

## University of Groningen

### Cost and outcome of liver transplantation

van der Hilst, Christian

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*  
2018

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

van der Hilst, C. (2018). *Cost and outcome of liver transplantation*. [Thesis fully internal (DIV), University of Groningen]. Rijksuniversiteit Groningen.

**Copyright**

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

**Take-down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

*Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.*

# **Chapter 2**

## **Aim and Outline of the Thesis**

## 1 INTRODUCTION

For decades, the number of patients on waiting lists for liver transplantation exceeds the supply of donor livers<sup>1</sup>. Waiting time for a suitable donor organ has become longer for individual patients. Consequently, their condition deteriorates leading to mortality and morbidity on the waiting list and an increased chance on inferior post-transplant results. Therefore, donor organ shortage leads to loss of (quality of) life.

The lack of donor availability has forced transplant centers to use all available donor organs optimally. In chapter 1, paragraph 1.8 'Availability of donor organs' elaborates on this subject. The use of donors from the expanded donor pool has consequences. The clinical, organizational, and logistical aspects of liver transplantation have become more complex by the use of livers from the expanded donor pool. Technical variant grafts cause more complications and, certainly in the early years, a higher mortality after liver transplantation than regular grafts<sup>2</sup>. These developments have a substantial impact on the cost of liver transplantation. To proceed with developments and innovations in extended criteria liver transplantation in the Netherlands, a national study was initiated by the National Health Care Institute (formerly known as College voor Zorgverzekeringen; CVZ) and the UMCG. This study was named the CVZ study.

## 2 STRUCTURE OF THE CVZ STUDY

The CVZ study consisted of three parts. The first part was about the legal and insurance prerequisites for the introduction of living donor liver transplantation in the Netherlands. It was mainly focused on the medical and income insurance of the living donor. The results of this part were published in a Dutch journal<sup>3</sup> and were reported to the proper regulating and legislating authorities<sup>4</sup>. This resulted in a Dutch law on financial compensation for living liver donors in 2009. An evaluation of the law concluded that the financial compensation was mostly feasible and effective in 2015<sup>5</sup>. The minister of Health, Welfare and Sport made some amendments which were effectuated in 2016<sup>6</sup>.

The second part of this study was a qualitative ethical study about living donor liver transplantation. It was mainly focused on the screening of potential living donors, the decision making process of acceptance of the donor and patient information. This part of the CVZ study was extensively described in the thesis of Dr. M.E. Knibbe<sup>7</sup>.

In the final part of the CVZ study the focus of research was on implications in terms of cost and outcome of liver transplantation with donor livers from the expanded donor pool. This part of the CVZ study was called the *Cost and Outcome of Liver Transplantation (COLT) study* and part of this study will be described in this thesis.

### 3 AIM OF THE THESIS

The aim of this thesis is twofold. The first aim is to analyze cost-effectiveness of the use of donor livers from the expanded donor pool for liver transplantation. The second aim is to analyze the economic consequences of initiatives to improve the outcome of liver transplantation.

#### 3.1 Part A: Cost-effectiveness of extended criteria donors in liver transplantation

The aim of part I is to assess the cost-effectiveness of liver transplantation with extended criteria donors. First, we try to set an international standard for cost of liver transplantation. In **chapter 3**, the cost of liver transplantation in an international context is presented. In a meta-analysis the cost for liver transplantation in different OECD countries is compared. Almost 6000 liver transplantations from 30 internationally published studies will be used to calculate an international mean cost for liver transplantation and analyzes for explanations for international differences.

Donor livers from so called non-heartbeating donors, meaning donors with circulatory arrest, are one of the most important groups of extended criteria donor livers. **Chapter 4** compares liver transplantations with livers from brain death donors (DBD) to livers from cardiac death donors (DCD). Costs as well as effectiveness in terms of patient and graft survival are taken into account in a full cost-effectiveness study with a cost-effectiveness plane. All Dutch primary, single-organ, non-fulminant liver transplantations in adults during a five-year period will be compared.

**Chapter 5** assesses liver transplantations from DBD donors by comparing different Eurotransplant donor risk index (ET-DRI) scores. A higher ET-DRI score indicates increased donor allograft risk<sup>8</sup>. In this chapter DCD livers are excluded. The influence of DBD graft quality on cost and outcome parameters will be determined.

