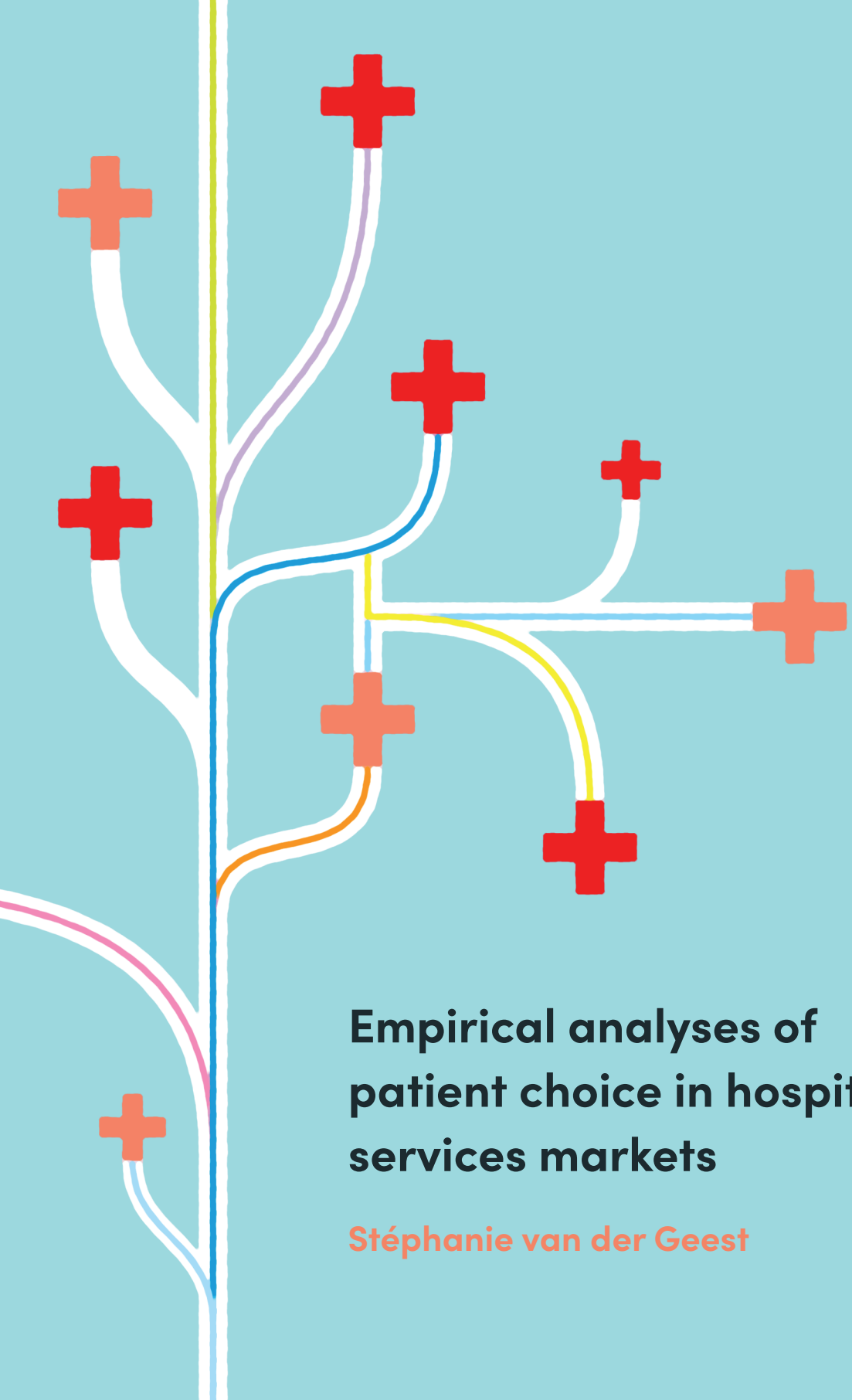

Empirical analyses of patient choice in hospital services markets

Stéphanie van der Geest

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Introduction

1.1 Patient hospital choice

1.1.1 Rationales for promoting patient choice

In Europe, patients' ability to choose *where* to receive publicly financed elective hospital care was historically limited due to regulatory or practical constraints. Information on hospital performance in the public domain was absent and some countries (e.g., England and Norway) had formal restrictions on the set of hospitals available to patients. The referring doctor, usually the general practitioner (GP), simply made the decision on behalf of the patient and most often the patient was sent to a local hospital, regardless of waiting times or service quality (Vrangbæk et al., 2012). Unless the severity of the patient's disease required a referral to a specialist or tertiary hospital located further away.

Over the past decades, however, several European governments have been actively promoting patient hospital choice at the point of referral.[1] Patients have been given comparative information on quality of care and waiting times to support choice and some governments have introduced choice via legislation as a general right for citizens. For example, in England as of late 2005, patients needing elective hospital care are being offered a choice of at least five hospital alternatives at the point of GP referral and information on providers is available that allows comparisons to be made on performance, patient views and distance from home (Thomson and Dixon, 2006; Dixon et al., 2010a). Across European countries, wider choice of hospital is now increasingly common, and patients have more ability to choose where to be treated (Siciliani et al., 2017).

Governments have sought to increase patient hospital choice for varied reasons (Thomson and Dixon, 2006; Dixon et al, 2010a; Vrangbæk et al., 2012). The stated rationales for the introduction of policies to strengthen patient hospital choice do not substantially differ across countries and can be summarized as follows.

First, the right to choose where to be treated is seen as having intrinsic value. Choice empowers patients to personalize care, which contributes to patients' individual liberty. Within the EU, choice of provider is now commonly recognised as a basic patient right and serves as a guiding principle in many health systems (EXPH, 2015). Also, from the

1 Patient choice of treatment modality has also been promoted as patients' participation in health care decision-making can contribute to improved treatment outcomes. Based on a systematic review of empirical studies on the impact of patient engagement in (the delivery of) health care, Bombard et al. (2018) report that most experiences with patient involvement are positive. However, they also conclude that it is not yet known whether patient involvement translates into improved quality of care. An analysis of increased patient involvement in treatment decision-making and the impact of patient choice of treatment modality is beyond the scope of this thesis.

literature it can be concluded that, although certainly not without difficulties (such as the risk of 'choice overload'), patient choice by itself is a 'good thing' (Dixon et al., 2010b).

Second, patient hospital choice has been promoted as a means of reducing waiting times. It would ensure a more efficient use of existing capacity as patients can deliberately choose hospitals with shorter waiting lists. Denmark, the Netherlands, and Portugal, for example, have successfully reduced waiting times by combining patient choice with maximum waiting times and additional financial resources (Siciliani et al., 2014).

Third, and most important from the health economics perspective that is central to this thesis, encouraging patient choice is expected to increase competition among hospitals. When used wisely, competition can be a helpful instrument for improving efficiency in healthcare (Barros et al., 2016). As an example, after empirically studying the procompetitive hospital policy reforms implemented in the English NHS, both Gaynor et al. (2013) and Propper (2018) conclude that competition contributed to better market outcomes.

For competition to work as intended at least three preconditions need to be met: (i) there must be alternatives available, (ii) there must be comparative information on the accessibility and quality of these options and (iii) patient responsiveness to differences in quality across hospital alternatives must be driving hospitals to raise their game in order to attract 'business'.[2,3] In a systematic review of the empirical literature, including 26 studies from six different countries,[4] Aggarwal et al. (2017) find substantial evidence that patients are prepared to travel beyond their nearest hospital for lower waiting times, indicators of better service quality, and access to advanced technology. However, they also report mobility to be lower for older patients and patients with lower socioeconomic backgrounds.

2 The second and third preconditions are particularly important in settings where hospital prices are market determined, rather than regulated by the government, for preventing a fall in quality due to (increased) competition. Based on economic theory, the outcome then depends, among other things, on the nature of competition among hospitals and the relative elasticities of demand with respect to quality and price for different consumers (Gaynor et al., 2015). For the Netherlands, after studying hip replacement readmission rates Roos et al. (2020) found preliminary evidence that permitting price competition among Dutch hospitals did not negatively impact quality.

3 In theory, patient choice can also be used as an instrument for strengthening hospital *price* competition by requiring price disclosure and offering price transparency tools to patients. In practice, however, the overall impact of such tools on patients is found to be weak due to low uptake (Zhang et al., 2020). That is why prices, if not fixed by the government, are typically determined through a bargaining process between third-party payers and hospitals (Douven et al., 2020).

4 These countries are Canada, England, Italy, the Netherlands, Sweden, and the US.

1.1.2 Patient channelling by third-party payers

While governments are promoting patient hospital choice at the point of referral, at the same time third-party payers – negotiating bilaterally with hospitals about the terms of healthcare provision – may want to restrict choice and direct their patients to specific hospitals.[5] Curbing patient choice can be motivated by the fact that shifting patient demand toward the most efficient hospitals has the potential to increase the value of the healthcare system and reduce total costs. Another reason for restricting choice is that through patient channelling payers can effectively make the demand for hospital services more elastic which may enable them to conclude better contracts. Empirical research shows that the ability to channel patients to selected hospitals has a stronger impact than payer size on the discounts that payers can obtain, suggesting that smaller payers can enhance their bargaining leverage as well (e.g., Sorensen, 2003 and Wu, 2009). Hence, the payer's ability to make a credible threat of directing its patients to other hospitals seems to play a critical role in hospital-insurer bargaining.

There are, roughly speaking, three strategies that payers can pursue to channel patients to hospitals that offer lower prices and/or higher quality: (1) provision of information and free advice to enrolees, (2) direct recommendations paired with financial incentives for enrolees, and (3) influencing referral decisions. Each of these strategies is briefly discussed below.

1. Provision of information and free advice to enrolees

Providing easily accessible information on the quality, waiting times and prices of hospital alternatives can guide enrolees needing elective hospital care toward specific hospitals without restricting patient choice of provider. For example, by offering decision support tools (like customer service call teams or patient decision aids) and waiting list mediation services, payers can help patients in making an optimal choice of hospitals. The idea is that better informed patients will make better choices. Without such information, patients would be unable to distinguish between high-value and low-value care.[6]

However, more information is not always better, and the way information is presented can make a difference to how it is used. Intentional framing of information and options, so-called 'nudges', can improve the choices people make (Boyce et al., 2010). One example of 'nudging' patients toward preferred hospital options is to designate groups of

5 Third-party payers in health care are entities reimbursing and managing health care expenses and include insurance companies, governmental payers and, like occasionally in the US, employers.

6 As part of the value-based healthcare (VBHC) concept, insurers have also started to actively use patient-reported data related to outcomes and experiences of care when purchasing health care (Neubert et al., 2020).

hospitals into tiers, based on the quality and/or cost of care. Hospitals in the highest tier that meet the standards set by the payer are then recommended to the patient without any obligation. To affect how patients select hospitals, it is vital that patients trust the information and recommendations provided by the payer. Therefore, it is important that payers are transparent about the criteria used to designate a hospital as their preferred option.

2. Direct recommendations paired with financial incentives for enrolees

When attempting to influence patient choice behaviour, informing, and nudging patients may be less effective than direct recommendations paired with financial incentives. Through their insurance benefit designs, payers have various (theoretical) options to affect patients' provider choices. Introducing patient cost-sharing that differs between preferred and non-preferred options and/or reducing the number of covered hospitals can be used for encouraging patients to seek care from designated high-value hospitals. Without the ambition to be exhaustive, several strategies employed by insurers can be highlighted.

One possibility is to offer consumers an insurance product with a narrow network of contracted hospitals selected from a broad network using cost and quality criteria. This option is used by health insurers in the US, who then not only compete on premiums but also on the breadth and quality of their provider networks (Gaynor et al., 2015; Handel and Ho, 2021). Compared to insurance products with broad networks, those with narrow networks typically offer consumers restricted provider choice in exchange for lower premiums.[7] In a recent paper, Liebman and Panhans (2021) find that three mechanisms are relevant when explaining why narrow network health plans cost less: healthier individuals are more likely to switch to these plans, negotiated prices are lower for these plans, and high-cost providers are more likely to be excluded from the narrow network. Note that, on the downside, next to lower premiums enrolees face the risk of unexpected extra costs. This so-called 'surprise billing' happens when people unknowingly receive care from an out-of-network (non-contracted) hospital. Hence, when opting for a narrow network health plan, enrolees are essentially limited to seeking care from a defined group of hospitals.

7 Markets in which insurance products with (narrow) provider networks are sold to consumers are called option demand markets (Capps et al., 2003). This 'option demand' concept was first introduced by Dranove and White (1996) when discussing the supplier power of medical specialists. It refers to markets in which intermediaries sell choice sets to consumers and consumers select their intermediary before knowing their specific needs. The value that any one consumer places on a given network of providers depends on his expectation of how well the options included in the network will be able to meet his needs.

Rather than restricting patient choice through a narrow network of contracted providers, payers can also opt for offering tiered networks. These are broad networks of hospitals sorted into tiers, ideally based on the cost and quality of the care they provide. To channel patients to hospitals in the higher performing tier payers offer differential out-of-pocket costs per tier (Scanlon et al., 2008; Sinaiko et al., 2014; Frank et al., 2015). Patients that seek care from hospitals designated in the higher tier(s) pay lower cost-sharing amounts at the point of service. These out-of-pocket costs can take the form of co-payments, co-insurance or deductibles and may be subject to out-of-pocket maximums. The type of cost-sharing payment determines how the amount of cost-sharing is calculated.[8] Differential cost-sharing by tier allows the patient to make deliberate trade-offs between hospital choice and the (extra) cost of care.

Another option is a reference-based pricing approach which typically has no in- and out-of-network payment tiers. Reference-based pricing places a limit on the patient's reimbursement based upon some reference point (Williams, 2020). Therefore, the out-of-pocket costs are the difference, if any, between the actual price of the hospital service received and the reference price set.[9] Hence, incentives are created for patients to select lower-priced providers that still offer high quality of care (Robinson et al., 2017). Reference-based pricing is basically a reverse deductible. The payer rather than the enrolee pays the first part of the price, up to the reimbursement limit and the enrolee pays the rest (i.e., a balance billing amount). It allows patients to make a choice, enabling them to weigh the out-of-pocket costs against the benefits of the hospital where they want to be treated. Reference-based pricing may be particularly applied to hospital services that vary substantially in price and are commonly considered to have little variation in quality.

A different category of benefit designs is to have the out-of-pocket costs dependent on obtaining authorization from the payer before receiving care. The denial or approval of care determines the level of coverage for that service. If the care is not authorized, it can have considerable financial implications for enrolees. This mechanism, also called contingent coverage, may also be used to influence patients to seek care at specific providers.

8 Co-payments and deductibles are both fixed amounts, as opposed to coinsurance, which is a percentage of the cost of covered health-related services. In the US health system, the coinsurance percentage is typically applied in addition to a deductible which needs to be paid before the health insurer pays anything.

9 If the payer will only pay for the service at providers who agree to charge the reference price without balance billing, the payer has merely created a narrow network consisting of providers who agree to be paid at or below the reference price amount.

Benefit designs featuring cost differentials for specific hospitals are essentially financial penalties ('sticks') for the use of hospitals designated as lower value by a payer. Financial reward systems, however, can encourage patients to price shop without exposing them to increased out-of-pocket spending. Patients who receive care from designated hospitals are eligible for a reward payment ('a carrot'). Reimbursement of the (extra) travel costs for the patient, and his companion, to ease the inconvenience of possibly greater travel distances may be in some cases a reward as well.[10]

The financial incentives discussed above can vary greatly in how they restrict patient hospital choice at the point of referral. For example, a high cost-sharing program may render an alternative option unaffordable – and thereby no meaningful choice – whereas a reward payment preserves patient choice. Moreover, the level of complexity affected by the design chosen by the payer differs between the financial incentives. Especially, cost-sharing features created to steer patients to specific hospitals can be difficult to understand for enrolees.[11] If the average insured individual has difficulties to determine the amount of out-of-pocket costs in advance, the financial incentive is probably less effective.

3. Influencing referral decisions

The types of channelling instruments discussed so far (i.e., informing, nudging, and offering financial incentives) are directly focused on the patient. When patients exercise their choice after consulting their GP, who often act as gatekeeper, a different strategy to affect how patients select hospitals is influencing the decisions made by their referring doctors. This approach may have great intuitive appeal to payers for channelling patients who lack the ability to process and understand basic information needed to make appropriate health insurance and healthcare decisions. Patients with poor health literacy skills and low health insurance literacy levels usually do not understand both the financial and health implications of health insurance plans. For that reason, they may also distrust the information received from payers. As doctors are typically more trusted than third-party payers, influencing the decisions made by referring doctors is another potential promising channelling strategy to pursue.

10 Also possible are non-monetary rewards as an extra benefit. These benefits are then unrelated to the hospital service at issue, such as an extra health check-up, gift card or another present. Generally, the rewards represent only a small monetary value.

11 See for example the discrete choice experiment conducted by Salampessy et al. (2018) assessing the effect of cost-sharing design characteristics on patients' decisions to adhere to the medical treatment advised by their physician.

By providing comparative performance information about quality, availability, and price of hospital care, payers can support doctors in choosing a hospital best fitted to the patient's needs as well as being within the payer's interests. Additionally, through their contracting practices payers can establish strong financial incentives for referring doctors to only recommend hospitals preferred by the payer to patients. Creating financial incentives for doctors would convert them into "double agents" (Blomqvist, 1991). This means that referring doctors are supposed to act as agents both for the patient and the third-party payer (which has an interest in keeping down the costs to society).

In his paper studying hospital choices for elective hip replacement in the English NHS in 2011/2012, Beckert (2018) shows that GPs responded to some incentives that arose from their other role as agent of health authorities. During this period, local healthcare budgets were controlled by Primary Care Trusts (PCTs); i.e., publicly funded local bodies that purchased hospital services for their local population on behalf of their associated GPs.[12] These budgets were fixed annually and there was some variation in tariffs across hospitals. It was found that GPs as patients' agents selected choice options based on quality, but as agents of health authorities also considered the financial implications of referrals on the PCT's budget.

Benefits versus costs

For each strategy discussed above it should be noted that, next to the potential benefits, substantial costs may be involved. Paying patients financial rewards or lowering the level of cost-sharing if they seek care from designated higher-value hospitals is obviously costly to the payer. Influencing the decisions of referring doctors may require costly implementation of an information system and an incentive program. In a multi-payer system with insurer competition, there is also a risk patients may switch insurer if an insurer chooses to exclude their preferred hospital from its network and limits coverage to contracted hospitals or increases cost-sharing to such an extent that it is perceived as a severe restriction on patient choice. Ultimately, for payers the decision which channelling strategy to pursue, if any, is weighing the costs involved against the benefits of patient channelling. The latter crucially depends on how effective a channelling instrument is in changing patients' choice of hospital. More empirical research in this area is needed.

12 It is worth noting in this regard that during the 1990s the NHS had a fund holding regime. Under the fund holding regime gatekeepers were given a budget and they were only charged for care received by their patients. Hence, GPs could personally benefit from referral decisions. Dusheiko et al. (2006) show that the financial incentives for gatekeepers and the large financial rewards for practices led to a reduction in admission rates.

1.1.3 Less patient choice through centralization of hospital care

From the perspective of patient choice, and the rationales underlying it, the current trend toward centralizing complex hospital care is of particular interest. In response to an increasing number of empirical studies suggesting that hospitals that perform a larger number of certain highly complex surgeries achieve better patient outcomes than hospitals that provide these services less frequently (Mesman et al., 2015), various countries have been implementing minimum volume standards predominantly for highly specialized surgical procedures (Morche et al., 2018). Concentrating these surgical procedures at a few geographically dispersed high-volume units, and thus eliminating low-volume providers, is expected to lead to higher quality of care and lower costs.

Yet centralization or regionalization reduces the number of hospital alternatives for the patient at the point of referral. Similarly, it reduces the number of alternative hospitals with whom third-party payers can negotiate about the price and/or quality of care. This may substantially reduce the amount of hospital competition for certain highly specialized services, which as noted above, policy makers have been using as an instrument to lower prices and improve quality of care.[13] Excessive centralization will stifle the potential benefits of price and/or quality competition among hospitals (Ho et al., 2007). Another consequence of centralization is that it may require patients to travel further for treatment which could widen inequities in access for those less able to travel (Kobayashi et al., 2015; Huguet, 2020). Increased travel times could also lead to less treatment uptake for specific patient groups (Kelly et al., 2016). Policy makers are thus being challenged to find the right balance between the costs and benefits of market competition on the one hand and concentration of complex surgical procedures on the other (Or et al., 2022). To determine the appropriate policy intervention, an assessment of both patient outcomes and cost implications of centralization is needed.

1.2 Patient hospital choice in the Dutch context

The three rationales for strengthening patient hospital choice identified above also apply to the Netherlands.

First, patient choice has become an important policy priority from the perspective of patient empowerment (Kroneman et al., 2016). Through legislation and regulation on rights, complaints, and participation of patients the government has strengthened the

13 This is particularly true since independent treatment centres, which only deliver relatively less complex care to more low-risk patient groups, are not seen as competitors to the hospitals that offer these highly specialized services (ACM, 2021).

position of patients in Dutch healthcare.[14] As a means of patient empowerment, the government is also actively providing information to help patients choose a hospital.

Second, patient choice has been used as a means of shortening waiting times. There is some empirical evidence that patients are indeed willing to travel to more distant hospitals with shorter waiting times (Varkevisser and Van der Geest, 2007; Varkevisser et al., 2010). Increased transparency of hospitals' waiting times has enabled patients, either themselves or through the waiting list mediation services offered by insurers, to make well-considered choices among alternative hospitals (Schut and Varkevisser, 2013).

Third, since the major health system reform in 2006, patient choice is expected to strengthen competition among hospitals (Schut and Varkevisser, 2017; Victoor et al., 2012). Central to this reform were two changes: (i) a transfer of the responsibility for organizing curative health services from the government to insurers and (ii) the introduction of regulated competition among insurers and providers of curative healthcare which resembles the 'managed competition' model described by Enthoven (1993). Within this system, patients are encouraged to actively choose their hospital using the publicly available consumer information about the quality of hospital services. To facilitate patient choice, several policy initiatives have been employed aimed at increasing market transparency, which is an important precondition for competition to produce the desired outcomes (Van de Ven et al., 2013). These initiatives include the mandatory publication of Hospital Standardized Mortality Ratios (HSMRs) and other outcome measures.[15]

To sum up, in the Netherlands patient choice has been promoted both as a goal of itself and as a tool to safeguard and improve accessibility and quality of healthcare within a much broader system in which regulated competition among insurers and providers of curative care is key.

The introduction of regulated (or managed) competition has strengthened the role of market mechanisms in Dutch healthcare. Since mid-2000s wide-ranging reforms

14 For example, patients have the right to be clearly informed about treatments, related risks and alternatives, the right of informed consent for elective treatment and the right to be informed about the qualifications of providers which also means that medical errors must be reported to patients. In addition, patients have different options and pathways to file complaints and can influence for example medical guidelines, insurance policies and management of healthcare institutions through formal representation in councils and other bodies.

15 Making health care quality transparent is a task of the National Health Care Institute (*Zorginstituut Nederland*). Quality standards specify the requirements for data measurement and the available information on quality of care is published in a public database (www.zorginzicht.nl), which everyone can access.

were implemented for this. A fundamental reform of the health insurance system was intended to increase competition among insurers and give private health insurers appropriate incentives to act as prudent purchasers of healthcare for their customers. In addition, health services markets were deregulated and insurer-provider negotiations about price, quality and volume were gradually introduced. Contracts secured with individual health insurers have replaced the former prospective budgeting system with regulated per diem rates that provided hospitals with relatively stable revenue flows.[16] To strengthen competition among providers, insurers have been allowed to contract selectively and thus form narrow provider networks. Patients who visit an out-of-network provider may not be fully reimbursed. As a result of the reforms, insurers are expected to compete for customers on premiums, as well as their scope and quality of the provider networks, while providers are expected to compete on price and quality for inclusion in those networks.

However, in practice Dutch health insurers have hardly been using the possibility of selective contracting, particularly in the hospital sector (Maarse et al., 2016). There are two main reasons for this. First, because of a series of court rulings, insurers cannot substantially limit the reimbursement of non-contracted care. That is, reimbursement is not allowed to be set at a level that makes it unaffordable for individual patients to visit any healthcare provider they want. Consequently, patients who visit an out-of-network provider are almost fully reimbursed making the option of offering narrow networks hardly effective for patient channelling. To overcome this, health insurers in the Netherlands often require their enrolees to obtain authorization before receiving care from a non-contracted provider. Though powerful, this instrument is also very laborious for insurers – for example, every request for authorization must be assessed individually – and it is therefore not likely to remain popular as a patient channelling strategy (Jannink, 2021). Second, insurers suffer from a credible commitment problem. That is, people seem to doubt whether insurers with restrictive networks are committed to provide good quality care (Boonen et al., 2011; Bes et al., 2013, Groenewegen et al., 2019). When discussing the lack of trust in Dutch health insurers' purchasing role, Maarse and Jeurissen (2019) conclude that several factors contribute to this, including a lack of information, a belief that insurers act as profit-driven organisations, critical public communication on insurers' behaviour, and a public fear of insurers interfering in the relationship patients have with their doctor. This public fear of interference has been fuelled by media campaigns of provider associations, such as the VvAA (Van de Ven, 2015).

16 After studying about 900 hospital-insurer contracts in the Netherlands, Gajadien et al. (2023) conclude that between 2013 and 2018 hospitals were exposed to more financial risk. However, they also observe a greater use of ancillary risk-mitigating agreements and multiyear contracts with global budgets.

The lack of trust in health insurers does not only contribute to the low uptake of narrow hospital networks but has an impact on the use of other patient channelling strategies as well. For example, although insurers since 2009 are allowed to waive patients' annual deductible in case they opt for a designated preferred provider within the insurer's broad provider network, this financial incentive is only scarcely used. As an alternative, insurers more frequently try to influence patient choice of provider through the provision of information and free advice.[17] The impact of both types of channelling strategies on patient choice will be empirically assessed in this thesis. More specifically, this involves the tiered provider network with a differential deductible used by health insurer De Friesland Zorgverzekeraar (DFZ) and the public release of a preferred provider label ('TopCare') without any differential cost-sharing by health insurer Menzis.

The general current trend toward centralizing (complex) hospital care, as discussed in Section 1.1.3, is also relevant for patient choice in the Netherlands. Since 2003, when the Health Care Inspectorate for the first time introduced volume indicators for two high-risk interventions (repairs of unruptured abdominal aortic aneurysm and resections for oesophageal carcinoma), more minimum volume standards for complex surgeries have been introduced primarily by the medical professionals (Mesman et al., 2017). For example, the professional associations in cancer care have now published their tenth set of comprehensive norms for all tumour types, including minimum volume standards (SONCOS, 2022). As a result of all standards, the number of low-volume hospitals performing complex (cancer) surgeries has substantially decreased in the Netherlands. The increased volume at the hospital level is associated with a beneficial effect on patient outcomes; see Table 2 in Mesman et al. (2017) for an overview of the relevant empirical literature. However, centralization of surgeries also reduces the number of hospital alternatives and thus has a (potential) impact on patient travel times (Versteeg et al., 2018) and competition among hospitals (Van der Schors et al., 2020).

1.3 Aim and research objectives

As discussed in the previous sections, reinforcing patient choice has become a prominent objective of health policy. This is particularly true for hospital care. As a result, patients' choices are important for the functioning and outcomes of hospital services markets. Therefore, the aim of this thesis is to broaden our understanding of patient choice in hospital services markets by empirically studying relationships between pa-

17 See for example Bes et al. (2018) who evaluate an experiment in which a Dutch health insurer offered its enrolees advice on their choice of physiotherapist when they call customer service. They find this channelling strategy to be successful.

tient choice, hospital quality ratings, patient channelling instruments, and centralization of complex cancer surgery.[18] More specifically, the research objectives of this thesis can be formulated as follows:

1. Investigate patients' sensitivity to quality differences among hospitals as reported in public information sources (*chapter 2*).
2. Investigate whether health insurers can channel patient choice toward high-quality providers by awarding these preferred providers a quality label (*chapter 3*).
3. Investigate whether health insurers can steer patient choice toward high-performing providers by applying a differential deductible (*chapters 4 and 5*).
4. Investigate the impact of centralizing cancer surgery services on patient travel times and equity in access (*chapter 6*).

