,
       t1.Deel_kdevrt, t2.Soort_Verrichting_Subsoort_Desc,
       t1.SAS_DTM_IGG_VRT, t1.SAS_DTM_EDE_VRT, t1.PDR, t1.KDE_KTS,
       t1.Kostenhonorarium_nw;
QUIT;
Appendix P: LESA Guideline example

Figure 33: Analysis request form in alphabetical order

Figure 34: Problem oriented analysis request form