#### 3.2 Part B: Economic evaluation of initiatives to improve outcome of liver transplantation

Even though liver transplantation is a successful intervention with excellent patient and graft survival, there is still room for improvement. Improvements are usually described in terms of clinical outcome only. This part describes two initiatives for clinical improvement with additional cost analysis.

Blood loss and resulting blood transfusion occur in most liver transplantations, often with undesired side effects like increased morbidity and mortality<sup>9</sup>. In **chapter 6** the use of blood products is reviewed clinically to determine the effect on outcome. **Chapter 7** contains a study in which a cost-effectiveness study is conducted after the results of the clinical study in the previous chapter. In a more recent cohort of patients, the impact on costs and outcome of the use of blood products is examined.

Retransplantation is one of the most costly reinterventions in liver transplantation<sup>10</sup>. Mostly retransplantation is needed due to primary non function or hepatic artery thrombosis (HAT)<sup>11</sup>. Early detection of HAT may reduce mortality and the need for retransplantation and thus save costs. Early detection of this major complication requires intensive radiological surveillance in the early post-transplant phase. Therefore deployment of extra staff and equipment is required. In **chapter 8** a cost study is added to a randomized controlled trial of an implantable continuous Doppler monitoring device for detection of hepatic artery thrombosis after liver transplantation. It is compared with the current method of percutaneous Doppler ultrasound screening.

**Chapter 9** summarizes the previous chapters. The discussion and future perspectives are described with special reference to the possible role of economic evaluations in expensive healthcare interventions.

## REFERENCES

1. Optn.transplant.hrsa.gov. OPTN/UNOS Statistics: The need continues to grow. [cited 2016 June 9]. Available from: <http://optn.transplant.hrsa.gov>.
2. Busuttill RW and Tanaka K. The utility of marginal donors in liver transplantation. *Liver Transpl* 2003;9:651-663.
3. Hubben JH and Slooff MJH. Leverdonor niet langer kind van de rekening: Tegemoetkoming voor medische kosten en gederfde inkomsten [Liver donors no longer foot the bill: Compensation for medical costs and loss of income]. *Ned Tijdschr Geneeskd*. 2010;154:A1820. Dutch.
4. Minister of Health, Welfare and Sport. Regeling: Subsidieregeling donatie bij leven, Stcrt. 2009;97 (May 29, 2009). Dutch.
5. Dijkzeul A, Stutje A, and Vollebregt B. Evaluatie subsidieregeling donatie bij leven: KWINK Groep. 2015 June. Sponsored by the Ministry of Health, Welfare and Sport. Dutch.
6. Minister of Health, Welfare and Sport. Subsidieregeling donatie bij leven. December 17, 2015. 877668-144766-GMT. Dutch.
7. Knibbe ME. Not a matter of choice: ethical perspectives on decision making about living parental liver donation [dissertation]. Groningen (NL): S.I. Publicaties; 2009.
8. Braat AE, Blok JJ, Putter H, Adam R, Burroughs AK, Rahmel AO, Porte RJ, Rogiers X, and Ringers J. The Eurotransplant donor risk index in liver transplantation: ET-DRI. *Am J Transpl* 2012;12:2789-2796.
9. Ramos E, Dalmau A, Sabate A, Lama C, Llado L, Figueras J, and Jaurrieta E. Intraoperative red blood cell transfusion in liver transplantation: influence on patient outcome, prediction of requirements, and measures to reduce them. *Liver Transpl* 2003;9:1320-1327.
10. Azoulay D, Linhares MM, Huguete E, Delvart V, Castaing D, Adam R, Ichai P, Saliba F, Lemoine A, Samuel D, and Bismuth H. Decision for retransplantation of the liver; an experience- and cost-based analysis. *Ann Surg* 2002;236:713-721.
11. Higgins SW. Futility and rationing in liver retransplantation: When and how can we say no? *Journal of Hepatology* 2012;56:1404-1411.





# Part A

Cost-Effectiveness of  
Extended Criteria Donors  
in Liver Transplantation