1.4 Outline of the thesis

After this introductory chapter, this thesis includes five research chapters, each addressing one of the research objectives formulated above, followed by a concluding chapter. All chapters can be read independently, but since the research chapters are written as separate articles for publication in international journals there is some overlap in describing the institutional background.

In **chapter 2**, the relationship between quality of care, hospital reputation and patient hospital choice is examined. Individual patient-level claims data from a former large Dutch health insurer (Agis) including all enrolees admitted to a hospital for non-emergency angioplasty in 2006, are used for estimating a mixed logit model of patients' hospital choices. The estimated coefficients are then used to calculate patients' willingness to travel for better quality of care (i.e., a lower readmission rate) and the expected changes in hospitals' demand after improving their quality.

Chapter 3 examines whether the launch of a quality label (called 'TopCare') by a large Dutch health insurer (Menzis) affected its enrolees' hospital choices for two surgical treatments (breast cancer surgery and inguinal hernia repair). The recommendations from the insurer were not paired with a financial incentive for enrolees. To estimate the effect of the quality label on patients' hospital choices, conditional logit models are specified that control for pre-existing patient preferences. These models are estimated

18 By doing so this thesis contributes to previous PhD research conducted in this area by Boonen (2009), Varkevisser (2009), Victoor (2015), and Bes (2018).

using individual patient choice data obtained from the insurer covering the years before and after the launch of the quality label.

Chapter 4 evaluates the impact of a 1-year natural experiment with patient channelling on providers' market shares. In 2009, the largest regional Dutch health insurer De Friesland Zorgverzekeraar (DFZ) designated preferred providers for two different procedures (cataract surgery and varicose veins treatment) and gave its enrolees a financial incentive for choosing them. That is, patients were exempted from paying their deductible for the cost of care received at providers designated as a preferred provider. Using claims data over the period 2007–2009, a difference-in-difference approach is applied to study the impact of this channelling strategy on the allocation of patients across individual providers. As a follow-up study, **chapter 5** examines the effect of DFZ's differential deductible to steer patient choice of provider in a Dutch regional market for varicose veins treatment in more detail. Using individual patient choice data and information about their out-of-pocket payments covering the year of the experiment and 1 year before, a conditional logit model is estimated that controls for pre-existing patient preferences.

Chapter 6 simulates the impact of centralization of prostate cancer surgery services on travel burden and equity in the English National Health Service (NHS). Using patient-level data on all men undergoing radical prostatectomy in the English NHS in the years 2010 to 2014, three scenarios for centralization of prostate cancer surgery services are considered. The probability of patients travelling to each of the remaining centres is predicted using a conditional logit model of patient choice, based on preferences revealed through actual hospital selections. Multivariable linear regression analyses the impact on travel time according to patient characteristics.

Finally, in **chapter 7** the main conclusions and policy recommendations, based on the findings presented in the preceding chapters, are summarised.

References

ACM (2021), *Verbod van concentratie Bergman Clinics Nederland B.V. en M.K. Health B.V.*, Autoriteit Consument & Markt, Den Haag

Aggarwal, A., D. Lewis, M. Mason, R. Sullivan and J. van der Meulen (2017), Patient mobility for elective secondary health care services in response to patient choice policies: a systematic review, *Medical Care Research and Review*, 74(4): 379-403

Barros, P.P., W.B.F. Brouwer, S. Thomson and M. Varkevisser (2016), Competition among health care providers: helpful or harmful?, *European Journal of Health Economics*, 17(3): 229-233

Beckert, W. (2018), Choice in the presence of experts: The role of general practitioners in patients' hospital choice, *Journal of Health Economics*, 60: 98-117

Bes, R.E. (2018), *Selective contracting by health insurers: the perspective of enrolees*, dissertation, Maastricht University

Bes, R.E., S. Wendel, E.C. Curfs, P.P. Groenewegen and J.D. De Jong (2013), Acceptance of selective contracting: the role of trust in the health insurer, *BMC Health Services Research*, 13: 375

Blomqvist, A. (1991), The doctor as double agent: information asymmetry, health insurance, and medical care, *Journal of Health Economics*, 10(4): 411-432

Bombard, Y., G. Ross Baker, E. Orlando, C. Fancott, P. Bhatia, S. Casalino, K. Onate, J.-L Denis and M.-P Pomey (2018), Engaging patients to improve quality of care: a systematic review, *Implementation Science*, 13(98): 1-22

Boonen, L.H.H.M. (2009), *Consumer channeling in health care: (im)possible?*, dissertation, Erasmus University Rotterdam

Boonen, L.H.H.M. and F.T. Schut (2011), Preferred providers and the credible commitment problem in health insurance: first experiences with the implementation of managed competition in the Dutch health care system, *Health Economics, Policy and Law*, 6(2): 219-235

Boyce, T., A. Dixon, B. Fasolo and E. Reutskaja (2010), *Choosing a high-quality hospital: the role of nudges, scorecard design and information*, London: The King's Fund

Capps, C., D. Dranove and M. Satterthwaite (2003), Competition and market power in option demand markets, *RAND Journal of Economics*, 34(4): 737-763

Dixon, A., R. Robertson and R. Bal (2010a), The experience of implementing choice at point of referral: a comparison of the Netherlands and England, *Health Economics, Policy and Law*, 5(3): 295-317

Dixon, A., R. Robinson, J. Appleby, P. Burge, N. Devlin and H. Magee (2010b), *Patient choice: how patients choose and how providers respond*, London: The King's Fund

Douven, R., M. Burger and F. Schut (2020), Does managed competition constrain hospitals' contract prices? Evidence from the Netherlands, *Health Economics, Policy and Law,* 15(3):341-354

Dranove, D. and W.D. White (1996), Specialization, option demand, and the pricing of medical specialists, *Journal of Economics and Management Strategy*, 5(2): 277-306

Dusheiko, M., H. Gravelle, R. Jacobs and P. Smith (2006), The effect of financial incentives on gatekeeping doctors: evidence from a natural experiment, *Journal of Health Economics*, 25(3): 449–478

Enthoven, A.C. (1993), The history and principles of managed competition, *Health Affairs*, 12(Suppl. 1): 24-48

EXPH (2015), *Report on Investigating policy options regarding competition among providers of health care services in EU Member States*, Expert Panel on effective ways of investing in Health, 7 May 2015

Frank, M.B., J. Hsu, M.B. Landrum and M.E. Chernew (2015), The impact of a tiered network on hospital choice, *Health Services Research*, 50(5): 1628-1648

Gaynor, M., K. Ho and R.J. Town (2015), The industrial organization of health-care markets, *Journal of Economic Literature*, 53(2): 35-284

Gaynor, M., R. Moreno-Serra and C. Propper (2013), Death by market power: reform, competition, and patient outcomes in the National Health Service, *American Economic Journal: Economic Policy*, 5(4): 134-166.

Gajadien, C.S., P.J.G. Dohmen, F. Eijkenaar, F.T. Schut, E.M. van Raaij and R. Heijink (2023), Financial risk allocation and provider incentives in hospital-insurer contracts in the Netherlands, *European Journal of Health Economics*, 24(1): 125-138

Groenewegen, P.P., J. Hansen and J.D. de Jong (2019), Trust in times of health reform, *Health Policy*, 123(3): 281-287

Handel, B.R. and K. Ho (2021), Industrial organization of health care markets, *NBER Working Paper 29137*, Cambridge (MA): National Bureau of Economic Research

Ho, V., R.J. Town and M.J. Heslin (2007), Regionalization versus competition in complex cancer surgery, *Health Economics, Policy and Law*, 2(1): 51-71

Huguet, M. (2020), Centralization of care in high volume hospitals and inequalities in access to care, *Social Science & Medicine*, 260: 113177

Jannink, M.E. (2021), Het machtigingsvereiste: een machtig sturingsinstrument voor zorgverzekeraars?, *Tijdschrift voor Gezondheidsrecht*, (45)4: 390-398

Kelly, C., C. Hulme, T. Farragher and G. Clarke (2016), Are differences in travel time or distance to healthcare for adults in global north countries associated with an impact on health outcomes? A systematic review, *BMJ Open*, 6: e013059

Kobayashi, D., T. Otsubo and Y. Imanaka (2015), The effect of centralization of health care services on travel time and its equality, *Health Policy*, 119(3): 298-306

Kroneman M., W. Boerma, M. van den Berg, P. Groenewegen, J. de Jong and E. van Ginneken (2016), The Netherlands: health system review, *Health Systems in Transition*, 18(2): 1-239

Liebman, E. and M.T Panhans (2021), Why do narrow network plans cost less?, *Health Economics*, 30(10): 2437-2451

Maarse, H. and P. Jeurissen (2019), Low institutional trust in health insurers in Dutch health care, *Health Policy*, 123(3): 288-292

Maarse, H., P. Jeurissen and D. Ruwaard (2016), Results of the market-oriented reform in the Netherlands: a review, *Health Economics, Policy and Law*, 11(2), 161-178

Mesman, R., G.P. Westert, B.J.M.M. Berden and M.J. Faber (2015), Why do high-volume hospitals achieve better outcomes? A systematic review about intermediate factors in volume-outcome relationships, *Health Policy*, 119(8): 1055-1067

Mesman, R., M.J. Faber, B.J.J.M. Berden and G.P. Westert (2017), Evaluation of minimum volume standards for surgery in the Netherlands (2003–2017): A successful policy?, *Health Policy*, 121(12): 1263-1273

Morche, J., D. Renner, B. Pietsch, L. Kaiser, J. Brönneke, S. Gruber and K. Matthias (2018), International comparison of minimum volume standards for hospitals, *Health Policy*, 122(11): 1165-1176

Neubert, A., Ó.B. Fernandes, A. Lucevic, M. Pavlova, L. Gulácsi, P. Baji, N. Klazinga and D. Kringos (2020), Understanding the use of patient-reported data by health care insurers: a scoping review, *PLOS ONE*, December 28, 2020

Or, Z., E. Roccoco, M. Touré and J. Bonastre (2022), Impact of competition versus centralisation of hospital care on process quality: a multilevel analysis of breast cancer surgery in France, *International Journal of Health Policy and Management*, 11(4): 459-469

Propper, C. (2018), Competition in health care: lessons from the English experience, *Health Economics, Policy and Law*, 13(3-4): 492-508

Robinson J., T. Brown and C. Whaley (2017), Reference pricing changes the consumer choice architecture of health care, *Health Affairs*, 36(3): 524-530

Salampessy, B.H., M.M. Alblas, F.R.M. Portrait, X. Koolman and E.J.E. van der Hijden (2018), The effect of cost-sharing design characteristics on use of health care recommended by the treating physician: a discrete choice experiment, *BMC Health Services Research*, 18: 797

Scanlon, D.P., R.C. Lindrooth and J.B. Christianson (2008), Steering patients to safer hospitals? The effect of a tiered hospital network on hospital admissions, *Health Services Research*, 43(5, part 2): 1849-1868

Schut, F.T. and M. Varkevisser (2013), Tackling hospital waiting times: The impact of past and current policies in the Netherlands, *Health Policy*, 113(1-2): 127-133

Schut, F.T. and M. Varkevisser (2017), Competition policy for health care provision in the Netherlands, *Health Policy*, 121(2): 126-133

Siciliani, L., M. Chalkley and H. Gravelle (2017), Policies towards hospital and GP competition in five European countries, *Health Policy*, 121(2): 103-110

Siciliani, L., V. Moran and M. Borowitz (2014), Measuring and comparing health care waiting times in OECD countries, *Health Policy*, 118(3): 292-303

Sinaiko, A.D. and M.B. Rosenthal (2014), The impact of tiered physician networks on patient choices, *Health Services Research*, 49(4): 1348-1363

SONCOS (2022), *Multidisciplinaire normering oncologische zorg in Nederland*, SONCOS Normeringsrapport 10, Stichting Oncologische Samenwerking

Sorensen, A.T. (2003), Insurer-hospital bargaining: negotiated discounts in post-deregulation Connecticut, *Journal of Industrial Economics*, 51(4): 469-490

Thomson, S. and A. Dixon (2006), Choices in health care: the European experience, *Journal of Health Services Research & Policy*, 11(3): 167-171

Van de Ven, W.P.M.M., K. Beck, F. Buchner, E. Schokkaert, F.T. Schut, A. Shmueli and J. Wasem (2013), Preconditions for efficiency and affordability in competitive healthcare markets: Are they fulfilled in Belgium, Germany, Israel, the Netherlands, and Switzerland?, *Health Policy*, 109(3): 226-245

Van de Ven, W.P.M.M. (2015), *Het beste zorgstelsel?*, afscheidscollege, Erasmus Universiteit Rotterdam

Van der Schors, W., R. Kemp and M. Varkevisser (2020), Collaboration and competition policy in a market-based hospital system: a case study from the Netherlands, *Journal of Competition Law and Economics*, 16(2): 262-288

Varkevisser, M. (2009), *Patient choice, competition and antitrust enforcement in Dutch hospital markets*, dissertation, Erasmus University Rotterdam

Varkevisser, M. and S.A. van der Geest (2007), Why do patients bypass the nearest hospital? An empirical analysis for orthopaedic care and neurosurgery in the Netherlands, *European Journal of Health Economics*, 8(3): 287-295

Varkevisser, M., S.A. van der Geest and F.T. Schut (2010), Assessing hospital competition when prices don't matter to patients: the use of time-elasticities, *International Journal of Health Care Finance and Economics*, 10(1): 43-60

Versteeg, S.E., V.K.Y. Ho, S. Siesling and M. Varkevisser (2018), Centralisation of cancer surgery and the impact on patients' travel burden, *Health Policy*, 122(9): 1028-1034

Victoor, A. (2015), *(How) do patients choose a healthcare provider?*, dissertation, Tilburg University

Victoor, A., R.D. Friele, D. M.J. Delnoij and J.J.D.J.M. Rademakers (2012), Free choice of healthcare providers in the Netherlands is both a goal in itself and a precondition: modelling the policy assumptions underlying the promotion of patient choice through documentary analysis and interviews, *BMC Health Services Research*, 12: 441

Vrangbæk, K., R. Robertson, U. Winblad, H. van de Bovenkamp and A. Dixon (2012), Choice policies in Northern European health systems, *Health Economics, Policy and Law*, 7(1): 47-71

Williams, J. (2020), Reference pricing in health care: an inventory of techniques, and practical and policy implications, *Annals of Health Law*, 29(1): 211

Wu, V.Y. (2009), Managed care's price bargaining with hospitals, *Journal of Health Economics*, 28(2): 350-360

Zhang, A., K.-H. Prang, N. Devlin, A. Scott and M. Kehaler (2020), The impact of price transparency on consumers and providers: A scoping review, *Health Policy*, 124(8): 819-825

2

Are quality of care and hospital reputation related to patient choice of hospital? Empirical evidence from the Dutch market for non-emergency angioplasty

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Revised version of M. Varkevisser, S.A. van der Geest and F.T. Schut (2012), Do patients choose hospitals with high quality ratings? Empirical evidence from the market for angioplasty in the Netherlands, Journal of Health Economics, 31(2): 371-378

Abstract

A necessary condition for patient choice policies to promote quality in hospital markets is that patients are sensitive to differences in hospital quality. This paper examines the relationship between quality of care, as measured by readmission rate and pressure ulcers rate, hospital reputation, and patient hospital choice in the Dutch market for non-emergency angioplasty in an early year of public reporting of hospital quality. At the time, readmission rate as an indicator of treatment failure was not adjusted for differences in patient case-mix. Using individual patient-level claims data from a large health insurer to estimate a mixed logit choice model, we find that patients favour hospitals with low readmission rates after treatment for heart failure. Relative to a mean readmission rate of 8.5% we find that a 1%-point lower readmission rate would, on average, increase hospital demand by 12%. In addition, we find that hospitals can attract patients away from rival hospitals by improving their reputation, both overall and for cardiology specifically. Our results suggest that public reporting of quality information can increase the incentives to improve quality of care, but insofar patients base their hospital choice on quality information that is unadjusted for case-mix, it may result in suboptimal choices and risk selection by hospitals.

2.1 Introduction

In various European countries, competition-based healthcare reforms using patient choice have been implemented to improve market outcomes (Cutler, 2002; Barros et al., 2016; Siciliani et al., 2017). In view of this, patients have been given comparative information on the quality of providers to support choice. A necessary condition for patient choice policies to promote quality of healthcare is that patients are sensitive to quality differences among providers. When patients are prepared to travel beyond their nearest choice option for better quality, providers are given an incentive to raise their game to attract patients.

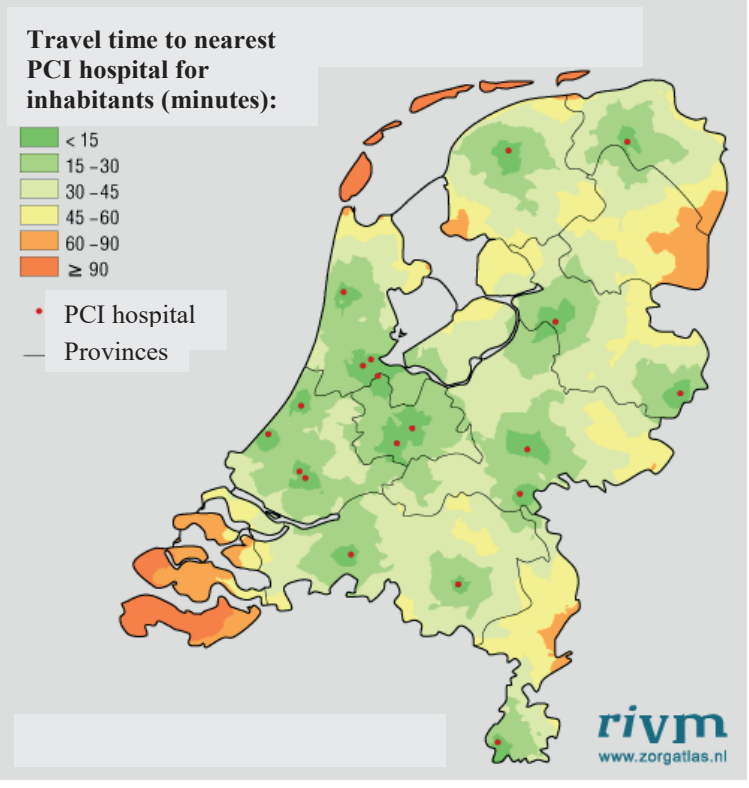
Comparative information on provider quality can take the form of publicly reported clinical outcome measures as well as reputation ranking lists. To maximise the benefits of public reporting, the publicly reported information must be accessible, interpretable, and consistent as public reporting will be of limited value when patients are overwhelmed by confusing and conflicting information (Rothberg et al., 2008). To secure meaningful comparability, particularly when data on outcomes are reported, the reporting also requires adequate patient case-mix adjustment (Marshall et al., 2003). Because inadequate case-mix adjustment poses a risk of providers discriminating against patients who based on certain characteristics are less likely to have a large improvement in health status after treatment. In their seminal study, Dranove et al. (2003) empirically showed that report cards may indeed encourage hospitals to "game" the system by turning away or discouraging higher-risk patients and seeking lower-risk patients.

This paper examines the relationship between quality of care and hospital reputation, and patient hospital choice for non-emergency angioplasty in the Netherlands in the first full year of public reporting of hospital quality. We estimated a mixed logit model of patients' hospital choices using individual patient-level claims data obtained from a large health insurer to test whether angioplasty patients in 2006 preferred higher-quality hospitals, even when considering possible extra travel time. We used the estimated coefficients from the patient choice model to calculate patients' willingness to travel for better quality of care (i.e., a lower readmission rate) and the expected changes in hospitals' demand after improving their quality. We find that patients favour hospitals with low readmission rates after treatment for heart failure and good reputations, both overall and for cardiology specifically. Our results suggest that hospitals can attract patients away from their rivals by raising quality, which is a necessary condition for patient choice policies to improve quality.

2.2 Dutch market for angioplasty

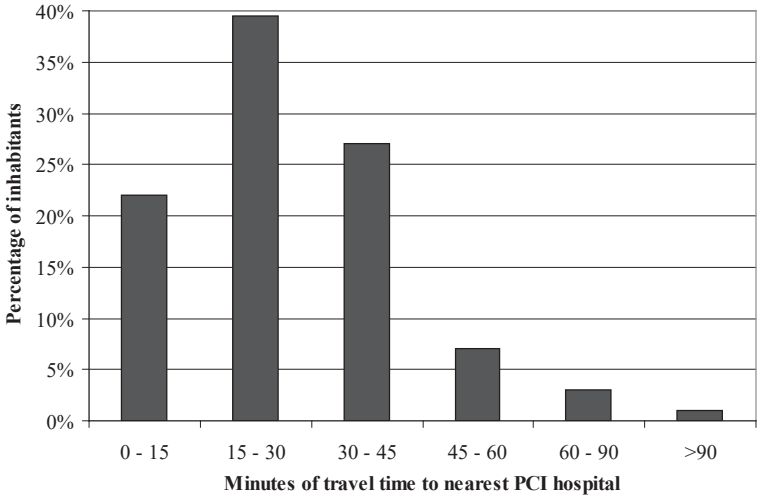
In the Netherlands, hospitals need a government-granted permit to perform percutaneous coronary intervention (PCI), also known as angioplasty. Issuing a restricted number of permits to specific hospitals helps the government to ensure the availability, geographic accessibility, and quality of specialised cardiac procedures. In 2006, around 20% of the general hospitals performed PCI procedures and roughly 95% of the Dutch population could reach at least one of these hospitals within 60 minutes of travel time (Figures 2.1 and 2.2). The costs of angioplasty are reimbursed under the mandatory basic health insurance scheme (Health Insurance Act) and in 2006 hospital payments for this procedure were fixed by government. These fixed prices (including reimbursement for hospital costs and a fixed physician fee but excluding the cost of capital) amounted to €6,400 for outpatient PCI and €9,000 for inpatient PCI.

Figure 2.1 PCI hospitals in the Netherlands (2006)



Note: the longest distance from west to east is 260 kilometres, from north to south the longest distance is 320 kilometres.

Figure 2.2 Travel time to nearest PCI hospital in the Netherlands (2006)



Source: www.zorgatlas.nl

The first indicators of hospital quality were made publicly accessible on the government-sponsored patient-oriented healthcare portal www.KiesBeter.nl (literally: "make better choices"). Patients could use this website to compare hospitals on different sets of quality measures developed by the former Health Care Inspectorate (IGZ), a Dutch government agency now part of the Health and Youth Care Inspectorate (IGJ), in cooperation with stakeholders, such as hospitals and physicians. The sets, published on the Internet with a one-year time lag, included indicators of overall hospital quality and the quality of treatment for specific diseases.

To compare hospitals on the quality of PCI, patients could reference the percentage of heart failure patients readmitted within 12 weeks after discharge as a general indicator of treatment failure. When public reporting started, this indicator was not adjusted for differences in patient case-mix. Another relevant quality indicator available for patients at the time was the hospital-wide percentage of patients with nosocomial pressure ulcers. Pressure ulcers can be extremely painful, cause discomfort and, in some cases, even lead to life-threatening complications. As proper care can prevent them from occurring in the hospital (Reddy et al., 2006), a low percentage of patients with nosocomial pressure ulcers indicates good quality of overall care within the hospital.

In addition to these quality indicators, patients could reference national rankings of hospital reputation. The weekly news magazine *Elsevier* annually made such hospital rankings based on a survey among a sample of general practitioners, medical specialists, residents, nurses, hospital managers, and hospital board members. Each year the hos-

pitals' overall reputation for quality as well as specialty-specific reputations, including cardiology, received a lot of media attention. The rankings and underlying scores were published in the magazine as well as freely available on the Internet.

2.3 Model specification

2.3.1 Patient choice

Our choice model assumes that patients are rational and maximise their utility when choosing a hospital for non-emergency angioplasty.[19] The utility of patient *i* from hospital alternative *j* is specified as:

$$U_{ij} = \delta \cdot t_{ij} + \sum_{k=1}^{n} \gamma_k \cdot H_{kj} + \varepsilon_{ij}$$

where t_{ij} represents travel time between the patient and the hospital and H_{kj} is a vector of hospital *j*'s relevant attributes observed by the patient. The error terms (ε_{ij}) represent the idiosyncratic part of patient *i*'s evaluation of hospital *j* including information obtained by word of mouth and possible prior experience. We assert that patient *i*, given his needs and preferences, will choose hospital *j* when any other hospital in his choice set (N_i) results in lower utility.

Aside from geographic location, hospitals are differentiated by quality of care, reputation, type, and size. Since prices for angioplasty well exceed the out-of-pocket limit set in the Netherlands, out-of-pocket costs are not included in the model. Waiting time was also not a factor when selecting a hospital, because at the time there were no short run capacity constraints resulting in waiting lists for non-emergency PCI (GHR, 2007).

We assume that anticipated utility at a hospital is based on its previous year's quality because relevant information is available only with a one-year lag. The use of lagged quality measures also prevents a simultaneity bias, a potential cause of endogeneity, which would arise if changes in demand affect quality (Gaynor et al., 2005). This would, for example, be the case when higher-volume hospitals have higher quality due to learning by doing. Because demand changes in period *t* cannot affect quality in *t-1*,

19 In the Netherlands, general practitioners (GPs) function as gatekeepers. Patients are free to choose their hospital and most patients choose after advice from or in consultation with their GP. Since GPs do not have a financial incentive to refer patients to specific hospitals, it is not in their financial interest to neglect patients' preferences when advising patients.

the observed variables for quality can be treated as exogenous in our choice model.[20] Another potential problem of endogeneity arises if quality scores are in part determined by systematic selection of patients. Although there was no adjustment for patient characteristics in the calculation of the hospital quality scores used in this study, we do not believe that unobserved patient selection is likely to have biased the quality scores significantly. In 2006, the public reporting of comparative information on hospital quality was just in its infancy. This makes it unlikely that hospitals, if aiming to do so at all, immediately responded by selecting lower-risk patients and turning away higher-risk patients. Furthermore, our approach of using lagged quality measures tackles the concern of endogeneity arising from the effect of choice on quality.

2.3.2 Mixed logit model

Following for example Tay (2003) and Pope (2009), we estimated a mixed logit model of patient hospital choice using individual patient-level data. Mixed logit is a highly flexible model that can approximate any random utility model (McFadden and Train, 2000; Train, 2009) and allows for choice heterogeneity across patients. The vector of coefficients representing the patient's tastes for travel time and hospital attributes are denoted as β and vary with patients in the sample with density $f(\beta)$, which is a function of, for example, the mean and covariance of the βs in the sample. This specification is the same as for the standard logit, except that β varies with patients rather than being fixed. The mixed logit unconditional choice probability is the integral of the conditional choice probability over all possible variables of β_i:

$$Pr_{ij} = \int \left(\frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}} \right) f(\beta)\, d\beta$$

When applying the mixed logit model, the researcher specifies a distribution for the coefficients and then estimates its parameters using maximum simulated likelihood (Hole, 2007).

We assigned a standard normal distribution to the random component of coefficients for university medical centre, prevalence of pressure ulcers, overall reputation, and reputation for cardiology and chose a uniform distribution to model the random coefficient of hospital size.

We assume that the coefficients of travel time and readmission rate are random with a lognormal distribution as both attributes are expected to be disliked by everyone. Since

20 Reputation is also treated as an exogeneous variable since it usually takes years to improve a reputation and changes in demand are therefore unlikely to affect reputation right away.

the lognormal distribution is defined over the positive range and both variables are expected to have a negative sign, they are multiplied by minus one before estimation. The ratio of two independent lognormally distributed terms is also lognormally distributed which allows us to calculate moments for the distribution of patients' willingness to travel to hospitals with lower readmission rates (Train, 2009).

Since a mixed logit model of patients' hospital choices already allows for (unrestricted) choice heterogeneity across patients, we did not include interaction terms of patient characteristics with hospital attributes. Furthermore, our data for the analysis do not include a rich set of patient characteristics, and we are primarily interested in the overall effects of quality ratings on hospital demand rather than knowing how preferences vary among patients with different age and sex. Additionally, among others, Hole (2008) provides empirical evidence that allowing provider attributes to interact with patient characteristics only partially accounts for the taste differences embodied in the data. It is likely that some preference heterogeneity is unrelated to observable patient characteristics, and vice versa.

It should be pointed out that the mixed logit model is a flexible extension of the more traditional conditional logit model (McFadden, 1974) as it does not assume independence of errors across alternatives. However, it does require other restrictive assumptions such as the distribution of the random coefficients. In more recent studies of patient hospital choice, researchers have therefore returned to the conditional logit model (e.g., Gutacker et al., 2016; Van der Geest and Varkevisser, 2019).[21] For that reason, this paper also reports the estimation results of the conditional logit model for comparison.

2.4 Data

Our primary source of data is the Agis Health Database with individual patient-level claims data from health insurer Agis.[22] In 2006, this insurer had around 1.2 million enrolees corresponding to a national market share of 9%. The key geographical market of Agis included both urban (Amsterdam, Utrecht) and rural areas. According to the insurer, samples from this database are representative for the patient population nationally. We obtained all non-emergency angioplasty claims for Agis enrolees in 2006 (n = 2,916).

21 As a recent contribution to the patient hospital choice literature, Raval et al. (2021) show that machine learning models can significantly outperform traditional econometric models, such as the mixed logit and conditional logit models, in predicting patient decisions.

22 In 2007, Agis became a subsidiary company of Achmea that decided to withdraw the brand name Agis from the market in 2014.

These data contain the hospital that provided the surgical operation and some basic patient information such as age, sex, and residential zip code.

Patient's travel time was defined as the fastest route by car from the patient's home to each hospital (in minutes) considering differences in average speed that exist between road types. For each patient, the route was obtained from a database that included all 4-digit zip codes in the Netherlands.[23] To avoid a potential bias caused by outliers, we excluded all patients who travelled more than 60 minutes (n = 142 or 5%). Each patient's choice set (N_i) included all hospitals performing PCI within 60 minutes of travel time, which is a reasonable threshold in the Netherlands, as Figure 2.2 illustrates. Patients with only one hospital option within one hour of travel time (n = 104 or 4%) were excluded as well.

The web-based Dutch National Atlas of Public Health (www.zorgatlas.nl) was used to obtain hospital type (i.e., university medical centre or general hospital) and size (i.e., number of beds). The IGZ provided us with data on hospitals' readmission rates after treatment for heart failure and point prevalence of pressure ulcers.

We used reputation scores from the 2006 *Elsevier* survey among a sample of physicians, nurse practitioners, GPs, and hospital managers.[24] Scores on each hospital's overall reputation were reported on a scale of 1 (very poor) to 10 (excellent). *Elsevier* used a seven-category discrete rating scale to determine a hospital's reputation for cardiology. Scores varied between a maximum of +3 if more than 50% of the respondents compliment the hospital's cardiology department and a minimum of -3 if more than 50% criticise it. The other values +2 (-2), +1 (-1), and 0 represent situations in which 33% (49%), 20% (32%), or <20% of the respondents complimented (criticised) the hospital's cardiology department, respectively.

23 Based on the database's features, the inaccuracy in distance between any two zip codes is at most about 250 meters in urban areas and 1,000 meters in rural areas.

24 Because reputation scores were published in a summer issue of the magazine, we also estimated the mixed logit model with data from the 2005 Elsevier survey as a sensitivity check. Since reputation varied little over time (correlation between 2005 and 2006 was 0.93 and 0.90 for overall reputation and reputation for cardiology, respectively) this did not alter the results.

2.5 Results

2.5.1 Descriptive statistics

Our sample includes 2,670 patients treated with elective angioplasty in 19 hospitals during the period January 2006 to December 2006 (Table 2.1). Their average age is 65 years and 66% are male. Almost 90% of the patient study sample has at least four PCI hospitals in their choice set. On average, patients travelled about 22 minutes to the hospital.

Table 2.1 Descriptive statistics

Variable	Mean	Std. dev.	Minimum	Maximum
Actual travel time (in minutes by car)	22	13	0	60
Patient characteristics (n = 2,670)				
Male	0.66		0	1
Age	65	12	28	95
Hospital attributes (n = 19)				
University medical centre	0.42		0	1
Hospital size (beds)	915	247	550	1,368
Readmission after heart failure[a]	8.5	4.4	3.0	18.0
Pressure ulcers[b]	6.4	2.5	2.3	11.1
Overall reputation[c]	7.2	0.4	6.6	8.0
Reputation for cardiology[d]	2	1	0	3

a. Percentage heart failure patients readmitted to the hospital within 12 weeks after discharge.
b. Point prevalence.
c. Average hospital score on a rating scale from 1 (very poor reputation) to 10 (excellent reputation).
d. Hospital score on a discrete rating scale from -3 (very poor reputation) to 3 (excellent reputation).

Figure 2.3 shows that there is little agreement among the four quality indicators, that were publicly available in 2006, for a single hospital. Hospitals ranked first by one indicator are ranked much lower by another. In addition, it is striking that readmission rate after heart failure was poorly correlated with reputation for cardiology ranking (Table 2.2). This is likely to have complicated patient choice, particularly since no guidance was offered to patients. For example, is it more important to choose a hospital with a low prevalence of pressure ulcers or one that has a good reputation as measured by the *Elsevier* index?

2.5.2 Mixed logit estimation results

Table 2.3 reports the mixed logit regression results for hospital choice of the angioplasty patients in our sample. For 61% of the patient group, the hospital option with the highest probability predicted by the model was the actual hospital choice, suggesting that

Figure 2.3 PCI hospitals' rankings based on four different quality indicators

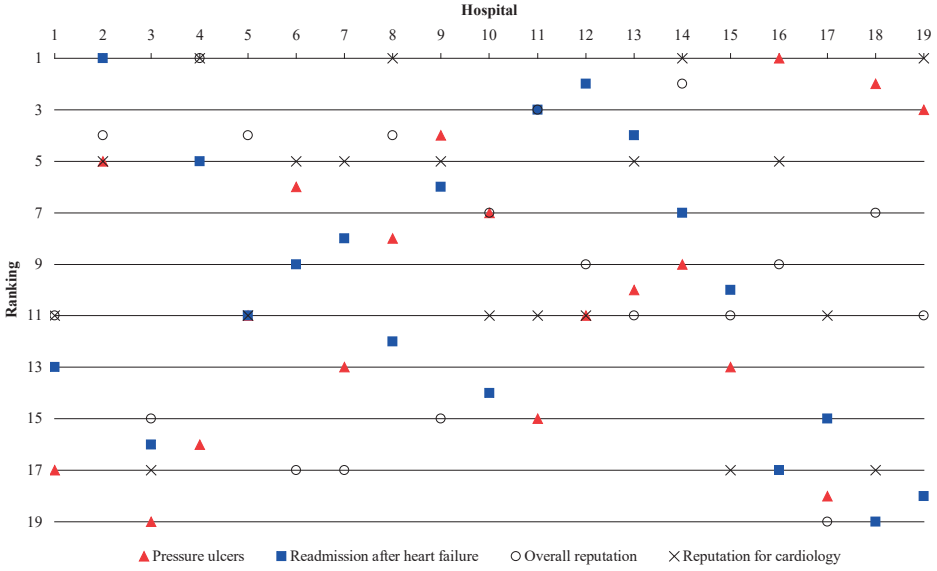


Table 2.2 Correlation between hospital quality ratings

	Pressure ulcers	Readmission after heart failure	Overall reputation	Reputation for cardiology
Pressure ulcers	1.00			
Readmission after heart failure	-0.32	1.00		
Overall reputation	-0.09	-0.21	1.00	
Reputation for cardiology	-0.30	-0.20	0.30	1.00

the estimated choice model fits the data quite good.[25] The estimation results show that, in general, PCI patients prefer hospitals nearby as well as high-quality hospitals in terms of readmission rate and reputation scores. The relationship between hospital-wide prevalence of pressure ulcers and patient choice seems counterintuitive. We find that patients tend to select hospitals with a high rate of pressure ulcers. However, this result may come from a misinterpretation by patients, or the quality measure is inversely correlated with an unobserved hospital attribute that has a positive effect on patient choice.[26]

25 This "hit-or-miss" criterion was first used by Town and Vistnes (2001) to measure their choice model's goodness of fit.

26 Multicollinearity does not seem to be driving this result. The Variance Inflation Factor (VIF) for the pressure ulcers rate variable is 12.47, which by itself does not call for elimination from the analysis (O'Brien, 2007). In addition, estimating the model without the pressure ulcers rate variable did not change the estimated coefficients and simulation results.

Table 2.3 Mixed logit model of patient hospital choice

Variable	Parameter	Value		Std. Error
Travel time	Mean of ln(coefficient)	-1.2807	*	0.0690
	Std. dev. of ln(coefficient)	0.6711	*	0.0750
Readmission rate	Mean of ln(coefficient)	-0.8814	*	0.0883
	Std. dev. of ln(coefficient)	0.0063		0.0737
University medical centre	Mean of coefficient	2.3492	*	0.2767
	Std. dev. of coefficient	0.2158		0.5578
Prevalence of pressure ulcers	Mean of coefficient	0.1622	*	0.0378
	Std. dev. of coefficient	0.0222		0.0382
Overall reputation	Mean of coefficient	1.7033	*	0.3201
	Std. dev. of coefficient	2.6911	*	0.4127
Reputation for cardiology	Mean of coefficient	1.6251	*	0.1470
	Std. dev. of coefficient	1.4375	*	0.1611
Hospital size	Mean coefficient	0.0037	*	0.0006
Number of observations		22,722		
SSL at convergence		-2608.72		

Note: * denotes significance at the 1% level.

The estimated parameters for travel time and readmission rate are the mean m_k and standard deviation sd_k of the natural logarithm of the coefficients. Table 2.4 presents the point estimates of the corresponding coefficients calculated from these estimates and multiplied by minus one to undo the sign change introduced in the estimation process.

Table 2.4 Point estimates of lognormal coefficients

Variable	Median	Mean	Std. dev.
Travel time	-0.2779	-0.3480	-0.2625
Readmission rate	-0.4142	-0.4142	-0.0026

The ratio of a PCI patient's readmission rate coefficient to the travel time coefficient is a measure of the extra time the patient is willing to travel to a hospital with a lower readmission rate (WTT). As discussed above, here the random coefficients for travel time and readmission rate are both given independent lognormal distributions. The ratio of two independent lognormally distributed terms is also lognormally distributed, allowing us to use the means (*m*) and standard deviations (*sd*) estimated from the mixed logit model to derive the WTT distribution (Train, 2009). The mean and standard deviation of WTT

are given by $m_{\text{readmission rate}} - m_{\text{travel time}}$ and $\sqrt{sd^2_{\text{readmission rate}} + sd^2_{\text{travel time}}}$, respectively (Meijer and Rouwendal, 2006).[27]

As a result, the log of the ratio of the readmission rate coefficient to the travel time coefficient has an estimated mean of 0.40 and standard deviation of 0.45. The ratio itself therefore has a median of 1.49, mean of 1.87, and standard deviation of 1.41. Hence, the average willingness to travel for a 1%-point lower readmission rate is about 2 minutes. When compared to the average actual travel time of 22 minutes, this reflects a 9% increase in travel time. From the estimated value of the WTT standard deviation, it follows that variation across individual patients is rather large. The 95% confidence interval has an upper limit of almost 5 minutes and a lower limit close to zero. This suggests that, after weighing the costs of increased travel time against the benefits, only few patients are unwilling to travel for lower readmission rates.

We also find that preferences for reputation vary across patients. Using the estimated mean and standard deviation of the random coefficient, the percentage of patients that places a positive value on a hospital attribute and the percentage that places a negative value can be calculated (Train, 2009). The distribution of the coefficient of a hospital's reputation for cardiology has an estimated mean of 1.63 and estimated standard deviation of 1.44, such that 87% of the patients were above zero and 13% below. This suggests that almost nine out of every ten PCI patients favour an above average reputation for cardiology. Hospitals with an above average overall reputation were preferred by almost three-quarters (74%) of the PCI patients, all else equal.

The estimated standard deviation of the readmission rate coefficient, however, is not statistically significant, implying that the coefficient does not vary between patients. Hence, all else equal, patients prefer hospitals with lower readmission rates to the same extent. The estimated standard deviation of the travel time coefficient is significant which suggests that patients differ in their aversion to travel for angioplasty.

The estimation results for the conditional logit model are reported in the appendix (Table 2.A). Only few of the possible interaction terms are found to be significant indicating that the patient characteristics observed in the data (age, sex) are probably too few and too basic to reveal preference heterogeneity. Overall, the signs and significance of the coefficients are quite similar across the two models.

27 Since in our mixed logit model the coefficients are uncorrelated, the covariance is zero and drops out.

2.6 Effect of a quality improvement on demand

Using the estimated coefficients from the patient choice model, we simulated for each individual hospital the change in hospital demand after improving one quality measure, holding all other attributes constant. Table 2.5 reports the mean effect on hospital demand, averaged over all hospitals, of three quality improvement scenarios.[28]

Table 2.5 Average effect on hospital demand of an increase in reported quality

		Effect on hospital demand			
	Change	Mean	Std. dev.	Min.	Max.
Overall reputation	+1 point	+65%	0.50	+18%	+230%
Reputation for cardiology	+1 point	+53%	0.25	+24%	+100%
Readmission rate	-1%-point	+12%	0.05	+4%	+24%

We find that with a one-point improvement in overall reputation, which equals an average increase of 14%, there would be on average an increase in demand of 65% which would be the equivalent of 92 patients. However, the variation across individual hospitals is substantial: the predicted increase in demand ranges from 18% to 230%. A one-point improvement in reputation for cardiology specifically, which equals an average increase of 50%, would result in an average increase in demand of 53% which would be the equivalent of 75 patients. Again, the variation across hospitals is large. A lower readmission rate is also associated with a substantial increase in hospital demand. Hospital demand would on average increase with 12%, or 19 patients, after a one-point decrease in readmission rate which is similar to an average decrease in readmission after heart failure of 12%. Most of these patients would come from a nearby rival. Across individual hospitals, the impact of a lower readmission rate varies ranging from 4% to 24%.

The geography of the Netherlands is likely to contribute to these strong effects of quality changes on hospitals' market shares. Because the country is small (33,900 km^2), highly urbanised, and one of the most densely populated countries on earth, most patients have multiple hospitals nearby and/or do not have to travel real far to a PCI hospital.

28 It should be borne in mind that it may take years to improve a reputation, while hospitals may be able to change their readmission rates more quickly. This supposition is supported by the fact that both overall reputation and reputation for cardiology specifically are highly correlated between 2005 and 2006 (0.93 and 0.90, respectively). By contrast, the correlation between both years for readmission rate is substantially lower (0.26). Therefore, it is improbable that the simulated improvements in hospital reputation would occur in the short run.

2.7 Conclusion

Using individual patient-level claims data and a mixed logit choice model, we find that in the Dutch market for non-emergency angioplasty patients have a willingness to travel to hospitals with low readmission rates after treatment for heart failure and good reputations, both overall and for cardiology specifically. Thus, PCI hospitals can attempt to attract patients away from rivals by improving these quality measures. Simulations show that relative to a mean readmission rate of 8.5% a 1%-point lower readmission rate would, on average, increase hospital demand by 12%. A change in hospital reputation, both overall and for cardiology, is also associated with a substantial increase in hospital demand. Although we could not establish strict causality between releasing hospital quality ratings and patient choice with our cross-sectional analysis, the results presented in this paper suggest that a necessary condition for patient choice policies to improve quality seems to be fulfilled in this market; i.e., patients are sensitive to quality differences among hospitals.

However, since readmission rates were not adjusted for patient case-mix, hospitals may have been tempted to engage in risk selection to improve their rating. Considering readmission rates unadjusted for case-mix, the finding that patients are more likely to be treated in hospitals with low readmission rates may be particularly relevant if, because of incentive-based health care reforms, competition among hospitals is increasing. In general, to prevent competing hospitals from manipulating their ratings through risk selection public ratings measuring hospital quality should be adjusted for differences in patient case-mix. Otherwise, competition among hospitals through patient choice will not be helpful for improving health care delivery.

If adequate risk-adjustment is not feasible for individual quality measures, an alternative might be to provide a single public measure of hospital quality summarizing a variety of measures across different areas of quality such as mortality, safety of care, readmissions, patient experience, and timeliness and effectiveness of care. Compared to individual quality measures, such a single measure is harder to manipulate for hospitals and an additional advantage could be that patients can then more easily identify differences in quality which would help them to make better choices.

References

Barros, P.P., W.B.F. Brouwer, S. Thomson and M. Varkevisser (2016), Competition among health care providers: helpful or harmful?, *European Journal of Health Economics*, 17(3): 229-233

Cutler, D.M. (2002), Equality, efficiency, and market fundamentals: the dynamics of international medical-care reform, *Journal of Economic Literature*, 40(3): 881-906

Dranove, D., D. Kessler, M. McClellan and M. Satterthwaite (2003), 'Is more information better? The effects of "report cards" on health care providers', *Journal of Political Economy*, 111(3), 555-588

Gaynor, M., H. Seider and W.B. Vogt (2005), The volume-outcome effect, scale economies, and learning-by-doing, *American Economic Review*, 95(2): 243–247

GHR (2007), *Bijzondere interventies aan het hart* [Cardiac interventions], publication no. 2007/01, Health Council of the Netherlands, The Hague

Gutacker, N., L. Siciliani, G. Moscelli and H. Gravelle (2016), Choice of hospital: which type of quality matters?, *Journal of Health Economics*, 50: 230-246

Hole, A.R. (2007), Fitting mixed logit models using maximum simulated likelihood, *The Stata Journal*, 7(3): 388-401

Hole, A.R. (2008), Modelling heterogeneity in patients' preferences for the attributes of a general practitioner appointment, *Journal of Health Economics*, 27(4): 1078-1094

Marshall, M.N., P.G. Shekelle, H.T.O. Davies and P.C. Smith (2003), Public reporting on quality in the United States and the United Kingdom, *Health Affairs*, 22(3): 134-148

McFadden, D. (1974), Conditional logit analysis of qualitative choice behavior, in P. Zarembka (ed.), *Frontiers in Econometrics*, 105-142, Academic Press (New York)

McFadden, D. and K. Train (2000), Mixed MNL models for discrete response, *Journal of Applied Econometrics*, 15(5): 447-470

Meijer, E. and J. Rouwendal (2006), Measuring welfare effects in models with random coefficients, *Journal of Applied Econometrics*, 21(2): 227-244

O'Brien, R.M. (2007), A caution regarding rules of thumb for Variance Inflation Factors, *Quality and Quantity*, 41(5): 673-690

Pope, D.G. (2009), Reacting to rankings: evidence from America's Best Hospitals, *Journal of Health Economics*, 28(6): 1154-1165

Raval, D., T. Rosenbaum and N.E. Wilson (2021), How do machine learning algorithms perform in predicting hospital choices? Evidence from changing environments, *Journal of Health Economics*, 78: 102481

Reddy, M., S.S. Gill and P.A. Rochon (2006), Preventing pressure ulcers: a systematic review, *JAMA*, 296(8): 974-984

Rothberg, M.B., E. Morsi, E.M. Benjamin, P.S. Pekow and P.K. Lindenauer (2008), Choosing the best hospital: the limitations of public quality reporting, *Health Affairs*, 27(6): 1680-1687

Siciliani, L., M. Chalkley and H. Gravelle (2017), Policies towards hospital and GP competition in five European countries, *Health Policy*, 121(2): 103-110

Tay, A. (2003), Assessing competition in hospital care markets: the importance of accounting for quality differentiation, *RAND Journal of Economics*, 34(4): 786-814

Town, R.J. and G. Vistnes (2001), Hospital competition in HMO networks, *Journal of Health Economics*, 20(5): 733-753

Train, K. (2009), *Discrete choice models with simulation*, 2nd edition, Cambridge University Press

Van der Geest, S.A. and M. Varkevisser (2019), Patient responsiveness to a differential deductible: empirical results from The Netherlands, *European Journal of Health Economics*, 20(4): 513-524

Appendix

Table 2.A Conditional logit estimates

	Coefficient		S.E.
Travel time	-0.1702	*	0.0060
University medical centre	2.0383	*	0.2537
Hospital size	0.0003		0.0004
Prevalence of pressure ulcers	0.0988	*	0.0301
Readmission rate	-0.2478	*	0.0255
Overall reputation	0.6782	*	0.2025
Reputation for cardiology	0.8963	*	0.0841
Interacted with **Age <50**			
Travel time	-0.0016		0.0124
University medical centre	0.3238		0.5843
Hospital size	-0.0003		0.0009
Prevalence of pressure ulcers	-0.0793		0.0668
Readmission rate	0.0476		0.0516
Overall reputation	-0.5285		0.4367
Reputation for cardiology	0.1814		0.1938
Interacted with **Age ≥75**			
Travel time	-0.0006		0.0101
University medical centre	-0.3872		0.4388
Hospital size	0.0008		0.0007
Prevalence of pressure ulcers	0.2432	*	0.0610
Readmission rate	-0.1476	*	0.0484
Overall reputation	0.6741	*	0.3428
Reputation for cardiology	-0.0622		0.1415
Interacted with **Female**			
Travel time	0.0146		0.0084
University medical centre	-0.1151		0.3871
Hospital size	-0.0003		0.0006
Prevalence of pressure ulcers	-0.1418	*	0.0462
Readmission rate	0.1220	*	0.0365
Overall reputation	-0.8916	*	0.3000
Reputation for cardiology	0.0625		0.1266
Number of observations	22,722		

Note: * denotes significance at the 5% level.

3

Steering them softly with a quality label? A case study analysis of a patient channelling strategy without financial incentives

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Abstract

Steering patients to lower priced and/or higher quality providers can increase the value of a healthcare system. In a managed care setting, health insurers can use financial incentives to channel their enrolees' healthcare provider choices. However, introducing cost-sharing differences among providers may cause large enrolee discontent and disenrollment. Simply informing and guiding enrolees to preferred providers without financial incentives may therefore be an attractive alternative for individual insurers. But the effectiveness of such a soft channelling strategy is unclear. This paper investigates whether a large Dutch health insurer's strategy of designating preferred hospitals for breast cancer surgery and for inguinal hernia repair affected enrolees' hospital choices. Preferred hospitals received a quality label (called "TopCare") because of their high-quality performances in previous years. The insurer recommended these hospitals to enrolees without an accompanying financial incentive. Using individual patient-level claims data from the insurer over a 5-year period and a conditional logit choice model, which controlled for pre-existing patient preferences, it is found that for both procedures patients *ex ante* already had a certain preference for the hospitals designated by the insurer as top-quality providers, even when considering possible additional travel time, and the quality label did not increase patient demand for the preferred hospitals. Hence, the insurer's strategy to guide a significant additional number of patients to preferred hospital alternatives with the introduction of a quality label alone, proved ineffective.

3.1 Introduction

Shifting patient demand towards the most efficient hospitals has the potential to increase the value of a healthcare system and reduce costs. For that reason, several managed care insurers in the US have used financial incentives to encourage patients to seek care at hospitals that offer lower prices and/or higher quality of care. Empirical evidence from these initiatives suggests that patients' provider choices change when out-of-pocket payments are higher for lower-performing and/or less cost-effective providers (e.g., Frank et al., 2015; Robinson et al., 2017; Whaley et al., 2019a; Prager, 2020).

Although providing financial incentives for seeking healthcare at preferred providers can help an individual insurer in patient channelling, it can also decrease its enrolee population if the introduction of cost-sharing differences among providers causes large enrolee discontent. In such instances, an alternative strategy of informing enrolees about high-value and low-value providers and guiding them to preferred provider options without using financial incentives may be a more attractive strategy to channel patients. This paper examines the effectiveness of such a soft channelling strategy that was pursued by a large health insurer in the Netherlands.

The Dutch healthcare system combines mandatory basic health insurance with regulated competition among both private health insurance companies and providers of curative healthcare services. Competition in the market for basic health insurance is expected to give health insurers appropriate incentives to act as prudent purchasers of healthcare for their customers. To foster efficiency through stronger competition among providers, insurers are attempting to shift patient demand to providers that offer lower prices and/or higher quality of care. In the Netherlands, insurers have two legal options for creating financial incentives to channel their enrolees' healthcare provider choices. The first option is offering consumers an insurance product with a narrow provider network. Enrolees who visit an out-of-network provider may not be fully reimbursed. The second option is creating a two-tiered provider network combined with a differential deductible meaning that the deductible is waived for the cost of care received at providers designated in the highest tier.

However, Dutch health insurers have so far hardly been using both options to create a financial channelling incentive. Main reason for this reluctance is strong consumer resistance against managed care insurance products with differential cost-sharing. In fact, there is a cultural and media backlash against managed care and, against selective contracting particularly (Duijmelinck and Van de Ven, 2016). This managed care backlash, other than in the US, already arose before insurers were offering managed

care insurance products. Even in the last five years, the percentage of consumers opting for one of a handful of insurance products offered nationally with a narrow network of hospitals and no full reimbursement of the cost of treatment delivered by out-of-network hospitals was less than 4% (VWS, 2022). Moreover, a discrete choice experiment quantifying trade-offs between basic health plan characteristics, including the premium discount associated with restricted choice, showed that most people may never opt for health plans with restricted provider choice (Determann et al., 2016).

Another important and plausible reason for the reluctance to use financial channelling incentives is that the cost-sharing difference that can be imposed legally between providers seems insufficient to effectively change patient provider choices (Van der Geest and Varkevisser, 2016; 2019). The difference in out-of-pocket spending that can be created with a differential deductible is limited to the out-of-pocket maximum, which is set very low in the Netherlands compared to other OECD countries. In addition, following Dutch court rulings insurers must reimburse most of the costs of out-of-network providers to guarantee that it is still affordable for patients to visit any provider they want (Schut and Varkevisser, 2017).

This paper provides a case study of a patient channelling strategy pursued by Menzis, a large health insurer in the Netherlands that launched a quality label, called "TopCare", to guide its enrolees in choosing a hospital for breast cancer surgery or inguinal hernia repair by ensuring high quality standards. Our study is an interesting contribution to the existing literature on patient channelling because it analyses whether a channelling strategy without financial incentives was effective in changing enrolees' hospital choices. We estimate a conditional logit model of patient hospital choice using individual claims data from the period before and after the launch of the TopCare label to test whether the insurer persuaded a significant additional number of enrolees to choose a preferred provider through issuing this quality label. We demonstrate that awarding preferred providers alone did not affect enrolees' hospital choices. From a health policy perspective, the results of this paper suggest that a soft channelling strategy without financial incentives is not, per se, effective in shifting patient demand towards high-quality hospitals. This finding is relevant because, as argued above, at least in the Dutch healthcare system, health insurers are reluctant to use financial incentives for patient channelling.

The paper proceeds as follows. First, we provide some background about the insurer's channelling strategy with the TopCare label. Then we describe our empirical methodology, followed by a description of the data used. After this, we present our main results. We conclude with a discussion of our main findings.

3.2 TopCare label

In October 2008, health insurer Menzis launched the TopCare label to guide its enrolees in choosing a hospital for breast cancer surgery or inguinal hernia repair by ensuring high quality standards. At the time, Menzis was the fourth largest health insurer with a national market share of around 13% and regionally the largest in 3 out of 12 provinces. The criteria for awarding the TopCare label were developed by the insurer itself and related to medical quality, waiting times and provision of patient information.

All hospitals performing breast cancer surgery or inguinal hernia repair could apply for the quality label that would be valid for just over 2 years, until December 2010. Awarded hospitals were high performing on the criteria in previous years and therefore designated as the preferred option by Menzis. One of the pros of applying to the quality label was that, if accepted, the hospital would earn a financial bonus provided that certain criteria were also met in the following two years. In addition, applying for the quality label was an opportunity for hospitals to build or enhance their reputation for quality enabling them to increase patient volume.

At the time of the quality label's introduction, in the Netherlands comparative information on quality of care, waiting times and patient satisfaction was not readily available to patients. A quality management programme that was launched by the Dutch government in the early 2002s "lacked effective coordination" and resulted in "a patchwork of initiatives" (Jeurissen and Maarse, 2021) and was therefore not very helpful for facilitating patient hospital choice. Yet parts of this programme were used by the insurer to develop its TopCare label which was intended to inform patients in a succinct way about hospitals' performances on quality and waiting time measures. The quality label basically categorized hospitals into two tiers: excellent high quality and good standard quality. Twenty-one hospitals (23% of all contracted hospitals), geographically spread out across the country, received the TopCare label for breast cancer surgery. Twenty-seven hospitals (29% of all contracted hospitals) also dispersed throughout the country, were awarded as top-quality provider for inguinal hernia repair.

Between 2008 and 2010, Menzis actively informed and educated its enrolees about the TopCare label through marketing materials, distributed both via mail and online. The full list of awarded hospitals was posted on the insurer's website including additional information about the performances of these hospitals. In addition, customer services call scripts were adjusted to guide enrolees who would call with questions, to preferred providers. General practitioners (GPs) were also informed, since a referral by a GP is required to get reimbursed for specialist medical care and Dutch patients are usually

choosing their hospital after advice from or in consultation with their GP (Victoor et al., 2013).

Each awarded hospital also developed its own marketing materials (e.g., advertisements, press releases, brochures) to draw the public's attention to their awardment, aiming to attract more patients. Additionally, the printed media well covered the launch and the awarding of the TopCare label to the preferred hospitals. A search in the LexisNexis Academic database resulted in many national and regional newspaper articles about the insurer's initiative to channel patients.

3.3 Conceptual framework and estimation strategy

Our conceptual model assumes that patient *i* receives one unit of care (i.e., breast cancer surgery or inguinal hernia repair) provided by hospital $j \in J$ at time *t*. When fully informed, patient utility depends on travel time to the hospital, relevant general hospital attributes and possibly the awardment of top-quality provider. Out-of-pocket costs are not included in the model because the insurer does not differentiate patient cost-sharing among hospitals. Moreover, for both procedures all contract prices well exceed the out-of-pocket limit set in the Netherlands. The patient selects the hospital with the highest expected indirect utility among the considered providers.

We used this framework to empirically compare the patient decision making before and after the introduction of the TopCare label. We estimated the effect separately for breast cancer surgery and inguinal hernia repair as follows:

$$Choice_{ijt} = \beta_1 Time_{ij} + \beta_2 X_{jt} + \beta_3 TopCare_j + \beta_4 Post_i \cdot TopCare_j + \varepsilon_{ij}$$

In this expression, $Choice_{ijt}$, is a dummy variable reflecting patient *i* choosing hospital *j* at time *t*. $Time_{ij}$ represents the travel time between the patient and the hospital, while X_{jt} is a vector of hospital attributes (i.e., size, type, and overall reputation). $TopCare_j$ indicates that hospital *j* was one of the hospitals designated as preferred option by the insurer. It enables us to estimate a patient preference for these hospitals even before they were awarded as top-quality provider by the insurer. The key variable of interest is the $Post_i$ x $TopCare_j$ interaction term where $Post_i$ indicates that patient *i* received surgical treatment after the introduction of the quality label. Its coefficient is an estimate of the

impact of the launch of the TopCare label, which occurred in October 2008.[29] The error terms (ε_{ij}) represent the idiosyncratic part of patient *i*'s evaluation of hospital *j* including information obtained by word of mouth and possible prior experience. We estimated each regression as a conditional logit model (McFadden, 1974) which is the standard approach in the patient choice literature (e.g., Beukers et al., 2014; Chou et al., 2014; Ho and Pakes, 2014; Frank et al., 2015; Gutacker et al., 2016, Pitkänen and Linnosmaa, 2021; Martini et al., 2022).

3.4 Data

Our primary source of data consists of all breast cancer surgery and inguinal hernia repair claims for enrolees of Menzis between January 2006 and December 2010. These data contain the date on which the patient was diagnosed, and treatment started as well as the hospital that provided the surgical operation. Some other basic patient information such as age (in ten-year age groups), sex and residential postal code is also included.

Both the sample of breast cancer patients[30] and inguinal hernia patients were restricted to first surgical treatments to avoid a potential bias caused by established patient-physician relationships or referrals to tertiary care hospitals. We thus excluded all claims for a second or third surgical treatment. Patients who suffered from recurring breast cancer and inguinal hernia accounted for 2 percent and 8 percent, respectively, of each patient group. A small number (< 0.5 percent) of inguinal hernia patients who were not treated in a hospital but in a freestanding ambulatory surgery centre, was also excluded. Additionally, we restricted patient choice sets to avoid a potential bias caused by outliers. That is, choice sets included all hospitals within one hour of travel time, which is about three times patients' average travel time for both surgical operations in Dutch healthcare.[31] This sampling leaves a total of 7,985 first-diagnosed breast cancer patients and 17,292 first-diagnosed inguinal hernia patients among the Menzis population across the 2006-10 period. On average, these patients had a choice of 16 hospital options. For both

29 A true causal interpretation of the interaction term would require claims data for a patient group unexposed to the information value of the TopCare label to make a comparison with a control group. However, it is most likely that patients from insurers other than Menzis were also aware of the list of awarded hospitals, because of the broad media coverage in the national and regional press as well as the marketing efforts by awarded hospitals.

30 Breast cancer is most often found in women, but in rare cases men can get breast cancer too. Our study sample only includes female patients.

31 In the sample of breast cancer and inguinal hernia patients less than 2 and 3 percent, respectively, were considered an outlier, because travel time was more than one hour. The few patients with only one hospital option within one hour of travel time were excluded as well.

patient groups, around 45 percent of the observations is from after the introduction of the TopCare label.

For each patient, travel time to all hospitals was retrieved from a matrix containing travel times (in min.) according to the fastest route by car between all 4-digit postal codes in the Netherlands.[32] The web-based Dutch National Atlas of Public Health was used to obtain hospital type and total number of beds. Eight hospitals were identified as university medical centre. Alongside general medical and surgical services (secondary care), these hospitals provide high-quality subspecialist care (tertiary care). None of the university medical centres were awarded as top-quality provider during our study period. We also grouped hospitals according to their total number of beds into the following categories: less than 300 beds (small), 300-800 beds (medium) and over 800 beds (large). Table 3.1 presents the result of this classification. Due to mergers, the total number of hospitals slightly decreased during the 2006-10 period.

Table 3.1 Hospital size

	Small	Medium	Large	Total
2006	16	57	21	94
2007	16	55	22	93
2008	16	55	22	93
2009	14	56	22	92
2010	14	55	22	91

Note: Among the small hospitals is Netherlands Cancer Institute/Antoni van Leeuwenhoek Hospital, a specialty hospital for cancer treatment.

To determine hospitals' overall reputation for quality we used scores from the annual hospital rankings published in magazine *Elsevier* which each year received a lot of media attention. Between 2005 and 2009, a survey among a sample of physicians, nurse practitioners, GPs, and hospital managers, was used to measure overall reputation for quality. Scores were reported on a scale of 1 (very poor) to 5 (very good). In 2010, reputations scores were based on clinical outcome and process indicators and reported on a scale of 1 (poor) to 4 (very good). For each patient, we recorded the overall reputation of all hospitals on the date of diagnosis. Because hospital reputation was measured at different scales throughout the study period, we included two hospital reputation variables in the conditional logit choice model.

32 The drive time matrix also accounts for differences in average speed that exist between different road types.

Table 3.2 displays summary statistics. For both surgical operations, the patient sample groups before and after the launch of the TopCare label have similar demographics. Average travel time to the hospital was also similar for both groups. Table 3.3 shows the geographic regions included in this study. This insurer's patient population was largely concentrated in the mid-Eastern and northern part of the Netherlands (Gelderland, Overijssel, Groningen, Drenthe, and Friesland), but there was also some presence in other parts of the country.

Table 3.2 Descriptive statistics of patient study samples

	Breast cancer		**Inguinal hernia**	
	Before launch TopCare label	After launch TopCare label	Before launch TopCare label	After launch TopCare label
Number of patients	4,428	3,557	9,422	7,870
% female patients	100	100	12	12
% age <20	0	0	14	12
% age 20-39	5	4	12	11
% age 40-59	46	43	33	32
% age >59	49	53	41	45
Average time travelled (in min.)	18	19	19	19

Table 3.3 Geographic distribution of study population (2006-2010) in %

Province	**Breast cancer**	**Inguinal hernia**
Gelderland	32	32
Overijssel	22	21
Groningen	19	17
Drenthe	2	2
Friesland	1	1
Elsewhere	24	27

3.5 Results

Table 3.4 reports the conditional logit regression results for the hospital choice of both breast cancer and inguinal hernia patients. In the second row, we do not find that after the launch of the TopCare label, patient decision-making was different, despite the quality information that was provided through issuing the quality label for preferred hospitals. In both regressions, the coefficient of the *Post x TopCare* interaction term is not statistically significant. Since there are no indications that capacity constraints at the preferred hospitals might have offset the effect of the quality label, these results suggest that the introduction of the TopCare label did not affect enrolees' hospital choices. The

coefficient of the *TopCare* variable, however, is statistically significant. Its positive sign indicates that among patients there already was a certain preference for the group of preferred hospitals, even when considering possible additional travel time, before the insurer designated these hospitals as top-quality provider for breast cancer surgery or inguinal hernia repair.

Table 3.4 Conditional logit estimates of patient hospital choice

Variable	Breast cancer			Inguinal hernia		
	β	Sig.	SE	β	Sig.	SE
TopCare	0.535	**	(0.051)	0.137	**	(0.032)
Post x TopCare	-0.039		(0.075)	-0.074		(0.043)
Time	-0.204	**	(0.002)	-0.187	**	(0.001)
UMC	-0.859	**	(0.061)	-0.901	**	(0.045)
Small hospital	-0.103		(0.068)	-0.399	**	(0.048)
Large hospital	0.484	**	(0.043)	0.464	**	(0.030)
Reputation (based on survey)	-0.043	*	(0.018)	-0.054	**	(0.012)
Reputation (based on indicators)	0.117	**	(0.042)	0.103	**	(0.026)
N. of observations	124,968			278,133		
N. of patients	7,985			17,292		
Correct predicted (%)	73%			72%		

Note: * Significant at the 5 percent level; ** Significant at the 1 percent level.

For 73% and 72% of the breast cancer and inguinal hernia patient group, respectively, the hospital option with the highest probability predicted by the model was the actual hospital choice, suggesting that the estimated choice models fit the data quite good. To further test the accuracy of our model, we predicted the total number of first-diagnosed patients in awarded and non-awarded hospitals by summing up all patients' estimated choice probabilities for preferred and non-preferred hospital choices, respectively. Table 3.5 presents the actual and predicted number of patients broken down by procedure and year. From the figures in the table, it can be observed that the choice models fit the data rather well.

Figure 3.1 plots the percentage of preferred and non-preferred hospital choices really made among the two patient groups over time. It forms descriptive evidence of the fact that the TopCare label did not provide a significant additional number of patients with new information on preferred hospitals to convince them to make a different hospital choice. Since the second quarter of 2008, which is prior to the introduction of the quality label in October 2008, the percentage of preferred hospital choices among breast cancer patients was slightly increasing. However, the proportion of enrolees that chose

a TopCare hospital was decreasing again in the fourth quarter of 2009. In the inguinal hernia patient group, the percentage of preferred hospital choices is also rather stable, fluctuating mildly around 42% throughout the study period.

Table 3.5 Actual and predicted number of first-diagnosed patients in awarded and non-awarded hospitals, by procedure and year

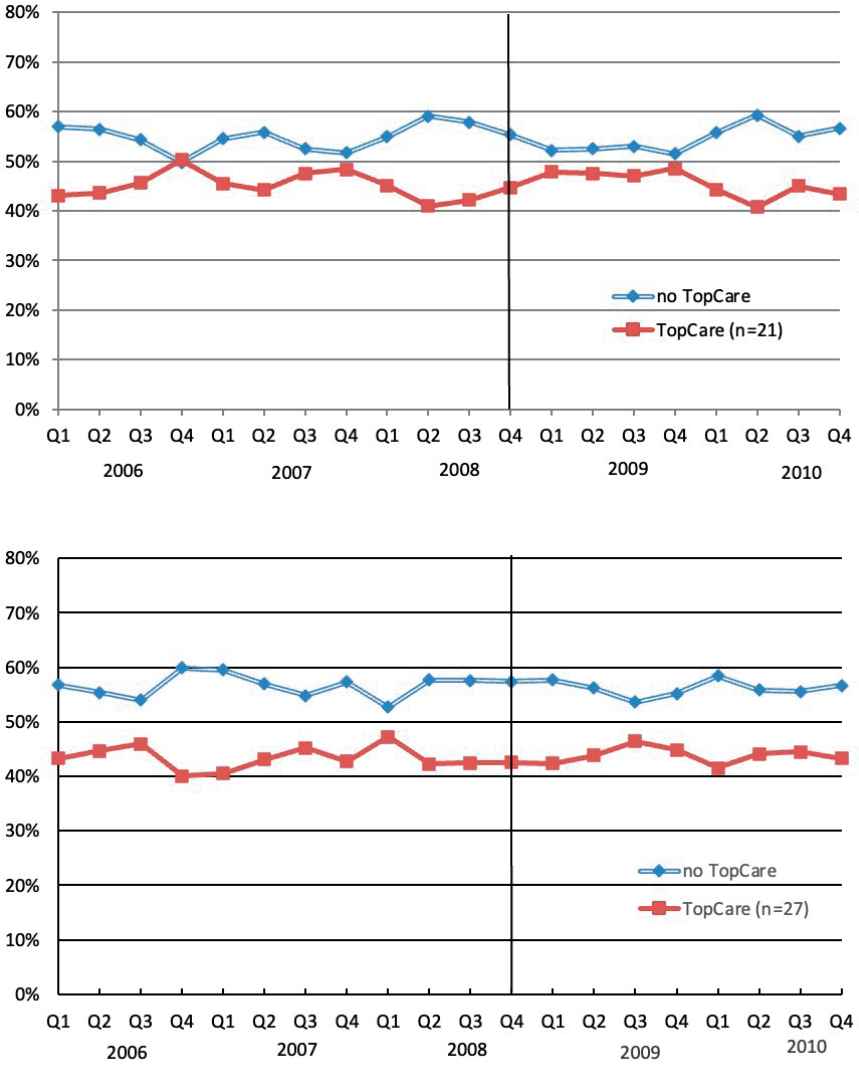
	Actual number of patients		Predicted number of patients	
	Awarded hospitals	Non-awarded hospitals	Awarded hospitals	Non-awarded hospitals
Breast cancer (n=7,985)				
2006	762	906	754	914
2007	764	886	756	894
2008	667	875	690	852
2009	752	824	728	848
2010	671	878	688	861
Inguinal hernia (n=17,292)				
2006	1,516	1,970	1,495	1,991
2007	1,496	1,999	1,511	1,984
2008	1,431	1,839	1,450	1,820
2009	1,594	2,008	1,585	2,017
2010	1,490	1,949	1,486	1,953

3.6 Discussion and conclusion

In the Dutch healthcare system, competing health insurers have been reluctant to use financial incentives for patient channelling. The effectiveness of a soft channelling strategy that is intended to steer enrolees to preferred provider options without exposing them to differential out-of-pocket spending is however unclear. This paper provides a case study in which a large Dutch health insurer developed and introduced a quality label, aggregating various measures across different areas of quality and accessibility, to guide its enrolees in choosing a hospital for breast cancer surgery or inguinal hernia repair.

Using individual patient-level claims data from the insurer over a 5-year period and a conditional logit choice model, which controlled for pre-existing patient preferences, we find that patient decision-making before and after the launch of the TopCare label was not significantly different, despite the quality information that was provided through issuing this quality label for preferred hospitals. We find that among both patient groups there already was a certain preference for the preferred hospitals, even when considering possible additional travel time, before the insurer designated these hospitals as

Figure 3.1 Trends in the proportion of preferred and non-preferred hospital choices made by first-diagnosed breast cancer (upper panel) and inguinal hernia patients (lower panel)



Note: the vertical line represents the launch of the quality label.

top-quality providers for breast cancer surgery or inguinal hernia repair. Patients who went to preferred hospitals perhaps followed the recommendation of their GP, a patient association, or a surgery-experienced patient in their social network. Their recommendations might have been based on private information about hospital quality that was not available to the wider public. To them, the TopCare label probably did not reveal new information but rather confirmed their believes about hospitals' performances on quality and accessibility.

The TopCare label evidently did not result in a significant additional number of patients choosing one of the preferred hospitals for surgical treatment. We hypothesize that after the introduction of the quality label patients did not act upon the information provided to them because they were not persuaded by it and/or not willing to incur possible additional travel time. Considering this, it is interesting to point out that in previous research on the effects of publicly reported hospital quality report cards higher-ranking hospitals also do not consistently experience increases in market share. There is evidence that patients primarily respond to information that differs from prior beliefs in a negative way (Dranove and Sfekas, 2008). Thus, patients might have not responded to the new quality information because it did not explicitly inform them about low-performing hospitals.

A strong and clear financial incentive that would have accompanied the quality label might have persuaded several patients to seek care at a preferred hospital. But, as discussed earlier in the paper, introducing differential out-of-pocket payments among hospitals can backfire for the insurer if it leads to enrolee discontent and disenrollment. As an alternative, insurers may consider a strategy of financially rewarding patients who receive care from preferred hospitals. In the US, employers and insurers are increasingly using financial rewards as nudge to encourage the use of lower-priced providers. Particularly in markets with wide price variation these reward programs have led to large reductions in prices paid for services resulting in substantial net savings (Whaley et al., 2019b; 2022). Whether a strategy of rewards would also be profitable for channelling patients to high-quality providers that are not necessarily lower-priced is unclear, but it may be interesting to explore.

Another plausible reason for patients not acting upon the TopCare label is that some of them might have ignored the new information from Menzis as being not credible. There are various indications that the insured in the Dutch healthcare system have little trust in health insurers' purchasing role (Boonen and Schut, 2011; Bes et al., 2013; Groenewegen et al., 2019; Maarse and Jeurissen, 2019). In fact, health insurers in the Netherlands are still facing the major challenge of building a trust-based relationship with their customers to adequately fulfil their role as active purchaser of healthcare in a system based upon the principles of regulated, or managed, competition (Stolper et al., 2023). Given the fact that over the years people have consistently far more trust in GPs than in health insurers (Meijer et al., 2021), informing and working cooperatively with GPs seems another promising strategy for insurers to steer patients to preferred providers.

A limitation of the paper is obviously that it uses data from a single insurer and captures the implementation of just one patient channelling strategy without financial incentives. While the insurer had a significant market share and its patient population was

geographically dispersed across the country, the results from this study may not be fully generalizable to other insurer populations and soft channelling strategies. Nevertheless, our paper convincingly demonstrates that a soft channelling strategy without financial incentives is not, per se, effective in shifting patient demand towards high-quality hospitals.

References

Bes, R.E., S. Wendel, E.C. Curfs, P.P. Groenewegen and J.D. de Jong (2013), Acceptance of selective contracting: the role of trust in the health insurer, *BMC Health Services Research*, 13: 375

Beukers, P.D.C., R.G.M. Kemp and M. Varkevisser (2014), Patient hospital choice for hip replacement: empirical evidence from the Netherlands, *European Journal of Health Economics*, 15(9): 927-936

Boonen, L.H.H.M. and F.T. Schut (2011), Preferred providers and the credible commitment problem in health insurance: first experiences with the implementation of managed competition in the Dutch health care system, *Health Economics, Policy and Law*, 6(2): 219-235

Chou, S.Y., M.E. Deily, S. Li and Y. Lu (2014), Competition and the impact of online hospital report cards, *Journal of Health Economics*, 34(1): 42-58

Determann D., M.S. Lambooij, E.W. de Bekker-Grob, A.P. Hayen, M. Varkevisser, F.T. Schut and G.A. de Wit (2016), What health plans do people prefer? The trade-off between premium and provider choice, *Social Science & Medicine*, 165: 10-18

Dranove, D. and A. Sfekas (2008), Start spreading the news: a structural estimate of the effects of New York hospital report cards, *Journal of Health Economics*, 27(5): 1201-1207

Duijmelinck, D. and W.P.M.M. van de Ven (2016), What can Europe learn from the managed care backlash in the United States?, *Health Policy*, 120(5): 509-518

Frank. M.B. J. Hsu, M.B. Landrum and M.E. Chernew (2015), The impact of a tiered network on hospital choice, *Health Services Research*, 50(5): 1628-1648

Groenewegen, P.P., J. Hansen and J.D. de Jong (2019), Trust in times of health reform, *Health Policy*, 123(3): 281-287

Gutacker, N., L. Siciliani, G. Moscelli and H. Gravelle (2016), Choice of hospital: which type of quality matters?, *Journal of Health Economics*, 50: 230-246

Ho, K. and A. Pakes (2014), Hospital choices, hospital prices, and financial incentives to physicians, *American Economic Review*, 104(12): 3841-3884

Jeurissen, P. and H. Maarse (2021), *The market reform in Dutch health care: results, lessons and prospects*, Observatory Studies Series, No. 55, European Observatory on Health Systems and Policies (Copenhagen)

Maarse, H. and P. Jeurissen (2019), Low institutional trust in health insurers in Dutch health care, *Health Policy*, 123(3): 288-292

Martini, G., R. Levaggi and D. Spinelli (2022), Is there a bias in patient choices for hospital care? Evidence from three Italian regional health systems, *Health Policy*, 126(7): 668-679

McFadden, D. (1974), Conditional logit analysis of qualitative choice behavior, in P. Zarembka (ed.), *Frontiers in Econometrics*, 105-142, Academic Press (New York)

Meijer, M., A. Brabers and J. de Jong (2021), *Update met cijfers uit 2020: meer vertrouwen in ziekenhuizen, thuiszorg en verpleeghuizen dan in 2018*, Barometer Vertrouwen in de Gezondheidszorg, Nivel (Utrecht)

Pitkänen, V. and I. Linnosmaa (2021), Choice, quality and patients' experience: evidence from a Finnish physiotherapy service, *International Journal of Health Economics and Management*, 21(2): 229-245

Prager, E. (2020), Healthcare demand under simple prices: evidence from tiered hospital networks, *American Economic Journal: Applied Economics*, 12(4): 196-223

Robinson, J.C., T.T. Brown and C. Whaley (2017), Reference pricing changes the 'choice architecture' of health care for consumers, *Health Affairs*, 36(3): 524-530

Schut, F.T. and M. Varkevisser (2017), Competition policy for health care provision in the Netherlands, *Health Policy*, 121(2): 126-133

Stolper, K.C.F., I. Yildirim, L.H.H.M. Boonen, F.T. Schut and M. Varkevisser (2023), *Do consumers perceive and trust health insurers within a system of managed competition as prudent buyers of care?*, EsCHER Working Paper Series, No. 2023006, Erasmus University Rotterdam

Van der Geest, S.A. and M. Varkevisser (2016), Using the deductible for patient channeling: did preferred providers gain patient volume?, *European Journal of Health Economics*, 17(5): 645-652

Van der Geest, S.A. and M. Varkevisser (2019), Patient responsiveness to a differential deductible: empirical results from the Netherlands, *European Journal of Health Economics*, 20(4): 513-524

Victoor, A., J. Noordman, J.A. Sonderkamp, D.M.J. Delnoij, R.D. Friele, S. van Dulmen and J.J.D.J.M. Rademakers (2013), Are patients' preferences regarding the place of treatment heard and addressed at the point of referral: an exploratory study based on observations of GP-patient consultations, *BMC Family Practice*, 14: 189

VWS (2022), *Verzoek om een reactie op het rapport 'De keuze voor en ervaringen met een zorgverzekeringspolis met beperkende voorwaarden'* [in Dutch], Ministry of Health Welfare and Sport, The Hague

Whaley, C.M., T. Brown and J. Robinson (2019a), Consumer responses to price transparency alone versus price transparency combined with reference pricing, *American Journal of Health Economics*, 5(2): 227-249

Whaley, C.M., L. Vu, N. Sood, M.E. Chernew, L. Metcalfe and A. Mehrotra (2019b), Paying patients to switch: impact of a rewards program on choice of providers, prices, and utilization, *Health Affairs*, 38(3): 440-447

Whaley, C., N. Sood, M. Chernew, L. Metcalfe and A. Mehrotra (2022), Paying patients to use lower-priced providers, *Health Services Research*, 57(1): 37-46

4

Using the deductible for patient channelling: did preferred providers gain patient volume?

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Abstract

In market-based health care systems, channelling patients to designated preferred providers can increase payer's bargaining clout, other things being equal. In the unique setting of the Dutch health care system with regulated competition, this paper evaluates the impact of a 1-year natural experiment with patient channelling on providers' market shares. In 2009 a large regional Dutch health insurer designated preferred providers for two different procedures (cataract surgery and varicose veins treatment) and gave its enrolees a positive financial incentive for choosing them. That is, patients were exempted from paying their deductible when they went to a preferred provider. Using claims data over the period 2007–2009, we apply a difference-in-difference approach to study the impact of this channelling strategy on the allocation of patients across individual providers. Our estimation results show that, in the year of the experiment, preferred providers of varicose veins treatment on average experienced a significant increase in patient volume relative to non-preferred providers. However, for cataract surgery no significant effect is found. Possible explanations for the observed difference between both procedures may be the insurer's selection of preferred providers and the design of the channelling incentive resulting in different expected financial benefits for both patient groups.

4.1 Introduction

In several countries, deregulation of pricing and the rise of managed care have led to a market-based health care system in which health care providers typically negotiate contracts separately with each third-party payer.[33] From the perspective of the payer, forming limited or tiered provider networks is a strategic choice to create competition among providers. It may endow the health insurer or other third-party payer with the power to negotiate better deals with providers. The promise of an extra volume of patients may stimulate providers to offer more favourable contract terms (such as price discounts and quality improvements) to the insurer than its competitors do. Sorensen (2003) and Wu (2009) attempted to empirically measure the effect of 'moving market share' to preferred providers on negotiated price discounts. Their findings suggest that health insurers which are better able to channel patients to preferred providers can indeed negotiate better deals with hospitals.

Another health care sector with a similar bargaining setting is the wholesale market for pharmaceuticals. Research by Ellison and Snyder (2010) suggest that negotiated discounts in this industry are sensitive to buyers' abilities to substitute across competing drug products. To influence consumer choice of prescription drugs, health insurers use formularies and financial incentives. For example, patients pay lower or no co-payments when they choose drugs that are preferred by their health insurer. Several studies show that these financial incentives are effective at both changing prescribing patterns and moving market share to preferred drugs (Goldman et al., 2007; Huskamp et al., 2003; Huskamp et al., 2005; Rector et al., 2003).

Other than for prescription drugs, financial incentives are also increasingly used to influence patient choice of health care provider. These incentives include, for example, (i) charging differential co-payments across provider tiers, (ii) requiring percentage coinsurance which automatically tiers providers according to price, or (iii) establishing a reimbursement limit which requires the patient to pay the difference between this limit and the insurer-provider negotiated price (Robinson, 2003; Robinson and MacPherson, 2012).[34] Generally speaking, we expect that channelling patients to preferred health care providers is more difficult than for pharmaceuticals, because of typically less observable differences in clinical and non-clinical quality and patients' distance (travel time) to alternative providers.

33 These countries include, for example, the Netherlands, Switzerland, and the United States.

34 The latter is known as reference pricing and can be interpreted as a reverse deductible. The insurer, rather than the enrolee, pays the first part of the negotiated fee, up to the reimbursement limit, and the enrolee pays the rest.

To date, the health economics literature provides only limited evidence based on real world data, that financial incentives (i.e., cost sharing differences across providers) are effective at encouraging patients to choose preferred providers. Scanlon et al. (2008) examined whether waiving standard coinsurance for patients who chose safer hospitals, at a large manufacturing company headquartered in the Midwest of the United States, changed hospital admissions patterns by estimating patients' probability of choosing a specific hospital. Their findings suggest that the financial incentive significantly influenced patient choice behaviour. Rosenthal et al. (2009) studied the effect of excluding physicians from a preferred provider organization network in the Las Vegas (Nevada) metropolitan area resulting in higher out-of-pocket payments to see an out-of-network physician. They found that this network narrowing indeed reduced the odds of continuing to see an excluded physician. Robinson and Brown (2013) evaluated the impact of an initiative with reference pricing (reimbursement limit) on patient provider choices for orthopaedic surgery in California and concluded that it encouraged patients to select low-price facilities. In a more recent study, Robinson et al. (2015) examined the effect of another reference-based benefit design in California that financially encouraged patients to select lower-price ambulatory surgery centres for cataract surgery instead of hospital outpatient departments. Their results show that the introduction of this benefit design was associated with a significant increase in patients' ambulatory surgery centre use. Using data from health plans in Massachusetts, Sinaiko and Rosenthal (2014) assessed whether tier-rankings had an impact on physician market shares. Overall, they found patients to be quite loyal to physicians. Patients who stayed with their plan year to year were no more likely to switch away from lower-tiered physicians than higher-tiered physicians. The tiering did, however, appear to impact physician market share through the channelling of new patient visits away from the lowest-tiered physicians. Finally, Frank et al. (2015) studied a three-tiered hospital network in Massachusetts employing large differential cost sharing to encourage patients to seek care at hospitals in the preferred tier. Their study shows that the tiered network indeed steered patients toward preferred hospitals for planned admissions.

Outside the context of the US health care system, Boonen et al. (2008) examined how patients responded to incentives used by two Dutch health insurers to influence the choice of pharmacy. Based on the effects found for two natural experiments, they concluded that patients are sensitive to rather small incentives and that temporary incentives may have a long-term effect on provider choice in the market for outpatient prescription drugs.

Related to the empirical studies discussed above, this paper analyses a natural 1-year experiment in which a large regional Dutch health insurer designated preferred providers

for two different procedures: cataract surgery and varicose veins treatment. Its enrolees were given a positive financial incentive for choosing these providers. That is, patients were exempted from paying their deductible when they went to a preferred provider. Using unique 3-year panel data, we took the providers' perspective and examined whether preferred providers gained patient volume relative to non-preferred providers caused by patients acting – at least to some extent – as price sensitive consumers of health care.[35] The paper proceeds as follows. In "Background" the natural experiment is presented in detail. "Data and method" describes both the data and method used for the empirical analysis. In "Results" the estimation results are presented. "Conclusion and discussion" concludes the paper with a discussion of our findings.

4.2 Background

In the Dutch health care system with regulated competition, introduced in 2006, it is mandatory for all citizens to buy standardized basic health insurance covering the costs of common medical care including primary care, hospital services (for up to 1 year), and pharmaceuticals.[36] The premium for basic health insurance is community-rated. Every adult has a mandatory annual deductible (€155 in 2009) that must be met (excluding primary care and maternity care) before medical services are reimbursed by the insurer. Consumers obtain a discount on their premium if they opt for a voluntary deductible (at most €500). These premium discounts may differ by insurer. In addition to the mandatory deductible and any voluntary deductible, enrolees pay a co-payment (a fixed euro amount) for some medical care (e.g., durable medical equipment, certain pharmaceuticals). Overall, from an international perspective, out-of-pocket health care spending in the Netherlands was, in 2009, the lowest of all OECD countries (OECD, 2011).

Competing private health insurers are provided with financial incentives as well as tools to organize and manage acute (curative) care for their enrolees by establishing and maintaining provider networks. Insurers have the legal discretion to engage in selective contracting. That is, they are allowed to form limited provider networks. In 2009, insurers were still very reluctant to limit their provider network for hospital services. Only one very small health plan (13,000 enrolees) provided as of January 2008 access to a limited

35 Note that the patient channelling experiment did not increase the insurer's total patient volume because (i) both procedures were only available to patients after a referral from their general practitioner based on their medical needs, and (ii) patients were legally not allowed to switch health insurer during the year 2009 to have their deductible waived for the procedure.

36 For more detailed information about the Dutch health care system, see for example Schut and Van de Ven (2011) and Schut et al. (2013).

network of hospitals (NZa, 2008). An important explanation for this reluctance was that a vast majority of enrolees did not believe that insurers with restrictive networks were committed to provide good quality care (Boonen and Schut, 2011).[37]

For channelling their enrolees to contracted providers, insurers are legally allowed to use out-of-network cost sharing. A health insurer may require coinsurance to visit a non-contracted provider, discouraging the use of this provider. In addition to selective contracting, insurers are allowed to designate preferred providers within their provider network (i.e., forming tiered provider networks). To encourage patients to visit one of the designated preferred providers, an insurer may decide to waive the annual deductible when they choose to do so. In an attempt to stimulate Dutch health insurers to manage care, they have been permitted by law to apply this positive channelling incentive (i.e., financially rewarding preferred provider choices) since 2009. It provides insurers with another instrument to differentiate cost sharing rates across provider tiers.

In 2009, 15 health insurers, representing about 58% of all Dutch enrolees, used a differential deductible for channelling patients to preferred providers (NZa, 2009). One of these insurers was De Friesland Zorgverzekeraar (DFZ), the largest regional health insurer in the Netherlands with a market share of about 65% in the Dutch province Friesland (or Frisia).[38] At the national level DFZ had a market share of only 3% in 2009 (NZa, 2009).

Starting from January 2009, DFZ designated preferred providers for two medical procedures: cataract surgery and varicose veins treatment. For each procedure a set of providers was recognized as preferred because of above average performance on guideline adherence, waiting time and patient satisfaction. Each set included three hospitals and one freestanding ambulatory surgery centre. The largest hospital in Friesland was selected for both procedures. In the communication to enrolees, it was explained that the preferred providers were carefully selected for reasons of quality. Some positive points for each preferred provider were summed up, such as the fact that a first appointment was possible within 1 or 2 weeks. More detailed information about the selection process was not disclosed. Furthermore, DFZ pointed out that one would be exempted from paying the deductible when visiting a preferred provider. This exemption would concern both the mandatory deductible (€155 in 2009) and, where relevant, the voluntary deductible

37 These sentiments are comparable to the managed care backlash that occurred in the United States during the late 1990s (Blendon et al., 1998; Enthoven and Singer, 1999). However, the difference is that the Dutch backlash had already occurred before managed care was being applied on a large scale.

38 Friesland is a province in the northwest of the Netherlands. Most of Friesland is on the mainland, but it also includes four small islands which are connected to the mainland by ferry. The total land area equals 3349 km^2. Friesland has a total population of 646,000 and a population density of 190 inhabitants /km^2: in 2010 the penultimate population density in the Netherlands.

(at most €500).[39] Since for both procedures the national average of the insurer-provider negotiated prices far exceeds the maximum deductible,[40] the difference in cost-sharing across the two tiers of providers could add up to a maximum of €655. However, the exemption would only apply for cataract surgery or varicose veins treatment. Enrolees still had to pay their annual deductible when using other medical services. With this incentive design, the financial benefit of choosing a preferred provider was different among patient groups. Enrolees who opted for a voluntary deductible in 2009 had a higher potential financial benefit than enrolees with no voluntary deductible. Patients with other medical expenses in 2009 had a small financial benefit or no benefit at all.

In September 2009, DFZ decided to stop using the differential deductible to channel patients as of January 2010 before properly evaluating its effect on the allocation of patients across providers. According to a press release issued by DFZ, the main reason underlying this over-hasty decision was that a majority of enrolees reacted negatively towards the differential deductible. They said that they experienced it as an infringement on their freedom to choose their own provider. Moreover, DFZ admitted that due to a lack of reliable indicators it proved to be very difficult to select providers performing above average on clinical quality. To prevent any negative effects, i.e., losing market share during the open enrolment period in December 2009, DFZ therefore decided rather early to discontinue this financial channelling incentive. Notice that because the experiment did not continue after 1 year, the possibility that patients may have (better) learned about the channelling incentive and its financial benefit in later years was ruled out beforehand.

4.3 Data and method

From DFZ we obtained for both procedures provider claims data for the period January 2007 through December 2009, including the provider name, date of admission and patient's zip code. In this study we only used claims concerning patients residing in Friesland because the overwhelming majority of this health insurer's enrolees reside in this province. For all DFZ enrolees who needed treatment for varicose veins and cataract in 2007–2009 as much as 85 and 93%, respectively, lived in Friesland. Since the upper north-western part of the country is clearly the key geographical market of this insurer, it is not surprising to find that all preferred providers are situated in the north of the Netherlands. Therefore, we focused our analysis on providers in this part of the coun-

39 Some other insurers chose to apply the exemption only for the mandatory deductible.

40 This information is obtained from the website http://www.open disdata.nl/ (accessed on July 17, 2014). DFZ did not provide us with information on their negotiated prices for confidentiality reasons.

try that had a contract with DFZ during each year of the period 2007–2009. For both procedures in the sample period, DFZ did not contract providers selectively. We only included providers which admitted at least one enrolee in each sample year. Annually, these providers accounted for around 98% of the number of Frisian enrolees needing treatment for varicose veins. For cataract surgery this percentage was even closer to 100%.

Our panel of providers delivering cataract surgery to DFZ insured patients contained two ambulatory surgery centres (both in the city of Groningen), one university hospital (also in the city of Groningen) and seven general hospitals. As illustrated in Figure 4.1, four of them were designated as preferred provider. For varicose veins treatment, the provider panel included two ambulatory surgery centres (both located outside the Frisian province in the cities of Alkmaar and Assen), one university hospital (in the city of Groningen) and 9 general hospitals. Three of these providers were designated by the insurer as preferred providers.[41]

Figure 4.1 Location of providers included in the two study samples

Notes: Providers treating varicose veins and cataract are denoted with V and C, respectively. Preferred providers are marked with an *asterisk* (*). The province of Friesland is denoted by the *thick dashed line* to the east and by the sea to the west.

41 The fourth provider designated as preferred provider by DFZ, a general hospital located relatively far away, was not included in our study because none of the Frisian enrolees of DFZ visited this provider in the sample period.

Each study sample contained data on patient volume for each individual provider for the years 2007, 2008, and 2009. To calculate the total number of patients per provider per year we used each patient's first visit in the calendar year for that procedure. About one third of the patients in each study sample required more than one treatment.[42] Because the percentage of these patients choosing different providers was negligible (1.4 and 0.3% for varicose veins and cataract surgery, respectively), patients were included only once to avoid double counting.

Table 4.1 provides the descriptive statistics of the variable patient volume for the two study samples. From this Table it follows that for both procedures, variation in the number of patients across providers was substantial during the 3-year study period.

Table 4.1 Patient volume per year, by study sample

	Varicose veins (*n*=12)			**Cataract** (*n*=10)		
	2007	2008	2009	2007	2008	2009
Mean	162	182	186	297	345	300
Std. dev.	216	248	251	312	359	321
Minimum	1	1	1	2	2	2
Maximum	646	760	798	733	817	845

To study the effect of the preferred provider status on the allocation of patients across providers, we used a difference-in-difference approach. Providers in the sample that were not designated as preferred provider in 2009 served as the control group. Table 4.2 shows for both study samples total patient volume data broken down by preferred provider status and year. As described above, three of the providers in the varicose veins sample were designated preferred provider in 2009 and four providers in the cataract sample. When considering Table 4.2, the most interesting observation is that in the varicose veins sample the preferred providers in 2009 jointly experienced an increase in patient volume, while their non-preferred competitors suffered a decrease in patient volume. In the cataract sample this difference is not observed. In this market the preferred providers and non-preferred providers both suffered a substantial decrease in number of patients, though the percentage loss of patients was slightly smaller for the first group of providers.

To test whether the status of preferred provider on average had a statistically significant impact on patient volume, we estimated two regression models: a fixed-effects model

42 If there are cataracts in both eyes that require surgery, the surgeries are normally not performed at the same time. Also, for people who have varicose veins in both legs, treatment is commonly performed apart.

and a first-difference model. Since these models are both very useful for program evaluation and one is not better than the other (Woolridge, 2008), we used them both to see whether they give the same results.

Table 4.2 Patient volume of preferred providers and non-preferred providers, by study sample

	N	2007	2008	Δ(%)	2009	Δ(%)	Total
Varicose veins							
Preferred providers	3	712	839	+17.8	931	+11.0	2,482
Non-preferred providers	9	1,235	1,343	+8.7	1,297	-3.4	3,875
Total	12	1,947	2,182	+12.1	2,228	+2.1	6,357
Cataract							
Preferred providers	4	2,000	2,311	+15.6	2,016	-12.8	6,327
Non-preferred providers	6	968	1,142	+18.0	987	-13.6	3,097
Total	10	2,968	3,453	+16.3	3,003	-13.0	9,424

In the fixed-effects model, provider fixed effects were included to prevent a bias in the coefficient for preferred provider status resulting from omitted variables. Hence, we used provider fixed effects to remove unobserved variations that were correlated with both preferred provider status and patient volume. The provider fixed effect (a_i), or unobserved provider effect, captured all factors affecting patient volume that were generally time-constant in the 3-year study period. In addition to, for example, the provider's geographical location and its size, these effects also included such attributes as clinical quality and reputation.[43] Similar to Sivey (2012),[44] we used provider fixed effects to improve the validity of the estimate of the preferred provider status coefficient, which was our only interest. The resulting fixed-effects model for patient volume was:[45]

$$Patients_{it} = \beta_1 PREF_{it} + \beta_2 d2008_t + \beta_3 d2009_t + a_i + \varepsilon_{it}$$

where *i* denotes different providers and *t* denotes year of admission (2007, 2008 or 2009). Hence, the total number of observations is 36 and 30 for the study sample varicose veins and cataract, respectively. The vector *a* includes the provider fixed effects. The variables

43 At the individual provider level, overall reputation (as measured by a popular Dutch news magazine) was indeed strongly correlated over the 3-year time period. The availability of public information about clinical quality was very limited in the sample period.

44 In his study, Sivey (2012) examined patient hospital choice for cataract surgery in the United Kingdom, concentrating on the trade-off between travel time and waiting time.

45 This model is similar to the equation used by Cutler et al. (2004) examining whether quality report cards in New York State and Pennsylvania affected the distribution of patients across individual providers of bypass surgery. Wang et al. (2011) adopted a similar estimation strategy when examining the impact of report cards on providers' patient volume in the market for bypass surgery in Pennsylvania.

d2008 and d2009 are dummy variables for 2008 and 2009, respectively. The key independent variable is whether in the year of the experiment a provider was designated as preferred provider (PREF). The estimated coefficient β_1 represents the average change in patient volume for the preferred providers compared to the non-preferred providers, other things being equal.

In the first-differenced equation each variable is differenced over time. As a result, the provider fixed effects (a_i) drop out. This gives:

$$\Delta Patients_{it} = \beta_1 \Delta PREF_{it} + \beta_2 \Delta d2008_t + \beta_3 \Delta d2009_t + \Delta \varepsilon_{it}$$

where *i* again denotes different providers and *t* now refers to either 2008 or 2009. Hence, the total number of observations used for estimating the first-differenced equation is 24 and 20 for the study sample varicose veins and cataract, respectively. As explained above, again our primary interest is in coefficient β_1.

4.4 Results

The top set of Table 4.3 shows the results of the fixed-effects estimation. The bottom set of results is based on the first-difference equation.

The fixed-effects results indicate that the preferred provider status had a significant effect on the allocation of patients across providers treating varicose veins. For this treatment, being designated as preferred provider was, on average, associated with an increase of 51 varicose veins patients per year. The average preferred provider treats about 276 patients per year, so for this hypothetical provider the percentage change in volume was about 18%. The coefficient on d2008 indicates that total patient volume (i.e., aggregated for all providers) substantially increased from 2007 to 2008.

The estimate in the first-difference equation also suggests that preferred provider status on average increased patient volume, but it is not statistically significant (*p* value = 0.11). This may be the result of the decreased sample size. Again, the intercept for 2008 in this model shows that patient volume increased significantly for all providers in this year. Based on the R^2 it can be concluded that the fixed-effects estimation better explains the observed variation in providers' patient volume when compared to the first-difference equation.

In contrast to the impact on providers treating varicose veins, the preferred provider status does not seem to increase patient volume for preferred providers of cataract surgery. The coefficient on the preferred provider status variable is in both model specifications not statistically different from zero.

Table 4.3 Fixed-effects and first-difference estimation of patient volume equation

	Varicose veins			Cataract		
	β	Sig.	S.E	β	Sig.	S.E
Fixed-effects						
PREF	50.94	**	20.10	-23.54		31.05
d2008	19.58	*	10.05	48.50	**	17.57
d2009	10.68		11.24	12.92		21.51
Constant	162.25	***	7.11	296.80	***	12.42
Obs.	36			30		
R^2	0.38			0.37		
First-difference						
ΔPREF	35.78		21.51	-47.92		37.82
Δd2008	19.58	**	9.31	48.50	**	18.53
Δd2009	14.47		14.22	22.67		30.25
Obs.	24			20		
R^2	0.26			0.46		

The intercept reported in the fixed-effects estimation is the average of the provider-specific intercepts (a_i)
* $p = 0.1$; ** $p = 0.05$; *** $p = 0.01$

4.5 Conclusion and discussion

Forming preferred provider networks may increase an insurer's bargaining clout if designating preferred providers has a significant effect on the allocation of patients across individual providers. The results from our analysis, using claims data from a unique natural experiment where enrolees from a large regional Dutch health insurer were exempted from paying their deductible if they went to a preferred provider, suggest that this strategy can be effective in changing the allocation of patients across providers. We found evidence that preferred providers of varicose veins treatment on average experienced a significant increase in patient volume relative to non-preferred providers. However, for cataract surgery no significant effect was found. We can think of two possible reasons for the observed difference in effectiveness between both procedures.

First, in the year prior to the experiment, the joint market share of the preferred providers for varicose veins treatment (38%) was substantially smaller than the joint market share of the preferred providers for cataract surgery (67%). Other things being equal, the

higher this joint market share, the lower the percentage of patients expected to change from non-preferred to preferred providers in 2009. As a result of the insurer's selection of preferred providers, the potential number of cataract patients not yet choosing a preferred provider was simply much smaller than for varicose veins patients, which provides an ex ante explanation for the observed difference in the channelling strategy's effectiveness between both procedures.

Second, the expected financial benefit associated with choosing a preferred provider may have been higher for varicose veins patients than for cataract patients. Due to the design of the channelling incentive, the deductible exemption was only relevant for cataract surgery or varicose veins treatment. According to data provided by the insurer, the group of varicose veins patients was on average much younger than the cataract patient group (51 and 73 years, respectively). Consequently, given that health care expenditures increase with age, we expect varicose veins patients to have, on average, lower expenses for other medical services than cataract patients. Hence, their probability of exceeding the annual deductible was likely to be lower and the expected financial benefit of choosing a preferred provider therefore higher. This potential effect may have been strengthened by the fact that 3 times as many varicose veins patients as cataract patients opted for a voluntary deductible additional to the mandatory one in 2009 (2.1 and 0.7%, respectively). As a result, there are reasons to assume that the differential deductible was more effective as a channelling instrument for varicose veins patients than for cataract patients.

In summary, our results suggest that the insurer's patient channelling experiment in 2009 changed the allocation of varicose veins patients across providers. That is, a significant increase in patient volume for preferred providers treating varicose veins was found. However, whether this increase was sufficient to strengthen the bargaining power of the insurer, resulting in lower prices and/or better quality, is an interesting empirical question that unfortunately cannot be answered with the available data. Future research should focus on the extent to which insurers' channelling strategies motivate health care providers to improve their performance.

References

Blendon, R.J., M. Brodie, J.M. Benson, D.E. Altman, L. Levitt, T. Hoff and L. Hugick (1998), Understanding the managed care backlash, *Health Affairs*, 17(4): 80–94

Boonen, L.H.H.M. and F.T. Schut (2011), Preferred providers and the credible commitment problem in health insurance: first experiences with the implementation of managed competition in the Dutch health care system, *Health Economics, Policy and Law*, 6(2): 219–235

Boonen, L.H.H.M., F.T. Schut and X. Koolman (2008), Consumer channeling by health insurers: natural experiments with preferred providers in the Dutch pharmacy market, *Health Economics*, 17(3): 299–316

Cutler, D.M., R.S. Huckman and M.B. Landrum (2004), The role of information in medical markets: an analysis of publicly reported outcomes in cardiac surgery, *American Economic Review*, 94(2): 342–346

Ellison, S.F. and C.M. Snyder (2010), Countervailing power in wholesale pharmaceuticals, *Journal of Industrial Economics*, 58(1): 32–53

Enthoven, A.C. and S.J. Singer (1999), Unrealistic expectations born of defective institutions, *Journal of Health Politics, Policy and Law*, 24(5): 931–939

Frank, M.B., J. Hsu, M.B. Landrum and M.E. Chernew (2015), The impact of a tiered network on hospital choice, *Health Services Research*, 50(5): 1628–1648

Goldman, D.P., G.F. Joyce and Y. Zheng (2007), Prescription drug cost sharing: associations with medication and medical utilization and spending and health, *JAMA*, 298(1): 61–69

Huskamp, H.A., P.A. Deverka, A.M. Epstein, R.S. Epstein, K.A. McGuigan and R.G. Frank (2003), The effect of incentive-based formularies on prescription-drug utilization and spending, *New England Journal of Medicine*, 349(23): 2224–2232

Huskamp, H.A., R.G. Frank, K.A. McGuigan and Y. Zhang (2005), The impact of a three-tier formulary on demand response for prescription drugs, *Journal of Economics & Management Strategy*, 14(3): 729–753

NZa (2008), *Monitor Zorgverzekeringsmarkt 2008*, Nederlandse Zorgautoriteit (Dutch Healthcare Authority), Utrecht

NZa (2009), *Monitor Zorgverzekeringsmarkt 2009*, Nederlandse Zorgautoriteit (Dutch Healthcare Authority), Utrecht

OECD (2011), *Health at a glance 2011: OECD indicators*, OECD Publishing

Rector, T.S., M.D. Finch, P.M. Danzon, M.V. Pauly and B.S. Manda (2003), Effect of tiered prescription copayments on the use of preferred brand medications, *Medical Care*, 41(3): 398–406

Robinson, J.C. (2003), Hospital tiers in health insurance: balancing consumer choice with financial incentives, *Health Affairs*, Web Exclusives, W3: 135-146

Robinson, J.C. and K. MacPherson (2012), Payers test reference pricing and centers of excellence to steer patients to low-price and high-quality providers, *Health Affairs*, 31(9): 2028–2036

Robinson, J.C. and T.T. Brown (2013), Increases in consumer cost sharing redirect patient volumes and reduce hospital prices for orthopedic surgery, *Health Affairs*, 32(8): 1392–1397

Robinson, J.C., T. Brown and C. Whaley (2015), Reference-based benefit design changes consumers' choices and employers' payments for ambulatory surgery, *Health Affairs*, 34(3): 415–422

Rosenthal, M.B., Z. Li and A. Milstein (2009), Do patients continue to see physicians who are removed from a PPO network?, *American Journal of Managed Care*, 15(10): 713–719

Scanlon, D.P., R.C. Lindrooth and J.B. Christianson (2008), The effect of a tiered hospital network on hospital admissions, *Health Services Research*, 43(5): 1849–1868

Schut, E., S. Sorbe and J. Høj (2013), *Health care reform and long-term care in the Netherlands*, OECD Economics Department Working Papers, No. 1010, OECD Publishing

Schut, F.T. and W.P.M.M. van de Ven (2011), Effects of purchaser competition in the Dutch health system: is the glass half full or half empty?, *Health Economics, Policy and Law*, 6(1): 109–123

Sinaiko, A.D. and M.B. Rosenthal (2014), The impact of tiered physician networks on patient choices, *Health Services Research*, 49(4): 1348–1363

Sivey, P. (2012), The effect of waiting time and distance on hospital choice for English cataract patients, *Health Economics*, 21(4): 444–456

Sorensen, A.T. (2003), Insurer-hospital bargaining: negotiated discounts in post-deregulation Connecticut, *Journal of Industrial Economics*, 51(4): 469–490

Wang, J., J. Hockenberry, S.Y. Chou and M. Yang (2011), Do bad report cards have consequences? Impacts of publicly reported provider quality information on the CABG market in Pennsylvania, *Journal of Health Economics*, 30(2): 392–407

Wooldridge, J.M. (2008), *Introductory econometrics: a modern approach*, 4th international edition, Cengage Learning

Wu, V.Y. (2009), Managed care's price bargaining with hospitals, *Journal of Health Economics*, 28(2): 350–360

5

Patient responsiveness to a differential deductible: empirical results from The Netherlands

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Abstract

Health insurers may use financial incentives to encourage their enrolees to choose preferred providers for medical treatment. Empirical evidence whether differences in cost-sharing rates across providers affects patient choice behaviour is, especially from Europe, limited. This paper examines the effect of a differential deductible to steer patient provider choice in a Dutch regional market for varicose veins treatment. Using individual patients' choice data and information about their out-of-pocket payments covering the year of the experiment and 1 year before, we estimate a conditional logit model that explicitly controls for pre-existing patient preferences. Our results suggest that in this natural experiment designating preferred providers and waiving the deductible for enrolees using these providers significantly influenced patient choice. The average cross-price elasticity of demand is found to be 0.02, indicating that patient responsiveness to the cost-sharing differential itself was low. Unlike fixed cost-sharing differences, the deductible exemption was conditional on the patient's other medical expenses occurring in the policy year. The differential deductible did, therefore, not result in a financial benefit for patients with annual costs exceeding their total deductible.

5.1 Introduction

Managed care insurers that are more successful at channelling patients can negotiate better deals with health care providers (Gowrisankaran et al., 2015; Sorensen, 2003; Wu, 2009). A credible threat of losing patient volume seems to stimulate providers to offer more favourable contract terms, such as price discounts and quality improvements, than they otherwise would have offered. To channel patients to specific providers, insurers may differentiate cost-sharing rates across provider alternatives requiring higher out-of-pocket payments for visits to non-preferred providers than for visits to preferred providers. There is emerging empirical evidence from the US that the use of financial incentives affects patient choice behaviour (see for example Frank et al., 2015; Robinson et al., 2015; Sinaiko and Rosenthal, 2014). These incentives include differential co-payments across provider tiers, percentage coinsurance rates which automatically tiers providers according to price, and reimbursement limits requiring the patient to pay the difference between this limit and the insurer–provider negotiated price.

This paper examines a channelling experiment with a differential deductible in The Netherlands. In this 1-year experiment De Friesland Zorgverzekeraar (DFZ), at that time the largest independent regional health insurer in The Netherlands, designated preferred providers for two procedures (cataract surgery and varicose veins treatment). It also used a financial incentive to encourage their enrolees to choose these providers for medical treatment. The insurer exempted its enrolees from paying their annual deductible when they sought care at a preferred provider. The deductible exemption, however, was conditional on the enrolee's other medical expenses occurring in the policy year. People still had to pay their annual deductible when using other medical services than cataract surgery and varicose veins treatment. During the experiment, the enrolee's financial benefit when visiting a preferred provider thus depended upon his ex post total medical expenses in the policy year. Hence, people had to make a prediction about the 'price' associated with visiting a non-preferred provider.

To test whether this channelling experiment affected the allocation of patients across individual providers, Van der Geest and Varkevisser (2016) estimated two OLS regression models using providers' patient volume data over a 3-year period.[46] In this study, it was concluded that in the year of the experiment the allocation of cataract patients across individual providers was not affected by the channelling experiment, whereas preferred providers of varicose veins treatment on average gained patient volume relative to non-

46 The data was obtained from health insurer DFZ. Hence, each provider's patient volume is the number of patients with health insurance provided by DFZ.

preferred providers. Both the insurer's selection of preferred providers in terms of joint market share and the design of the financial incentive are likely explanations for this result.

As a follow-up study, this paper focuses on the procedure for which the allocation of patients across providers was significantly affected. It assesses in more detail how responsive patients were to the cost-sharing differential between preferred and non-preferred providers of varicose veins treatment apart from the insurer's preferred provider label. It contributes to the emerging, but still small body of literature examining the effect of differential cost-sharing on patient provider choices. Using additionally obtained data on each individual patient's out-of-pocket payment and a few patient characteristics, we estimate a conditional logit model of patient choice to empirically disentangle the effect of the preferred provider label and the financial channelling incentive provided. We use choice data covering the year of the experiment and 1 year before to control for pre-existing patient preferences. The estimated coefficients are then used for calculating preferred and non-preferred providers' average cross-price elasticity of demand.

The paper is structured as follows. We first briefly summarize the institutional context and the natural experiment. Then we describe our empirical methodology, followed by a discussion of the data. After this, we present our estimation and simulation results. We conclude with a summary and discussion of our main findings.

5.2 Background

The Netherlands has a system of universal health insurance based on regulated competition in the private sector. This system adheres closely to Enthoven's plan of managed competition in health care (Enthoven, 1993). All citizens are obliged to buy standardized basic health insurance covering the costs of all common medical care including primary care, hospital services (for up to 1 year), and pharmaceuticals. The premium for basic health insurance is community-rated. There is a risk equalization system in place to reduce insurers' incentives for risk selection. Every adult has a mandatory annual deductible that must be met before medical services are reimbursed by the insurer (excluding primary care and maternity care). Consumers obtain a community-rated discount on their premium if they opt for a voluntary deductible (at most 500 euro).

Competing private health insurers are provided with financial incentives as well as tools to organize and manage acute (curative) care for their enrolees by establishing and maintaining provider networks. To increase their bargaining power vis-à-vis providers,

health insurers may restrict access to a network of providers. Enrolees using out-of-network providers receive a lower reimbursement rate. Other than selective contracting, insurers can designate preferred providers within their contracted network; i.e., forming a two-tiered provider network. To encourage enrolees to choose providers labelled as 'preferred' or 'higher value' they may waive the annual deductible for visiting a preferred provider.[47]

DFZ, then the largest regional health insurer in The Netherlands with a market share of about 65% in the Dutch province Friesland (or Frisia),[48] used such a differential deductible for patient channelling in 2009. It designated three hospitals (including the largest hospital in Friesland) and one free-standing ambulatory surgery centre as preferred providers for varicose veins treatment because of above average performance in guideline adherence, waiting time and patient satisfaction.[49] To enrolees it was emphasized that the preferred providers were carefully selected for reasons of quality and, therefore, labelled as 'higher value'. The deductible exemption would concern both the enrolee's mandatory deductible (155 euro in 2009) as well as, when relevant, the voluntary deductible (at most 500 euro). The difference in cost-sharing between preferred and non-preferred providers could, therefore, add up to a maximum of 655 euro. Hospital-insurer negotiated prices for the treatment of varicose veins typically differed from about 700 euros to about 2000 euros for the more complex treatments and thus in 2009 exceeded the patient's deductible.[50] However, the deductible exemption was conditional on the enrolee's other medical expenses occurring in the year 2009. Enrolees still had to pay their annual deductible when using other medical services than varicose veins treatment and cataract surgery.[51]

47 For more information about the bargaining position of Dutch health insurers in the negotiations with health care providers, see Schut and Varkevisser (2017).

48 Friesland is a province in the northwest of The Netherlands. Most of Friesland is on the mainland, but it also includes four small islands which are connected to the mainland by ferry. The total land area equals 3349 km^2. Friesland has a total population of 646,000 and is with a population density of 190 inhabitants per km^2 one of the most sparsely populated regions in The Netherlands.

49 Varicose veins are swollen and enlarged veins that are visible through the skin and may appear blue or dark purple. They are caused by increased blood pressure inside the superficial veins and commonly develop in the legs and ankles. Besides being a cosmetic problem, varicose veins can be very painful. Women are more likely to be affected by varicose veins than men. Treatment for varicose veins performed by medical specialists requires a referral from a general practitioner (GP) and involves both surgical (e.g., vein stripping) and nonsurgical approaches (e.g., compression stockings, sclerotherapy, and laser treatment). Most patients are treated in an out-patient setting.

50 For confidentiality reasons, DFZ did not provide us with information on their negotiated prices.

51 The actual financial benefit of choosing a preferred provider has been different among patient groups. Patients with no additional medical expenses in 2009 had a higher financial benefit of choosing a preferred provider than other patients. Furthermore, enrolees who opted for a voluntary deductible in 2009 had a higher potential financial benefit than enrolees with no voluntary deductible.

5.3 Empirical methodology

The aim of our study was to assess in detail how responsive patients were to the insurer's preferred provider label and the cost-sharing differential between preferred and non-preferred providers. We model patient provider choice using a utility maximization framework in which the patient chooses the provider that is most attractive based on attributes that vary across alternative providers.[52] To estimate our model we use pooled individual patient choice data from 1 year before (2008) and during the channelling experiment (2009). This allows us to control for unobservable prior preferences for providers that were designated as preferred provider by the insurer in 2009, as it is very unlikely that patient preferences (in terms of trade-offs between provider attributes) changed simultaneously with the introduction of the patient channelling experiment in these two consecutive years. Since all DFZ insured in 2009 were exposed to the financial incentive, we are not able to analyse whether the pre-to-post-difference was larger for exposed patients than for non-exposed patients. Our control group, therefore, necessarily consists of all varicose veins patients in 2008 since they were not exposed to any channelling incentive. Thus, we compare the probability that a given provider would be chosen by patients if that provider was selected as a preferred provider in 2009 with the probability that it was chosen in the year prior to the experiment.

As is standard in the contemporary hospital choice literature (see for example Beukers et al., 2014; Chou et al., 2014; Frank et al., 2015; Gaynor et al., 2016; Gutacker et al., 2016; Ho and Pakes, 2014), we use the random utility choice model introduced by McFadden (1974). Assuming the unobserved random components (ε_{ij}) are independently and identically distributed (idd), we estimate the following conditional logit model specification for analysing patient choice:[53]

$$Choice_{ij} = \beta_1 Post_i + \beta_2 Pref_j + \beta_3 Post_i \cdot Pref_j + \beta_4 Price_{ij} + \beta_5 Time_{ij} + \sum_{k=1}^{n} \gamma_k H_{kj} + \varepsilon_{ij}$$

52 In The Netherlands, GPs function as gatekeepers for specialized medical care but patients are free to choose which provider to visit. Based on videotaped Dutch GP-patient consultations, Victoor et al. (2013) concluded that many patients visit the provider that is recommended by their GP. In the study period, Dutch GPs did not have a (financial) interest to refer patients to particular providers while neglecting their preferences. We therefore do not take into account potential principal-agent problems. The term patient here thus refers to the patient-referring GP pair jointly choosing the most attractive provider. Note that the patient's (potential) financial benefit associated with the choice of a preferred provider may not be the deciding factor.

53 Time subscripts are not included in the model specification, because we pooled the data from 2008 to 2009. The variable $Post_i$ identifies whether an observation is either from before or after the start of the channelling experiment.

where $Choice_{ij}$ is a dummy variable identifying patient's *i* choice of hospital *j* given all *J* hospitals in his choice set. $Post_i$ is a dummy variable equal to 1 if patient *i*'s varicose veins treatment took place in 2009 when the two-tiered provider network was in place (and 0 if treatment took place in 2008). $Pref_j$ is a dummy variable indicating whether provider *j* belongs to the group preferred providers. It controls for pre-existing patient preferences for the providers designated as preferred provider by DFZ in 2009. The coefficient on the interaction between $Post_i$ and $Pref_j$ represents the change in utility from choosing a preferred provider in the year of the experiment. This is thus one of the coefficients of our primary interest while it allows us to test whether the preferred provider status affected patient choice behaviour. Please note that $\beta_1 Post_i$ will drop out the regression, as it does not vary within the choice set.

Through the price component of the utility function, we test whether the financial channelling incentive affected patient choice behaviour. The variable $Price_{ij}$ is the financial benefit (in euros) that patient *i* would miss out when visiting a non-preferred provider. Of course, this euro amount was equal to zero for all non-preferred providers in 2008, because at the time there was no financial incentive in place yet. However, during the experiment the price of non-preferred providers was based on patient's *i* expectation regarding the amount of his total deductible left unused in the 2009 policy year. In the absence of more detailed information about patients' total health care consumption, we use each patient's percentage of the total deductible left unused in 2008 multiplied by the total deductible amount (i.e., sum of mandatory and voluntary deductible) in 2009 as a proxy for his expected financial benefit.[54] This approach is similar to how Brot-Goldberg et al. (2017) model a consumer's expected end-of-the-year marginal price. Unfortunately, the obtained data do not allow us to control in a meaningful way for the fact that patients may have adjusted their expectations during the year of the experiment.[55] Note that using each patient's percentage of the deductible left unused in the year of the experiment as an alternative would incorrectly assume perfect foresight and result in an endogeneity problem.

The variable $Time_{ij}$ is the minimum driving time from the patient *i*'s home to provider *j*. The vector $H_{.j}$ represents two provider attributes we control for; i.e., provider type (general hospital, tertiary hospital or ambulatory surgery centre) and whether the provider is

54 For 99.4 percent of the patients in our study sample the total deductible in 2009 was the same as in 2008, except for the increase of the mandatory deductible imposed by the government (+ 5 euro).

55 Because we cannot track patients across claims related to other types of medical care other than varicose veins treatment, it is not possible to control for the presence of chronic conditions. Hence, we are not able to distinguish chronically ill from non-chronically ill patients who likely differed on expectations regarding their medical expenses in 2009.

located in the province of Friesland.[56] Clinical quality as provider attribute is not included in the model as choice determinant because public information about it was unavailable during the study period. Reliable outcome indicators for varicose veins treatment were being developed in The Netherlands at the time, but not yet available for patients (and GPs) to compare providers (Wittens et al., 2007). Note that differences in waiting time across providers are implicit part of the model because it was one of indicators used by the insurer when selecting the preferred providers. The error term (ε_{ij}) represents the idiosyncratic part of patient *i*'s evaluation of provider *j* including information obtained by word of mouth and possible prior experience.

To test whether there is patient heterogeneity in responsiveness to the channelling experiment, we also estimate an extended version of the model where we interact both $Post_i \times Pref_j$ and $Price_{ij}$ with three patient characteristics: age, gender, and social status. For age we construct a dummy variable to define the subgroup of retired people (in 2009 the standard retirement age was 65 years) who usually experience a (substantial) drop in income after retirement.

5.4 Data

5.4.1 Data sources

The data for this study come from multiple sources. Most importantly, from health insurer DFZ we obtained individual claims data for all their varicose veins patients capturing the period January 2008 through December 2009. This data include the Diagnosis and Treatment Combination (DTC) code of the specific varicose veins treatment only,[57] the date of admission, the provider name and postal code, the patient's gender, age (on date of admission) and his residential postal code. For patients admitted in 2009, the insurer also provided information on the amount of voluntary deductible chosen for the calendar years 2008 and 2009 as well as the euro amount paid to the insurer of his total deductible (i.e., sum of mandatory and any voluntary deductible) in 2008 and 2009.[58] For the 2009 patient group we calculate the percentage left unused of the total deductible in 2008 to construct our proxy variable for the financial channelling incentive.

56 Other things being equal, Frisians might prefer regional providers because they are generally speaking proud of their own culture and identity. As an illustration, Friesland is the only one of the twelve provinces of The Netherlands to have, in addition to Dutch, its own official language.

57 In The Netherlands each patient admitted to a provider of specialized medical care is categorized into a Diagnosis and Treatment Combination (DTC) code, which includes all outpatient and/or inpatient activities and services associated with the patient's care from the initial consultation to the final check-up.

58 For only a very few patients ($n = 27$) DFZ could not provide us with data on out-of-pocket payment and amount of voluntary deductible in 2008 because they were not enrolled in that year.

We used a drive time matrix containing all 4-digit postal codes in The Netherlands to include the minimum driving time (in minutes) from an individual's residential postal code to each provider.[59] Data on type of provider are obtained from the web-based Dutch National Atlas of Public Health and the website of the Dutch association of tertiary medical teaching hospitals. Based on the provider's postal code, we construct the dummy variable whether a provider is located in Friesland or not.

Due to privacy concerns, DFZ could not provide any detailed patient-level socio-economic information. In addition to the available individual patient data on age and gender, from The Netherlands Institute for Social Research (SCP) we obtained a social status score for each 4-digit postal code in 2010. Using factor analysis, SCP derived the social status of a 4-digit postal code area from a number of characteristics of the people living there: average income level, the percentage of people having a low income, the percentage low educated and the percentage unemployed. The higher the score, the higher the social status of the postal code area.

5.4.2 Patient study sample and patients' choice sets of providers

For the analysis, we use the obtained claims data to create a study sample of varicose veins patients. To prevent a bias caused by existing patient–physician relationships we only include for each patient the first primary treatment of the calendar year.[60] In addition, we selected patients living in Friesland because the patient channelling experiment was primarily aimed at this population. From all DFZ enrolees that needed treatment for varicose veins in 2008–2009 as much as 85% lived in Friesland. The other 15% were almost equally spread across the country.

For some patients the name of the provider visited is missing in the data, so we exclude them from the analysis ($n = 69$). We also drop all patients who were treated by a provider not located in the northern part of the country ($n = 28$). Since this small minority of patients travelled on average much longer than other patients (i.e., 119 min compared to 25 min), it is most likely that either these patients' starting addresses are incorrect or their observed provider choice reflects very special preferences or medical needs.

59 The drive time matrix also accounts for differences in average speed that exist between different road types.

60 If there are varicose veins in both legs that require treatment, these treatments are almost always registered as separate claims and performed on different dates. Nearly one-third of the patients in our sample required more than one treatment during a calendar year. In these cases, switching provider for the next treatment is rare (less than 5% in our sample).

As it is not possible to observe a patient's true choice set in these data, we rely on the aggregated choices of patients to identify supposed reasonable options. We presume each patient's choice set to consist of all providers contracted by DFZ for varicose veins treatment (located in the northern part of the country) that were visited by at least one enrolee in each sample year. This results in a uniform choice set for each patient including 13 different providers. Consequently, an additional small number of patients (n = 78) is excluded, because they visited a provider that was outside this choice set. In the choice set of 2009 three providers were designated as preferred provider.[61] The location of all providers included in the choice set is shown in Figure 5.1. More detailed information on these providers can be found in the "Appendix" (Table 5.A).

Figure 5.1 Location of providers included in the study

Notes: ASC = ambulatory surgery centre, GH = general hospital, and TH = tertiary hospital. Preferred providers are marked with an *asterisk* (*). The province of Friesland is denoted by the *thick dashed line* to the east and by the sea to the west.

5.5 Results

5.5.1 Descriptive statistics

Our final study sample includes 4252 unique varicose veins patients with DFZ insurance during the study period 2008–2009. Table 5.1 presents the descriptive statistics. From

61 The fourth provider designated as preferred provider by DFZ, a general hospital located relatively far away, was not included because none of the Frisian patients with DFZ insurance visited this provider in the study period.

this table it follows that the 2008 and 2009 patient groups are quite similar. Almost 80% of the patients were females and patients were on average slightly older than 50 years.[62] The average social status scores of the 2008 and 2009 patient group were -0.54 and -0.48, respectively, which is below the national average score (0.17). On average, patients travelled less than 25 min and almost all patients (95 and 93% in 2008 and 2009, respectively) did not leave the Frisian province for treatment. About 60% of the patients visited a general hospital, while around 35% visited a tertiary hospital. A considerably lower percentage of patients (3–6%) obtained care at an ambulatory surgery centre. In 2008, the three providers designated preferred during the channelling experiment jointly performed 39% of the procedures. The largest hospital in the region (Medisch Centrum Leeuwarden) represented 91% of this volume. In 2009, the preferred providers jointly performed 42% of the procedures. In both absolute and relative terms (49 patients and 71%, respectively) the freestanding ambulatory centre among the preferred providers (Braamkliniek) experienced the biggest increase in patient volume.

Table 5.1 Descriptive statistics of patient study sample

	2008 *n* = 2,123				**2009** *n* = 2,129			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Age (years)	51	14	15	87	51	14	21	90
Social status	-0.54	1.17	-7.25	2.94	-0.48	1.13	-5.49	3.19
Travel time (minutes)	24	39	0	455	25	39	0	455
Female	0.78		0	1	0.77		0	1
Age65+	0.19		0	1	0.18		0	1
Located in Friesland	0.95		0	1	0.93		0	1
Type of provider								
ASC	0.03		0	1	0.06		0	1
General hospital	0.61		0	1	0.57		0	1
Tertiary hospital	0.36		0	1	0.37		0	1
Preferred provider	0.39[a]		0	1	0.42		0	1

[a] Proportion of patients in 2008 visiting a provider that would be designated as preferred provider in 2009.

Table 5.2 presents some additional descriptive statistics of the 2009 patient group. The average total deductible – and, therefore, the maximum financial benefit for the average patient – in 2009 was 159.46 euro which is only slightly higher than the mandatory deductible in that year. The number of patients who opted for a voluntary deductible is in fact negligible (less than 2%). On average, the patients in the 2009 study sample left

62 Compared to the overall Dutch population females and elderly are overrepresented among the varicose veins patients.

22% of the total deductible unused in the year prior to the experiment resulting in an average *expected* financial benefit of 36.84 euro that one would miss out when visiting a non-preferred provider. However, there is significant variation across individual patients.

Table 5.2 Descriptive statistics of 2009 patient study sample

	2009 *n* = 2,129			
	Mean	Std. dev.	Min	Max
Mandatory deductible in 2009 (euros)	155.00	0.00	155.00	155.00
Voluntary deductible in 2009 (euros)	4.46	39.54	0.00	500.00
Total deductible in 2009 (euros)	159.46	39.54	155.00	655.00
Deductible left unused in 2008 (%)	22	36	0	100
Financial benefit of preferred provider choice (euros)	36.84	71.30	0.00	655.00

5.5.2 Model specifications

We estimate two model specifications: model A and model B. In addition to preferred provider status and price, the explanatory variables in both models include travel time, located in Friesland and type of provider to capture dimensions of provider heterogeneity that may have affected patient provider choice. The difference between both models is that model B allows both the effect of designating preferred providers and the financial channelling incentive to be heterogeneous among patient groups. These groups are identified using the few patient characteristics available in the dataset.

5.5.3 Goodness of fit

To measure the models' goodness of fit, following Town and Vistnes (2001), we construct a "hit-or-miss" criterion where predicted patient choice was the provider with the maximum predicted probability. Both model A and B correctly predict almost 8 out of every 10 patients' provider choices, suggesting a high degree of explanatory power. In addition, we predict each provider *j*'s patient volume by summing up all patients' estimated choice probabilities for provider *j*.

Table 5.B in the "Appendix" presents predicted patient volume for each individual provider using the two models. Notice that from this table it can be concluded that one of the preferred providers (UMC Groningen) apparently was not an attractive alternative for the patients included in the study sample; most likely because a university medical centre typically focuses on top clinical and highly specialized care.

5.5.4 Estimated coefficients

Table 5.3 reports our patient choice model's coefficient estimates and standard errors. Consistent with the existing empirical literature on patient provider choice, we find that varicose veins patients had a strong preference for providers located nearby, all else equal. In both models, the coefficient of *Time* is highly significant and negative. An artificial 10% increase in travel time, all else equal, reduces a provider's patient volume between 11 and 84% as minimum and maximum respectively. Related to this, patients also had a high propensity of selecting a provider located in the province Friesland, all else equal. Hence, they did not like to cross the regional border for treatment. Furthermore, patients were more likely to choose ambulatory surgery centres compared with general and tertiary hospitals, all else equal.

Table 5.3 Conditional logit estimates of patient choice

Variable	**Model A**			**Model B**		
	β	Sig.	S.E.	β	Sig.	S.E.
Pref	0.612		0.341	0.610		0.341
Post × Pref	0.219	**	0.094	– 0.080		0.174
Post × Pref × Age65+				– 0.217		0.187
Post × Pref × Female				0.487	***	0.174
Post × Pref × Social status				0.139	**	0.064
Price	– 0.002	**	0.001	– 0.000		0.001
Price × Age65+				– 0.009	**	0.003
Price × Female				– 0.001		0.002
Price × Social status				0.000		0.001
Travel time	– 0.128	***	0.002	– 0.128	***	0.002
Located in Friesland	1.676	***	0.149	1.669	***	0.149
Tertiary hospital	– 0.246		0.337	– 0.249		0.338
ASC	3.580	***	0.424	3.617	***	0.424
N observations	55,276			55,276		
N patients	4,252			4,252		
Correct predicted (%)	79			79		

Notes: ** Significant at the 5% level, *** Significant at the 1% level

In model A the significant coefficient of *Pref* interacted with *Post* indicates that being designated as preferred provider by health insurer DFZ in 2009 was a positive incentive for patients (p value = 0.02). Patients were more likely to visit those providers, all else equal. The coefficient of *Pref* is not statistically significant (p value = 0.07). Hence, it is not particularly apparent that patients had a pre-existing preference for providers that were designated as preferred provider in 2009. The negative sign found for the significant coefficient on *Price* in model A indicates that the financial channelling incentive affected

patient provider choice in the expected direction (*p* value = 0.04). The higher the price patients were expected to pay out-of-pocket, the less likely they were to seek care from a non-preferred provider. However, in contrast to the other provider attributes, patients were relatively insensitive to the financial benefit of visiting a preferred provider.

Despite the absence of an overall effect (i.e., for the "average" patient), the interaction variables in model B – capturing any differences in preferences across types of patients – suggest a statistically significant effect for females and social status with respect to the effect of the preferred provider status on patient choice.[63] The estimates indicate that females were more responsive to the preferred provider status than males. The same seems to hold for patients with a higher social status, which might reflect a higher cognitive ability to understand the channelling instrument. It might also relate to challenges faced by patients with a lower social status. For example, a reliance on public transportation would make travelling to a distant preferred provider more difficult for them. The significant coefficient on *Price* interacted with *Age65+* suggests that retired patients were more sensitive to the financial channelling incentive than their younger counterparts (*p* value = 0.01). It looks like the retired patient group – or the relatively healthy subpopulation in this group – took notice of the provided channelling incentive as well as expected themselves, based on their out-of-pocket payment in 2008, to benefit financially when choosing one of the preferred providers in 2009.

5.5.5 Cross-price elasticity of demand

We conduct a simulation analysis for examining patients' responsiveness to hypothetical changes in the cost-sharing rate.[64] Using model B, we simulate the impact of a twofold increase in patients' 2009 total deductible on patient volume. Following our proxy for patient's *i* expectations about his (potential) financial benefit, a twofold higher total deductible equals a doubling of the patient's maximum price of a non-preferred provider. For the average patient this corresponds to a maximum financial benefit of about 320 euro. Using the conditional logit estimates from Table 5.3, we recalculated each patient's choice probabilities for all individual providers when the hypothetical increase in deductible would apply. After summing up these probabilities at the provider level, the percentage change in predicted patient volume for the preferred providers is divided by the percentage change of the deductible. Table 5.4 presents the results of this simulation analysis. Based on the estimated coefficients, the hypothesized larger cost-sharing difference across preferred and non-preferred providers would increase the

63 Please note that when included in non-linear models the coefficients of interaction terms must be interpreted carefully (Karaca-Mandic et al., 2012).

64 This approach is commonly used in the hospital choice literature; e.g., Varkevisser et al. (2010; 2012), Beukers et al. (2014), and Gutacker et al. (2016).

predicted number of patients visiting the three preferred providers by 2.4%. Hence, the mean cross-price elasticity of demand equals 0.02 (SE = 0.00).[65] As a robustness check, we also performed the simulation analysis in two alternative ways. First, for the three patient subgroups separately (retired, female, lowest social status) the mean cross-price elasticities are found to be 0.05 (n = 153), 0.02 (n = 727), and 0.02 (n = 537), respectively. So, as follows from model B's coefficients, the retired patient group seems slightly more responsive to the channelling instrument. Second, when using model A rather than model B, the mean cross-price elasticity of demand also equals 0.02 (n = 899). Hence, including interaction terms does not change this elasticity.

Table 5.4 Estimated cross-price elasticity of demand (price of non-preferred providers + 100%)

Provider	Predicted patient volume	Mean	S.E.	95% confidence based on parametric bootstrap[a]	
MC Leeuwarden	795	0.02	0.000	0.02	0.02
Braamkliniek	98	0.03	0.000	0.02	0.03
UMC Groningen	6	0.07	0.001	0.06	0.07
Preferred providers	899	0.02	0.000	0.02	0.02

[a] For the parametric bootstrap we use the method of Krinsky and Robb (1986; 1990).

5.5.6 Who really benefited?

Another look at the data confirms the limited impact of the cost-sharing differential itself. In 2009, from the 2129 patients 42% chose one of the preferred providers. Based on their out-of-pockets payments in 2008, a total of 655 patients (31%) was expected to benefit from the difference in cost-sharing across the two tiers of providers (Table 5.5). This group includes all patients who did not fully use their deductible in the year preceding the channelling experiment. From them, 274 patients (42%) indeed selected a preferred provider for their treatment in 2009. The remaining 381 patients (58%), for whatever reason, during the channelling experiment did not respond to their prior end-of-the-year marginal price.

Table 5.5 Number of patients by provider choice in 2009 and expected financial benefit of preferred provider choice

Provider choice in 2009	Expected financial benefit:		Total
	> €0-€155	> €155-€655	
Preferred provider	258	16	274
Non-preferred provider	370	11	381
Total	628	27	655

65 The standard error is computed to test for the robustness of our findings. We used the vector of estimated parameters and corresponding covariance matrix from our conditional logit model to randomly draw 1000 sets of alternative, equally probable model parameters from a multivariate normal distribution with this vector and matrix as means and covariance, respectively.

Using the data that DFZ provided us on out-of-pocket payments in 2009, additional calculations reveal that only 19% of the 899 patients who during the channelling experiment selected a preferred provider did actually enjoy a financial benefit. For them this benefit was on average almost 100 euro. For the remaining patients the costs of medical services other than treatment for varicose veins were so high that they still had to pay their full deductible. Hence, many patients (81%) choosing to visit a preferred provider at the end of the year were not financially rewarded for doing so.

5.6 Conclusion

Health insurers offering managed care plans may use financial incentives for channelling patients to preferred providers with lower costs and/or higher quality. Empirical evidence whether differences in cost-sharing rates across providers impacts patient choice behaviour is emerging but, especially from European countries, still limited. This paper examined a Dutch insurer's channelling experiment with a differential deductible to steer patient provider choice in a regional market for varicose veins treatment. During the experiment, the insurer waived patients' deductible when they chose to visit a preferred provider for medical treatment. Since the exemption was conditional on the patient's other medical expenses occurring in the policy year, people had to make a prediction about the 'price' associated with visiting a non-preferred provider.

Using data covering the year of the experiment and 1 year before, we estimated a conditional logit model of patient choice. Our main results can be summarized as follows.

First, the estimation results indicate that, independent of their expected financial benefit imposed by the differential deductible, patients were more likely to choose a preferred provider than a non-preferred provider. In the year preceding the experiment, a clear preference for these providers was not observed. This suggests that the insurer succeeded in convincing a considerable number of patients of the preferred providers' better than average performances on guideline adherence, waiting time and patient satisfaction.

Second, the estimation results suggest that varicose veins patients were less likely to select a non-preferred provider when this, based om their percentage use of deductible in 2008, was associated with a higher expected out-of-pocket payment. The average

cross-price elasticity of demand is estimated to be 0.02, indicating that patient responsiveness to the cost-sharing differential itself was low.[66]

To conclude, our finding that patient demand for the preferred providers is rather insensitive to an increase in price of the non-preferred providers may be related to the relatively short length of the experiment. By cancelling it already after the first year, the insurer ruled out the possibility that more enrolees learned about the financial incentive in later years. The channelling experiment lasted only 1 year because, according to the insurer, enrolees reacted negatively towards the use of a differential deductible to influence patient choice. Furthermore, it seems likely that the design of the financial incentive contributed substantially to a low patient responsiveness. Unlike a fixed cost-sharing differential between preferred and non-preferred providers the deductible exemption studied here was conditional on the patient's other medical expenses occurring in the policy year. Most patients were, therefore, uncertain about their financial benefit of choosing a preferred provider making *ex ante* price comparison very difficult. On the other hand, the financial incentive was irrelevant for chronically ill patients because they will for sure meet their deductible within the year and thus do not have any incentive to respond to this channelling experiment.

Reducing the annual deductible when enrolees seek care at a preferred provider instead of waiving it only for that treatment might be a more effective financial incentive for patient channelling. However, it would also be more costly to insurers and causing a potential moral hazard effect on the use of other medical services. Moreover, a first prerequisite for a differential deductible to work as intended is that patients understand the concept of a deductible compared to their amount of medical spending. This is, as clearly illustrated by Handel and Kolstad (2015), not straightforward. When attempting to steer patients to preferred providers, we, therefore, expect insurers to be more successful using other types of cost-sharing differentials by provider tier, for example, making a cost-sharing distinction for co-payments, co-insurance, or the out-of-pocket maximum. This provides patients with a financial incentive that is both easy to understand and associated with a guaranteed financial benefit.

66 As pointed out by one of the reviewers, our study does not take into account that some patients requiring varicose vein treatment may forego treatment or switch to a different treatment rather than receive a (potentially) higher-cost procedure from a non-preferred provider. In theory, such substitution might indeed be relevant for patients who would choose to receive care from a non-preferred provider absent the tiering scheme. However, in practice the deductible – which underlies the potential price difference between preferred and non-preferred providers – is in The Netherlands not associated with unmet need for financial reasons (OECD/European Observatory on Health Systems and Policies, 2017).

References

Beukers, P.D.C., R.G.M. Kemp and M. Varkevisser (2014), Patient hospital choice for hip replacement: empirical evidence from The Netherlands, *European Journal of Health Economics*, 15(9): 927–936

Brot-Goldberg, Z.C., A. Chandra, B.R. Handel and J.T. Kolstad (2017), What does a deductible do? The impact of cost-sharing on health care prices, quantities, and spending dynamics, *Quarterly Journal of Economics*, 132(3): 1261–1318

Chou, S.Y., M.E. Deily, S. Li and Y. Lu (2014), Competition and the impact of online hospital report cards, *Journal of Health Economics*, 34(1): 42–58

Enthoven, A.C. (1993), The history and principles of managed competition, *Health Affairs*, 12(Suppl 1): 24–48

Frank, M.B., J. Hsu, M.B. Landrum and M.E. Chernew (2015), The impact of a tiered network on hospital choice, *Health Services Research*, 50(5): 1628–1648

Gaynor, M., C. Propper and S. Seiler (2016), Free to choose? Reform, choice, and consideration sets in the English National Health Service, *American Economic Review*, 106(11): 3521–3557

Gowrisankaran, G., A. Nevo and R. Town (2015), Mergers when prices are negotiated: evidence from the hospital industry, *American Economic Review*, 105(1): 172–203

Gutacker, N., L. Siciliani, G. Moscelli and H. Gravelle (2016), Choice of hospital: which type of quality matters?, *Journal of Health Economics*, 50: 230–246

Handel, B.R. and J.T. Kolstad (2015), Health insurance for "humans": information frictions, plan choice, and consumer welfare, *American Economic Review*, 105(8): 2449–2500

Ho, K. and A. Pakes (2014), Hospital choices, hospital prices, and financial incentives to physicians, *American Economic Review*, 104(12): 3841–3884

Karaca-Mandic, P., E.C. Norton and B. Dowd (2012), Interaction terms in nonlinear models, *Health Services Research*, 47(1): 255–274

Krinsky, I. and A.L. Robb (1986), On approximating the statistical properties of elasticities, *Review of Economics and Statistics*, 68(4): 715–719

Krinsky, I. and A.L. Robb (1990), On approximating the statistical properties of elasticities: a correction, *Review of Economics and Statistics*, 72(1): 189–190

McFadden, D. (1974), Conditional logit analysis of qualitative choice behavior, in P. Zarembka (ed.), *Frontiers in Econometrics*, pp. 105–142, Academic Press (New York)

OECD/European Observatory on Health Systems and Policies (2017), *Netherlands: Country Health Profile 2017*, in: State of Health in the EU, Paris/European Observatory on Health Systems and Policies, Brussels, OECD Publishing

Robinson, J.C., T. Brown and C. Whaley (2015), Reference-based benefit design changes consumers' choices and employers' payments for ambulatory surgery, *Health Affairs*, 34(3), 415–422

Schut, F.T. and M. Varkevisser (2017), Competition policy for health care provision in The Netherlands, *Health Policy*, 121(2): 126–133

Sinaiko, A.D. and M.D. Rosenthal (2014), The impact of tiered physician networks on patient choices, *Health Services Research*, 49(4): 1348–1363

Sorensen, A.L. (2003), Insurer-hospital bargaining: negotiated discounts in post-deregulation Connecticut, *Journal of Industrial Economics*, 51(4): 469–490

Town, R.J. and G. Vistnes (2001), Hospital competition in HMO networks, *Journal of Health Economics*, 20(5): 733–753

Van der Geest, S.A. and M. Varkevisser (2016), Using the deductible for patient channeling: did preferred providers gain patient volume?, *European Journal of Health Economics*, 17(5): 645–652

Varkevisser, M., S.A. van der Geest and F.T. Schut (2010), Assessing hospital competition when prices don't matter to patients: the use of time-elasticities, *International Journal of Health Care Finance and Economics*, 10(1): 43–60

Varkevisser, M., S.A. van der Geest and F.T. Schut (2012), Do patients choose hospitals with high quality ratings? Empirical evidence from the market for angioplasty in The Netherlands, *Journal of Health Economics*, 31(2): 371–378

Victoor, A., J. Noordman, J.A. Sonderkamp, D.M.J. Delnoij, R.D. Friele, S. van Dulmen and J.J.D.J.M. Rademakers (2013), Are patients' preferences regarding the place of treatment heard and addressed at the point of referral: an exploratory study based on observations of GP-patient consultations, *BMC Family Practice*, 14: 189

Wittens, C.H.A., J.J.E. van Everdingen and R.T. van Zelm (2007), *Kwaliteit van zorg rond Varices in de etalage: set van externe indicatoren*, ZonMw, Den Haag

Wu, V.Y. (2009), Managed care's price bargaining with hospitals, *Journal of Health Economics*, 28(2): 350–360

Appendix

Table 5.A Provider attributes

Provider name		City	Province	Typea	Preferred provider
1	MC Leeuwarden	Leeuwarden	Friesland	TH	Yes
2	Ziekenhuis Nij Smellinghe	Drachten	Friesland	GH	No
3	Antonius ziekenhuis	Sneek	Friesland	GH	No
4	Ziekenhuis De Tjongerschans	Heerenveen	Friesland	GH	No
5	Talma Sionsberg	Dokkum	Friesland	GH	No
6	Braamkliniek	Assen	Drenthe	ASC	Yes
7	Wilhelmina ziekenhuis	Assen	Drenthe	GH	No
8	UMC Groningen	Groningen	Groningen	TH	Yes
9	IJsselmeer ziekenhuis	Noordoostpolder	Flevoland	GH	No
10	Flebologisch centrum Oosterwal	Alkmaar	N-Holland	ASC	No
11	Martini ziekenhuis	Groningen	Groningen	TH	No
12	Refaja ziekenhuis	Stadskanaal	Groningen	GH	No
13	Zorgcombinatie Noorderboog	Meppel	Drenthe	GH	No

[a] *ASC* ambulatory surgery centre, *GH* general hospital, *TH* tertiary hospital

Table 5.B Actual and predicted patient volumes

	Provider name	Actual patient volume		Predicted patient volume									
				Model A					Model B				
		2008	2009	2008	2009	% total in 2008	% total in 2009	Diff. (%)	2008	2009	% total in 2008	% total in 2009	Diff. (%)
1.	**MC Leeuwarden**	**747**	**771**	**726**	**794**	**34.2**	**37.3**	**3.1**	**725**	**795**	**34.1**	**37.3**	**3.2**
2.	Ziekenhuis Nij Smellinghe	397	385	361	350	17.0	16.4	-0.6	361	350	17.0	16.4	-0.6
3.	Antonius ziekenhuis	415	415	403	360	19.0	16.9	-2.1	403	361	19.0	17.0	-2.0
4.	Ziekenhuis De Tjongerschans	333	252	315	272	14.8	12.8	-2.1	315	271	14.8	12.7	-2.1
5.	Talma Sionsberg	127	156	191	225	9.0	10.6	1.6	191	226	9.0	10.6	1.6
6.	**Braamkliniek**	**69**	**118**	**93**	**99**	**4.4**	**4.7**	**0.3**	**94**	**98**	**4.4**	**4.6**	**0.2**
7.	Wilhelmina ziekenhuis	13	11	2	2	0.1	0.1	0.0	2	2	0.1	0.1	0.0
8.	**UMC Groningen**	**8**	**10**	**5**	**6**	**0.2**	**0.3**	**0.0**	**5**	**6**	**0.2**	**0.3**	**0.0**
9.	IJsselmeer ziekenhuis	5	2	9	8	0.4	0.4	0.0	9	8	0.4	0.4	0.0
10.	Flebologisch centrum Oosterwal	4	6	3	1	0.1	0.0	-0.1	4	1	0.2	0.0	-0.1
11.	Martini ziekenhuis	3	1	5	4	0.2	0.2	0.0	5	4	0.2	0.2	0.0
12.	Refaja ziekenhuis	1	1	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
13.	Zorgcombinatie Noorderboog	1	1	9	6	0.4	0.3	-0.1	9	6	0.4	0.3	-0.1
	Total	2,123	2,129	2,123	2,129	100	100		2,123	2,129	100	100	
	Total of preferred providers	824	899	824	899	38.8	42.2	3.4	824	899	38.8	42.2	3.4
	Total of non-preferred providers	1,299	1,230	1,298	1,228	61.1	57.7	-3.5	1,299	1,229	61.2	57.7	-3.5

The preferred providers are highlighted in bold.

6

Simulating the impact of centralization of prostate cancer surgery services on travel burden and equity in the English National Health Service: A national population based model for health service re-design

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Abstract

Introduction: There is limited evidence on the impact of centralization of cancer treatment services on patient travel burden and access to treatment. Using prostate cancer surgery as an example, this national study analysis aims to simulate the effect of different centralization scenarios on the number of centre closures, patient travel times, and equity in access.

Methods: We used patient-level data on all men (n = 19,256) undergoing radical prostatectomy in the English National Health Service between January 1, 2010 and December 31, 2014, and considered three scenarios for centralization of prostate cancer surgery services A: procedure volume, B: availability of specialized services, and C: optimization of capacity. The probability of patients travelling to each of the remaining centres in the choice set was predicted using a conditional logit model, based on preferences revealed through actual hospital selections. Multivariable linear regression analysed the impact on travel time according to patient characteristics.

Results: Scenarios A, B, and C resulted in the closure of 28, 24, and 37 of the 65 radical prostatectomy centres, respectively, affecting 3993 (21%), 5763 (30%), and 7896 (41%) of the men in the study. Despite similar numbers of centre closures, the expected average increase on travel time was very different for scenario B (+15 minutes) and A (+28 minutes). A distance minimization approach, assigning patients to their next nearest centre, with patient preferences not considered, estimated a lower impact on travel burden in all scenarios. The additional travel burden on older, sicker, less affluent patients was evident, but where significant, the absolute difference was very small.

Conclusion: The study provides an innovative simulation approach using national patient-level datasets, patient preferences based on actual hospital selections, and personal characteristics to inform health service planning. With this approach, we demonstrated for prostate cancer surgery that three different centralization scenarios would lead to similar number of centre closures but to different increases in patient travel time, whilst all having a minimal impact on equity.

6.1 Introduction

The centralization of complex cancer surgery into high-volume units is occurring in most high-income countries as a consequence of a range of policies aiming to improve the quality and efficiency of cancer services (Wyld et al., 2015; Morche et al., 2018; Urbach, 2015). This has been in response to studies from predominantly Europe and the United States identifying improved outcomes of care for patients treated by specialized and experienced teams at centres performing a high volume of surgical procedures (Birkmeyer et al., 2002; Gruen et al., 2009), particularly for more complex surgery such as pancreatic, oesophageal, and prostate cancers. Prostate cancer is a relevant tumour type when considering the centralization of specialist services. First, the quality of the surgery has an impact on the chance of complete removal of the tumour whilst minimizing the risk of side effects, such as urinary incontinence and erectile dysfunction (Vickers et al., 2009). Second, a volume outcome relationship has been established for different endpoints following prostate cancer surgery (Trinh et al., 2013).

In light of this, national cancer plans in the English National Health Service (NHS) have since 2002 advocated the centralization of specialist urological surgical services into fewer, high-volume centres. The NHS provides treatment to more than 90% of cancer patients (The King's Fund, 2014). A new geographical configuration was established, with local cancer units referring patients suitable for a radical prostatectomy to a regional specialist centre (National Institute for Health and Care Excellence, 2002; NHS England, 2014). However, a consequence of centralization is that it may require patients to travel further for treatment which could widen inequities in access for those less able to travel (Kobayashi et al., 2015; Versteeg et al., 2018).

This is relevant considering a previous analysis for prostate cancer surgery which found that patterns of patient mobility have resulted in shifts in hospitals' market shares (Aggarwal et al., 2018a). One in three men who had a radical prostatectomy for prostate cancer between 2010 and 2014 in the English NHS travelled beyond or bypassed their nearest prostate cancer surgery centre. Men who were younger, fitter, and more affluent were more likely to travel to another surgery centre than the one nearest to them. This highlights concerns with respect to the increasing regionalization of specialist services. For example, increased travel times for cancer care could reduce treatment uptake for specific patient groups. This is particularly relevant for prostate cancer where competing radical treatment strategies exist (e.g., surgery, radiotherapy, and brachytherapy), which are often located at different geographic locations (Parry et al., 2019; Aggarwal et al., 2016a). In addition, apparent advantages of the volume-outcome relationship that may emerge from centralization of care may not be shared equally across the population,

but instead concentrated in patients best able to access the benefit of centralization. Those patients are likely to be closer to high performing centres, or else younger, fitter, and more affluent.

6.1.1 Centralization of prostate cancer services in the NHS

Since 2010, 15 of 65 functioning prostate cancer surgery centres have been closed in the English NHS due to a combination of regional coordination between specialist centres as well as the effects of hospital competition and patient choice, partly driven by the adoption of robotic surgery (Aggarwal et al., 2017). The integration of robotic surgery as a driver of centralization of prostate cancer surgery has been observed in several countries (Groeben et al., 2017; Riikonen et al., 2016; Stitzenberg et al., 2012).

The result of centralization on patient travel burden and treatment quality remains unknown, but it does highlight the need for a robust evidence-based approach to health service planning. An important question is to what extent changes in the configuration of specialist services have a negative impact on the ability of all patients to access centralized specialist services which could lead to unintended consequences on patient outcomes (Stitzenberg et al., 2009).

A recent study has used discrete choice experiments within small samples of patients, health professionals and the general public to get a better understanding of the acceptability of different centralization scenarios, focusing on the trade-off between travel time and treatment outcomes for cancer surgery (Vallejo-Torres et al., 2018). The willingness to travel found by this study seems improbably large. It was estimated that people are willing to travel 75 minutes extra for a 1% lower absolute risk of complications and even more than 5 hours extra to reduce their risk of death by 1%. The extent to which these "stated" preferences can be used as a means of informing policy is debatable because responses to hypothetical scenarios and patients' preferences "revealed" through their actual behaviour may be different (Wardman, 1988; Harrison et al., 2017; Quaife et al., 2018).

There is an increasing body of literature that has attempted to simulate the effect of centralization of health care services based on parameters derived from population-level administrative hospital data on actual patient visits. Previous studies attempting to assess the impact of centralization on travel times have followed the "distance minimization approach", simply diverting patients who were treated at a centre that is closed (as per the centralization scenario) to the *nearest* alternative centre that would be still open after centralization (Kobayashi et al., 2015; Poeran et al., 2014). An approach which only values distance or spatial access fails to acknowledge the significant number of

other factors that account for patient preference for treatment centre. Based on revealed preferences derived from studies of actual travel patterns, it is known that patients are prepared to travel beyond (bypass) their nearest hospital for treatment (Varkevisser and Van der Geest, 2007; Gutacker et al., 2016), for example in response to the reputation of hospitals and their surgeons, the availability of innovative technologies, and waiting time (Aggarwal et al., 2016b).

In this present study, we use data on actual travel patterns and an innovative simulation approach to provide a robust and comprehensive assessment of the impacts of three hypothetical re-design scenarios on travel time and equity in access to radical prostatectomy services in the English NHS, a single-payer system. Our simulation approach, however, can be applied by any authority, public or private, that is seeking to rationalize its health services into fewer centres nationally or regionally or within particular insurer catchment areas.

6.2 Methods

6.2.1 Data sources and study population

For this study, we obtained individual patient-level data on all men who were diagnosed with prostate cancer and underwent radical prostatectomy in the English NHS between January 1, 2010 and December 31, 2014 from the Hospital Episode Statistics (HES) database linked at the patient-level to English cancer registry data. These data provide information on where patients actually received the treatment.

The population-weighted centroids of the patients' Lower Super Output Areas (geographic areas defined by the Office for National Statistics that typically includes 1500 residents or 650 households) and the full postcodes for the hospitals where the surgery was undertaken were inputted into a geographical information system (ESRI ArcGIS 10.3) to calculate travel times according to the fastest route by car (using Ordnance Survey MasterMap Integrated Transport Network). For each patient, the travel time to all prostate cancer surgical centres was calculated.

The HES dataset was used to determine patient-level characteristics, including age, the number of comorbidities according to the Royal College of Surgeons Charlson comorbidity score (Armitage et al., 2010), socioeconomic deprivation expressed in terms of quintiles of national distribution of the Index of Multiple Deprivation (Department of Communities and Local Government, 2011), hospital that provided the surgical treatment, and date of the surgical procedure. National cancer registry data were used as the

data source for cancer stage, which was categorized according to a modified D'Amico classification system (D'Amico et al., 1998; Royal College of Surgeons of England, 2014).

6.2.2 Centralization scenarios

For the purpose of our study, we created three pragmatic centralization scenarios to identify hypothetical closures of surgical units based on current clinical and policy discussion regarding quality improvement, patient experience, and efficient use of NHS resources.

In *Scenario A* (volume), surgical treatment for prostate cancer is restricted to centres undertaking more than 50 radical prostatectomies per annum. This scenario follows evidence supporting improvements in peri- and postoperative outcomes as well as function when surgery is performed in high-volume relative to low-volume units. The threshold of 50 procedures is based on current guidelines and the volume outcome literature (Trinh et al., 2013).

In *Scenario B* (facilities), surgical treatment is restricted to comprehensive cancer treatment centres. This is defined as centres having both surgical and radiotherapy facilities on site independent of volume. From the patient perspective, it is desirable when the major treatment options (e.g., surgery and radiotherapy) are available in the same centre. Furthermore, comprehensive cancer centres provide all necessary support services for the management of patients (e.g., andrology services).

In *Scenario C* (capacity utilization), prostate cancer surgery is restricted to centres classified as "winners." A previous analysis has demonstrated that patient choice has an impact on market share, creating "winners" and "losers" with some centres having a net gain of patients due to patient selection and others a net loss (Aggarwal et al., 2017). Closing centres that have a net-loss of patients to alternative centres could be considered to be a direct response to choices that patients seemed to have made themselves.

6.2.3 Centralization simulation analysis

Simulation analysis was conducted to assess the impact of centralization of prostate cancer surgery services on patient travel times. After simulating the closure of a number of cancer surgery centres, the probability of travelling to each of the remaining centres in the choice set was predicted for all individual patients, using a conditional logit choice model (McFadden, 1974). Similar to other studies (Varkevisser and Van der Geest, 2007) we restricted patient choice sets to reduce the computational burden as well as to avoid a potential bias caused by outliers. That is, choice sets included all prostate

cancer surgery centres within 3 hours of travel time (which is about eight times patients' median travel time for prostatectomy in the English NHS).

In addition to travel time from the patient's home to the prostate cancer surgery centre, we included three centre-level characteristics: established robotic centre, university teaching hospital, and strong media reputation. These were informed by a previous systematic review of the literature and qualitative interviews with both men previously treated for prostate cancer and uro-oncology specialists currently practicing in the UK (Aggarwal et al., 2016b; 2018a; 2018b). A previous analysis has also demonstrated that men had greater odds of travelling to a centre with one of these characteristics for prostate cancer surgery, independent of travel time, with one in three men bypassing their nearest centre (Aggarwal et al., 2018a).

We also included five patient characteristics: elderly (≥65 year), comorbidity, socioeconomic background, and residence (residing in urban or rural area as well as residing in London or not). These characteristics were included as interaction terms with travel time in the conditional logit choice model.

Changes in travel burden resulting from centralization of surgery services were calculated as the difference between actual times travelled by patients for their radical prostatectomy precentralization and weighted average travel times postcentralization. The choice probabilities predicted by the conditional logit model were used as weights reflecting the relative importance of the remaining cancer centres to the patient. To compare this new simulation approach with the distance minimization approach used by previous simulation studies in this field of research, we also estimated the travel burden by assigning patients to their nearest available centre postcentralization.

To study what the impact on travel time of closing cancer centres is according to patient characteristics, we estimated a multivariable linear regression model with change in travel burden as the dependent variable and the five patient characteristics as explanatory variables. In addition, pre- and post- centralization average travel times are presented graphically for different patient groups to illustrate increased inequities in treatment access. All analyses were undertaken in Stata version 14.

6.3 Results

6.3.1 Patient sample and centralization scenarios

We studied 19,256 patients who were diagnosed with prostate cancer between January 2010 and December 2014, and who subsequently underwent a radical prostatectomy in the English NHS. We excluded 211 (1%) men who went to a cancer centre more than 3 hours away from their home address as well as 16 men (0.1%) who had only one provider option within 3 hours.

The final sample was composed of 19,029 men living in England matched to 65 providers of prostate cancer surgery. Among the patients, 8046 (42%) were aged 65 and over, 1422 (7%) had at least one comorbidity, and 9064 (48%) lived in the most socio-economically deprived areas (Table 6.1). In the sample, 4442 men (23%) lived in rural areas and 2656 (14%) in London. On average, patients travelled 31 minutes to their treatment centre. For each scenario, the hypothetical closures of surgical units are represented in Figure 6.1. Table 6.1 presents the descriptive statistics of these patient subgroups as well as the total patient group.

The number of patients affected by the centralization differs across scenarios. Under scenario A (volume), in which 28 centres (43%) performing <50 prostatectomies per year are closed, 3993 men (21% of the total patient group between 2010 and 2014) would have to choose a new treatment location.

A total of 5763 men (30%) would be affected by centralization scenario B (facilities), in which prostate cancer surgical treatment is restricted to 41 comprehensive cancer treatment centres and 24 (37%) centres are closed.

Under scenario C (capacity utilization), in which 37 centres (57%) identified as having a net loss of patients are closed, 7896 men (41%) would reselect treatment location. Under this latter scenario, 237 men (3%) would have no alternative cancer centre available within 3 hours of travel time. Their average travel time would increase from 50 to 213 minutes if they travelled to the nearest available centre postcentralization. For this very small group of men we did not calculate weighted average travel times postcentralization because, as explained above, an underlying assumption of the estimated choice model is that patient choice sets only include cancer surgery centres within 3 hours of travel time.

Figure 6.1 Location of open and closed prostate cancer surgery centres for each hypothetical centralization scenario

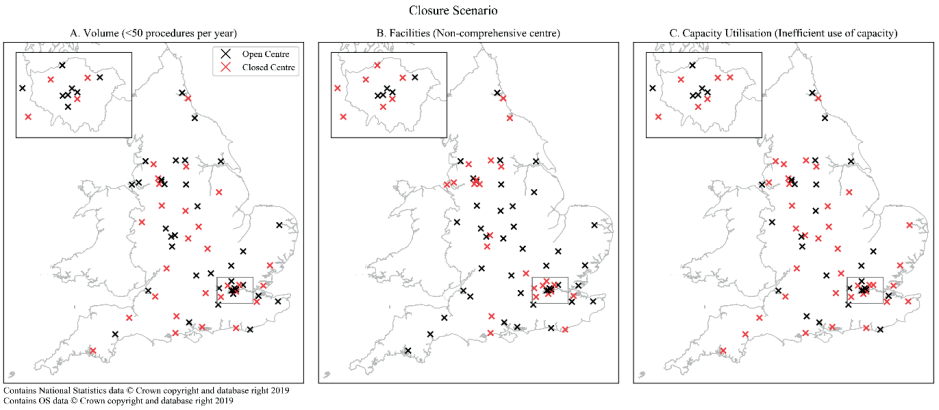


Table 6.1 Sociodemographic characteristics of patients in centres that closed according to the centralization scenario

	Total patient cohort	Scenario A (volume)	Scenario B (facilities)	Scenario C (capacity utilization)
	65 centres	28 centres closing	24 centres closing	37 centres closing
	19,029 patients included	3,993 patients moving to another centre	5,763 patients moving to another centre	7,896 patients moving to another centre
Aged 65 and over	8,046 (42)	1,689 (42)	2,380 (41)	3,302 (43)
Low socioeconomic status (national IMD quintiles 3-5)	9,064 (48)	1,959 (49)	2,797 (49)	3,847 (50)
At least one comorbidity	1,422 (7)	285 (7)	464 (8)	511 (7)
Place of residence:				
Rural area	4,442 (23)	1,041 (26)	1,021 (18)	1,808 (24)
London	2,656 (14)	247 (6)	637 (11)	778 (10)
Other urban area*	11,931(63)	2,705 (68)	4,105 (71)	5,073 (66)

Note: Values are numbers of patients with percentages in parentheses.
* Residence in an urban area, but not in London.

6.3.2 Patient preferences

Table 6.2 reports the estimation results of the conditional logit choice model. Patients preferred to have surgery in a centre requiring shorter travel time (odds ratio <1). There are statistically significant differences in the impact of travel time between patient groups at the 1% level. The impact of travel time was greater in men from a socioeconomically more deprived area (national IMD quintiles 3-5) than in men living in more affluent areas. This is demonstrated by the odds ratio of <1, indicating men from lower

socioeconomic areas had a lower willingness to travel. The impact of travel time was also greater in men aged 65 and over, in men with comorbidity, and in men living in London and other urban areas. They had a lower willingness to travel (odds ratios <1) than younger (<65), fitter (no comorbidities) men and those living in rural areas. Individuals also preferred to be treated in centres that provide robotic prostate cancer surgery and in centres that employ surgeons with a strong media reputation as demonstrated in a previous analysis (Aggarwal et al., 2018a).

6.3.3 Impact of centralization on travel time

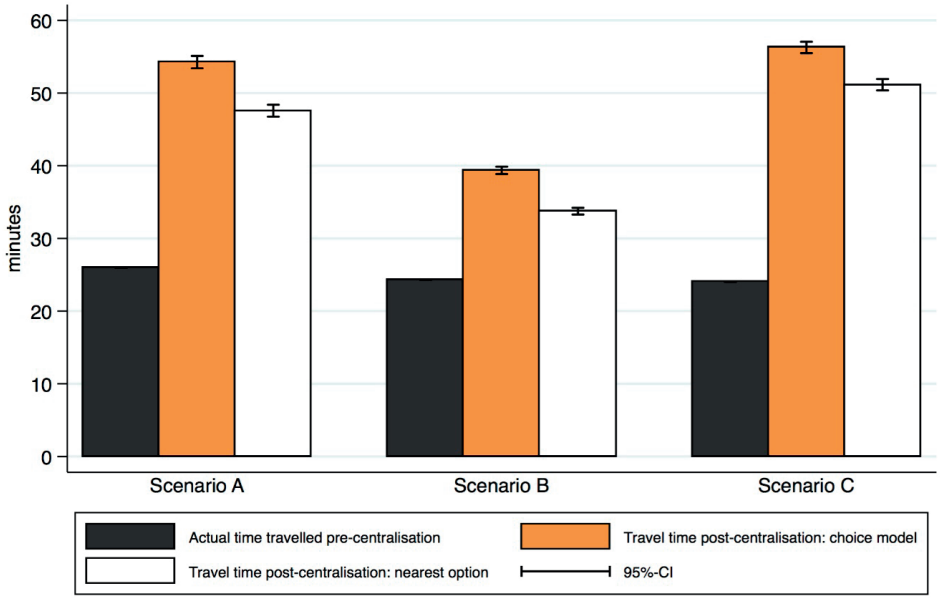
For each centralization scenario there is a substantial increase in the expected patient travel time using the estimated conditional logit choice model (Figure 6.2, orange bars). Patients affected by the centralization in scenario A had to travel an additional 28 minutes on average with postcentralization average travel time approaching 1 hour. Hence, travel time would more than double (108% relative increase) on average for them. Under centralization scenario B the additional travel time for the affected patients would be on average 15 minutes (+63%). Finally, in centralization scenario C, patients reselecting their treatment location would be expected to travel an additional 32 minutes (+133%).

Table 6.2 Odds ratios (OR) from the conditional logit choice model estimating the probability of travelling to one of the prostate cancer surgery centres available within 3 hours

	OR	95% confidence interval	P-value
Travel time (in minutes) for base case patient*	0.920	0.918 to 0.922	< 0.001
Interaction with patient characteristic*			
x Age ≥ 65	0.991	0.989 to 0.994	< 0.001
x Low socioeconomic status (IMD score 3-5)	0.996	0.994 to 0.999	0.003
x At least one comorbidity	0.987	0.981 to 0.992	< 0.001
x London (compared to other Urban area)	0.846	0.837 to 0.854	< 0.001
x Rural area (compared to other Urban area)	1.021	1.018 to 1.023	< 0.001
Strong media reputation	1.933	1.841 to 2.028	< 0.001
University-teaching hospital	0.928	0.889 to 0.970	0.001
Established robotic centre	1.756	1.655 to 1.862	< 0.001
N observations	505,045		
N patients	19,029		

* The base case patient represents an individual with the following characteristics: Age <65, Socioeconomic status - high (IMD 1-2), No comorbidities, living in an Urban area (not London). The impact of the patient characteristics on travel time is presented as interaction terms. These should be multiplied with the adjusted OR for 'travel time' for the base case patient (0.920) to formulate a new OR. Interaction terms can be used in any combination to assess the effect of different patient characteristics on the odds that a patient travels to a particular hospital. As an example, to calculate the new OR for an elderly man (age ≥ 65), with at least one comorbidity, living in London, but still of high socioeconomic status - multiply 0.920 by the corresponding interaction term for men who are elderly (0.991), have comorbidity (0.987) and who live in London (0.846). The new odds ratio is 0.920 × 0.991 × 0.987 x 0.846 = 0.761. Men with this sociodemographic profile have a lower willingness to travel than the base case patient described.

Figure 6.2 Average time travelled precentralization and average travel time expected postcentralization in minutes for scenarios A (volume), B (facilities), and C (capacity utilization)



Note:
Scenario A: only cancer centres performing at least 50 prostatectomies per annum, 28 centres closed, 3,993 patients affected;
Scenario B: only comprehensive cancer treatment centres, 24 centres closed, 5,763 patients affected;
Scenario C: only cancer centres that use capacity efficiently, 37 centres closed, 7,659 patients affected.

Figure 6.2 also considers what happens if patients are diverted to their next nearest centre (distance minimization approach). As expected, the increase in average patient travel time for those affected by centralization is consistently less with this approach compared to the simulation approach which considers patients' preferences. For example, patients would have to travel 22 more minutes (+85%) on average under scenario A if they would go to the next nearest centre compared to 28 more minutes if they would travel to a centre according to the predictions of the conditional logit choice model.

6.3.4 Impact of centralization on inequities in access

Table 6.3 demonstrates the results of the multivariable linear regression analysis examining the average impact of each centralization scenario on specific patient groups' travel time. In each scenario, as shown by the results for the base case patient, there is a significant increase in patient travel burden ranging from 16 minutes in scenario B to 30 minutes in scenario C.

For patients from London the increase in travel time is much less than for patients living in a rural area. For example, under scenario C the average increase in patient travel time for London dwellers is 23 minutes less, all else being equal.

Under scenarios A and C, for patients living in rural areas the increase in travel time is higher than for patients living in urban areas. The biggest impact is noted in scenario C (+15 minutes compared to patients from urban areas).

All three centralization scenarios would result in a very small decrease in travel times for older patients (>65 years old) compared to their younger counterparts, although this was only statistically significant for scenario B (average adjusted difference of -1.5 minutes). For patients with at least one recorded comorbidity, scenario A results in a significantly higher but very marginal increase in travel time (average adjusted difference +2.8 minutes) compared to patients with no comorbidity. For patients from less affluent areas (IMD score 3-5), both scenario B and C result in a significantly higher but very small increase in travel time (average adjusted differences of +1.3 and +1.7 minutes, respectively) compared to those living in more affluent areas.

Table 6.3 Impact of different centralization scenarios on travel time according to patient characteristics. Results of multivariable regression

	Scenario A (volume)		**Scenario B (facilities)**		**Scenario C (capacity utilization)**	
	3,993 patients		5,763 patients		7,659 patients	
Increase in travel time for base case patient*	29.10 (27.75 to 30.45)	P<0.001	16.46 (15.44 to 17.49)	P<0.001	30.19 (29.10 to 31.28)	P<0.001
Difference in increase in travel time compared to base case patient						
Age ≥ 65	-0.74 (-2.23 to 0.76)	P=0.334	-1.46 (-2.60 to -0.33)	P=0.012	-0.05 (-1.22 to 1.13)	P=0.940
Low socioeconomic status (IMD score 3-5)	-0.80 (-2.30 to 0.69)	P=0.292	1.32 (0.17 to 2.46)	P=0.024	1.70 (0.52 to 2.87)	P=0.005
At least one comorbidity	2.86 (0.00 to 5.73)	P=0.050	-1.10 (-3.16 to 0.95)	P=0.293	-0.73 (-3.06 to 1.60)	P=0.538
London (compared to other Urban area)	-23.25 (-26.36 to -20.13)	P<0.001	-12.96 (-14.78 to -11.14)	P<0.001	-22.69 (-24.66 to -20.73)	P<0.001
Rural (compared to other Urban area)	4.31 (2.62 to 6.01)	P<0.001	0.47 (-1.03 to 1.97)	P=0.539	15.08 (13.68 to 16.47)	P<0.001

Note: Values are changes in minutes of travel time with 95% confidence interval in parentheses and P stands for P-value.
* The base case patient represents an individual with the following characteristics: Age<65, Socioeconomic status - high (IMD 1-2), No comorbidities, living in an Urban area (not London).

The model enables an evaluation of men with different patient characteristics (Table 6.3). For example, under scenario C a man of lower socioeconomic status living in a rural area would have to travel an additional 46.7 minutes (30.19 + 15.08 + 1.70) compared to an additional 13.4 minutes (30.19 - 15.08 - 1.70) for an affluent man living in an urban area.

The Figures 6.A-6.C in the Appendix present the variation in impact of the three centralization scenarios across different patient groups, based on combinations of different characteristics that have been found to be statistically significant from the multivariable regression analyses as presented in Table 6.3.

6.4 Discussion

This study provides an innovative simulation approach for assessing the impact of centralizing complex cancer surgery services on patients' travel burden. Using individual patient-level data on all men who underwent radical prostatectomy in the English NHS between 2010 and 2014, we considered three pragmatic scenarios for centralization of prostate cancer surgery services: scenario A (volume), scenario B (facilities), and scenario C (capacity utilization).

Compared to previous studies in this field of research, our approach explicitly takes into account patients' preferences revealed through their actual hospital selections by using data on patient visits from administrative patient datasets to model patient choice. Travel times postcentralization are calculated as a weighted average of travel times to remaining cancer centres using the probabilities predicted by an estimated conditional logit choice model as weights. Our approach therefore results in more realistic predictions than previous studies that simply assumed that patients affected by centralization would go to their nearest alternative centre that would be still open.

For each of the centralization scenarios an overall increase in average travel burden is apparent, with the smallest impact found for scenario B (+15 minutes) and the biggest impact found for scenarios A (+28 minutes) and C (+32 minutes). Different scenarios have a different overall impact on (average) travel time and therefore on equity given the reduced willingness to travel of older, sicker, and lower socioeconomic groups. Of note, particularly under scenario C, extra travel time substantially differs according to whether patients live in rural or an urban area.

The results provide more general insights into the implications of a program of surgical service centralization on predicted travel burden, equity, and efficiency of the service. First, the use of a pure distance minimization approach in understanding travel burden on patients would not fully capture the impact of a patient's own personal characteristics and personal preferences for particular hospital characteristics. This is relevant in the context of the NHS and other health systems supporting patient choice (Aggarwal et al., 2016b).

Second, the use of national rather than regional datasets provides a clear understanding on the differential impact of national top-down policies on travel burden. Specifically, uniform policy criteria, disproportionately affect patients living in rural areas, who on average have to travel significantly further compared to those living in urban areas, which demonstrates the difficulties of "one size fits all" centralization policies. This is most clearly observed in Scenario C with its increases in travel time especially for patients in rural areas. This may result in lower utilization of curative and palliative treatments, creating regional inequities in outcomes.

Conversely, one can see how such mechanisms for service re-design may have a negligible impact on travel burden for patients in highly urbanized regions such as London. In these settings, the capacity of centres to expand their service would be the next criteria to consider. One caveat with our current approach is the use of private drive times alone as public transport times were not available. This could impact on the observed differences and behaviours, in the different regions.

Third, in addition to the overall increase in travel time which is likely to be more problematic for vulnerable patient groups, it was noted that patients' personal characteristics (e.g., socioeconomic status) could affect equity in access gradients further. All three centralization scenarios result in an increase in travel time for patients, however, the extra travel burden on specific patient groups resulting from these centralization scenarios is in reality very small.

Fourth, scenarios A and B result in similar numbers of cancer surgical unit closures (28 and 24 respectively), but very different impacts on patient travel burden that can inform policy. The findings suggest that efficiencies could be achieved by closing noncomprehensive cancer centres (scenario B), as the expected average increase in travel burden of 15 minutes is almost half that expected from Scenario A (28 minutes). The closure of centres in scenario B could result in increases in the number of procedures performed at the remaining 41 centres assuming demand remains the same, and hence the objectives

for A (creating high volume radical prostatectomy centres) and B (ensuring each cancer centre is a comprehensive cancer centre) may be achievable through a single policy.

Scenario C considers a different scenario, whereby centres, that are "losing" patients to other centres should be closed given preferences for alternative centres. Hence, patients through their choices and that of their primary care physicians, can influence which services remain open. However, the impact on patients with respect to travel burden is significant, particularly for rural dwellers, who face additional travel times of up to 45 minutes. The map in Figure 6.1C, shows that surgical units expected to close under this scenario would cover substantial catchment areas (e.g., Cornwall, Devon, Norfolk, Kent, Cumbria) where few alternative centres are available, and patients experience a significant travel burden in accessing local services. In addition, this could have a detrimental impact on access to specialist care. It also informs us that, within the NHS, a capacity maximization approach is unlikely to be achievable given the need to ensure equitable access nationally. Hence, centres may continue to operate despite having surplus capacity to protect access.

Although the simulation approach presented in this paper used data from a single-payer health system, it is certainly adaptable across different contexts. Our study shows how the impact of centralization options can be empirically investigated if relevant patient data are available. Our methodological approach can be further developed to incorporate information on hospital quality and patient outcomes; for example, rates of toxicity at the provider-level for patients undergoing radical prostatectomy (Sujenthiran et al., 2017). One can then model the effect of changes in provider-level quality on willingness to travel, and how this varies between different patient groups as previously described (Varkevisser et al., 2010). With respect to travel burden, it is not just travel time or distance that needs to be considered but also its cost to the patient. In addition, where provision of surgery and radiotherapy is not at a single site, the differential impact of the closure of such a site on the uptake of each of these treatment modalities can be considered (Hamdy et al., 2016).

Further simulations could estimate the expected improvements or worsening of patient outcomes that may result from centralization. In this way we can directly observe the trade-offs between travel times, equity, and quality, which need to be considered with health service planning (Poeran et al., 2014). This modelling approach could also be used to fit the *k* best centres to close, such that differences between population groups and/or headline travel times are minimized. This would present an a-theoretic, data driven comparator to the top-down policy approach simulated here.

6.5 Conclusion

In this paper, we present an innovative simulation approach using national patient-level datasets to understand better the impact of service re-design on patient travel burden and equity in access to services. Our study results show how in the English NHS the additional travel burden associated with unit closures is regionally patterned and can widen inequities in access for particular patient groups, particularly those living in rural areas. Equally it also demonstrates, how in certain scenarios, quite significant centralization of the service, with closure of just over one-third of current centres (24 of 65 centres), may result in only a relatively small impact on patients with respect to travel time. Future work should focus on better understanding the trade-offs between equity, travel burden, and patient outcomes to inform health care services re-design. In this regard, we expect the model to be applicable to other tumour types and specialist disciplines.

References

Aggarwal, A., D. Lewis, M. Mason, A. Purushotham, R. Sullivan, J. van der Meulen (2017), Effect of patient choice and hospital competition on service configuration and technology adoption within cancer surgery: a national, population-based study, *Lancet Oncology*, 18(11): 1445-1453

Aggarwal, A., J. Nossiter, P. Cathcart et al. (2016a), Organisation of prostate cancer services in the English National Health Service, *Clinical Oncology*, 28(8): 482-489

Aggarwal, A., D. Lewis, M. Mason, R. Sullivan and J. van der Meulen (2016b), Patient mobility for elective secondary health care services in response to patient choice policies: a systematic review, *Medical Care Research Review*, 74(4): 379-403

Aggarwal, A., D. Lewis, S.C. Charman et al. (2018a), Determinants of patient mobility for prostate cancer surgery: a population-based study of choice and competition, *European Urology*, 73(6): 822-825

Aggarwal, A., S. Bernays, H. Payne, J. van der Meulen and C. Davis (2018b), Hospital choice in cancer care: a qualitative study, *Clinical Oncology*, 30(7): e67-e73

Armitage, J.N., J.H. van der Meulen and Royal College of Surgeons Co-morbidity Consensus Group (2010), Identifying co-morbidity in surgical patients using administrative data with the Royal College of Surgeons Charlson Score, *British Journal of Surgery*, 97(5): 772-781

Birkmeyer, J.D., A.E. Siewers, E.V.A. Finlayson et al. (2002), Hospital volume and surgical mortality in the United States, *New England Journal of Medicine*, 346(15): 1128-1137

D'Amico, A.V., R. Whittington, S.B. Malkowicz SB et al. (1998), Biochemical outcome after radical prostatectomy, external beam radiation therapy, or interstitial radiation therapy for clinically localized prostate cancer, *JAMA*, 280(11): 969-974

Department of Communities and Local Government (2011), *The English Indices of Deprivation 2010*, London: Department of Communities and Local Government

Groeben, C., R. Koch, M. Baunacke, M.P. Wirth and J. Huber (2017), High volume is the key for improving in-hospital outcomes after radical prostatectomy: a total population analysis in Germany from 2006 to 2013, *World Journal of Urology*, 35(7): 1045-1053

Gruen, R.L., V. Pitt, S. Green, A. Parkhill, D. Campbell and D. Jolley (2009), The effect of provider case volume on cancer mortality: systematic review and meta-analysis, *CA: A Cancer Journal for Clinicians*, 59(3): 192-211

Gutacker, N., L. Siciliani, G. Moscelli and H. Gravelle (2016), Choice of hospital: which type of quality matters?, *Journal of Health Economics*, 50: 230-246

Hamdy, F.C., J.L. Donovan, J.A. Lane et al. (2016), 10-Year outcomes after monitoring, surgery, or radiotherapy for localized prostate cancer, *New England Journal of Medicine*, 375(15): 1415-1424

Harrison, M., K. Milbers, M. Hudson and N.Bansback (2017), Do patients and health care providers have discordant preferences about which aspects of treatments matter most? Evidence from a systematic review of discrete choice experiments, *BMJ Open*, 7(5): e014719

Kobayashi, D., T. Otsubo and Y. Imanaka (2015), The effect of centralization of health care services on travel time and its equality, *Health Policy*, 119(3): 298-306

McFadden, D. (1974), Conditional logit analysis of qualitative choice behavior, in P. Zarembka (ed.), *Frontiers in Econometrics*, pp. 105–142, Academic Press (New York)

Morche, J., D. Renner, B. Pietsch et al. (2018), International comparison of minimum volume standards for hospitals, *Health Policy*, 122(11): 1165-1176

National Institute for Health and Care Excellence (2002), *Improving outcomes in Urological Cancers – Guidance on Cancer Services*, London: National Institute for Health and Care Excellence

NHS England (2014), *National Cancer Peer Review Programme: Manual for Cancer Services: Urology Measures*, London: NHS England

Parry, M.G., A. Sujenthiran, T.E. Cowling et al. (2019), Impact of cancer service centralisation on the radical treatment of men with high-risk and locally advanced prostate cancer: a national cross-sectional analysis in England, *International Journal of Cancer*, 145(1): 40-48

Poeran, J., G.J.J.M. Borsboom, J.P. de Graaf et al. (2014), Does centralisation of acute obstetric care reduce intrapartum and first-week mortality? An empirical study of over 1 million births in the Netherlands, *Health Policy*, 117(1): 28-38

Quaife, M., F. Terris-Prestholt, G.L. Di Tanna and P. Vickerman (2018), How well do discrete choice experiments predict health choices? A systematic review and meta-analysis of external validity, *European Journal of Health Economics*, 19(8): 1053-1066

Riikonen, J., A. Kaipia, A. Petas et al. (2016), Initiation of robot-assisted radical prostatectomies in Finland: impact on centralization and quality of care, *Scandinavian Journal of Urology*, 50(3): 149-154

Royal College of Surgeons of England (2014), *National Prostate Cancer Audit - First Year Annual Report – Organisation of Services and Analysis of Existing Clinical Data*, London: The Royal College of Surgeons of England

Stitzenberg, K.B., E.R. Sigurdson, B.L. Egleston, R.B. Starkey and N.J. Meropol (2009), Centralization of cancer surgery: implications for patient access to optimal care, *Journal of Clinical Oncology*, 27(28): 4671-4678

Stitzenberg, K.B., Y.N. Wong, M.E. Nielsen, B.L. Egleston and R.G. Uzzo (2012), Trends in radical prostatectomy: centralization, robotics, and access to urologic cancer care, *Cancer*, 118(1): 54-62

Sujenthiran, A., S.C. Charman, M. Parry et al. (2017), Quantifying severe urinary complications after radical prostatectomy: the development and validation of a surgical performance indicator using hospital administrative data, *BJU International*, 120(2): 219-225

The King's Fund (2014), *The UK Private Health Market*, London: King's Fund

Trinh, Q.-D., A. Bjartell, S.J. Freedland et al. (2013), A systematic review of the volume-outcome relationship for radical prostatectomy, *European Urology*, 64(5): 786-798

Urbach, D.R. (2015), Pledging to eliminate low-volume surgery, *New England Journal of Medicine*, 373(15): 1388-1390

Vallejo-Torres, L., M. Melnychuk, C. Vindrola-Padros et al. (2018), Discrete-choice experiment to analyse preferences for centralizing specialist cancer surgery services, *British Journal of Surgery*, 105(5): 587-596

Varkevisser, M. and S.A. van der Geest (2007), Why do patients bypass the nearest hospital? An empirical analysis for orthopaedic care and neurosurgery in the Netherlands, *European Journal of Health Economics*, 8(3): 287-295

Varkevisser, M., S.A. van der Geest and F.T. Schut (2010), Assessing hospital competition when prices don't matter to patients: the use of time-elasticities, *International Journal of Health Care Finance and Economics*, 10(1): 43-60

Versteeg, S.E., V.K.Y. Ho, S. Siesling and M. Varkevisser (2018), Centralisation of cancer surgery and the impact on patients' travel burden, *Health Policy*, 122(9): 1028-1034

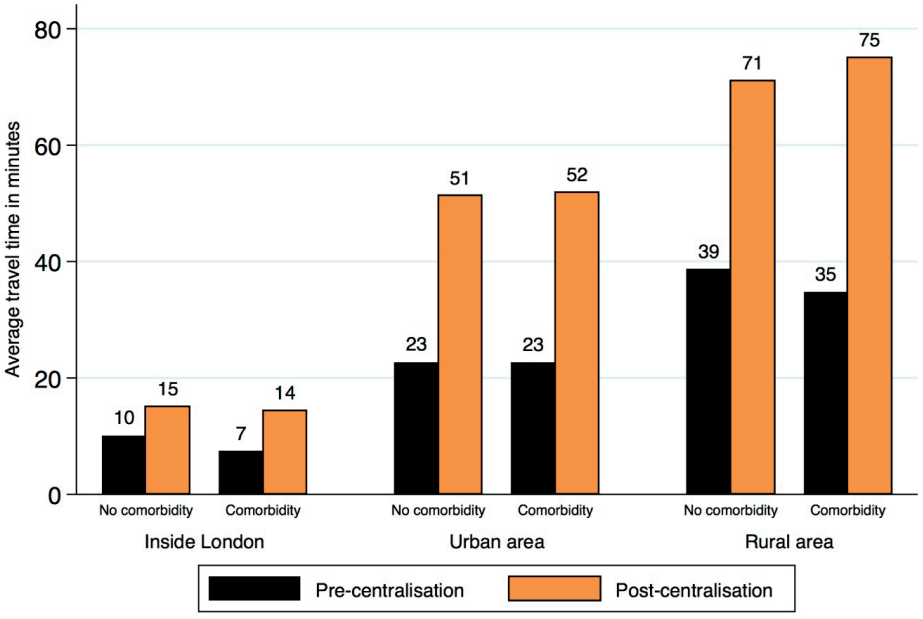
Vickers, A.J., C.J. Savage, M. Hruza et al. (2009), The surgical learning curve for laparoscopic radical prostatectomy: a retrospective cohort study, *Lancet Oncology*, 10(5): 475-480

Wardman, M. (1988), A comparison of revealed preference and stated preference models of travel behaviour, *Journal of Transport Economics & Policy*, 22(1): 71-91

Wyld, L., R.A. Audisio, G.J. Poston (2015), The evolution of cancer surgery and future perspectives, *Nature Reviews Clinical Oncology*, 12(2): 115-124

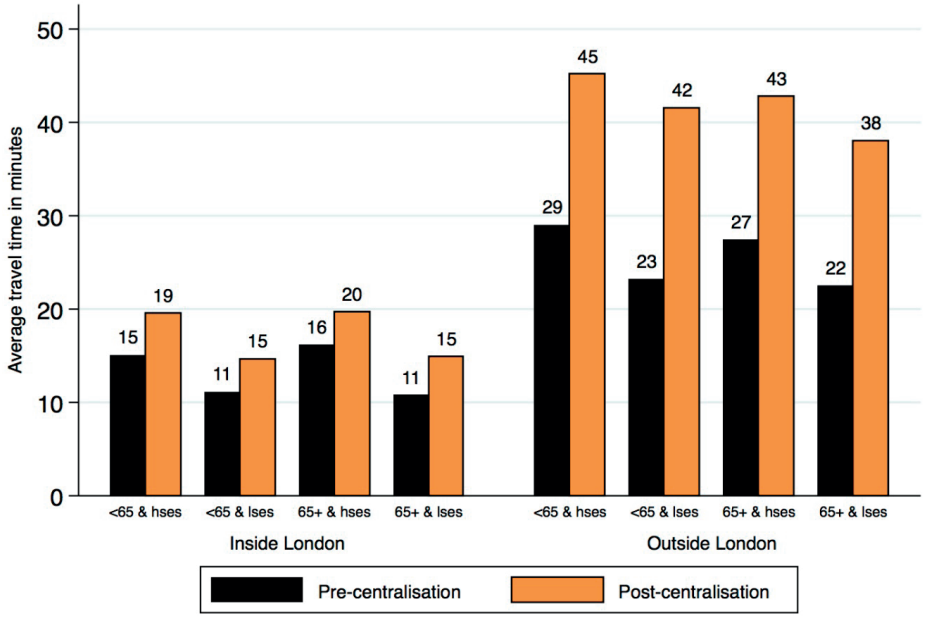
Appendix

Figure 6.A Pre- and post-scenario A average travel times for different patient subgroups



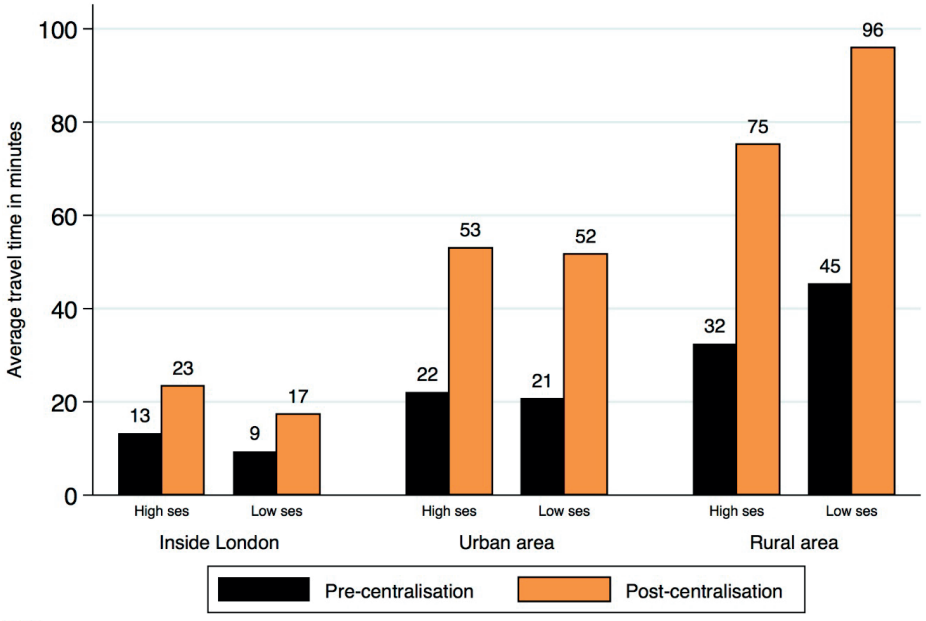
Note:
Scenario A: only cancer centres performing at least 50 prostatectomies per annum

Figure 6.B Pre- and post-scenario B average travel times for different patient subgroups



Note:
Scenario B: only comprehensive cancer treatment centres

Figure 6.C Pre- and post-scenario C average travel times for different patient subgroups



Note:
Scenario C: only cancer centres that use capacity efficiently

7

Summary and conclusion

7.1 Aim and research objectives

As explained in chapter 1, the aim of this thesis is to broaden our understanding of patient choice in hospital services markets. To this end, my research objectives were to:

1. Investigate patients' sensitivity to quality differences among hospitals as reported in public information sources (*chapter 2*).
2. Investigate whether health insurers can channel patient choice toward high-quality providers by awarding these preferred providers a quality label (*chapter 3*).
3. Investigate whether health insurers can steer patient choice toward high-performing providers by applying a differential deductible (*chapters 4 and 5*).
4. Investigate the impact of centralizing cancer surgery services on patient travel times and equity in access (*chapter 6*).

This chapter summarizes the main findings of the preceding chapters and offers some policy recommendations as well as suggestions for further research.

7.2 Patients' sensitivity to quality differences among hospitals

A necessary condition for patient choice policies to promote quality of healthcare is that patients are sensitive to quality differences among providers. When patients are prepared to travel beyond their nearest choice option for better quality, providers are given an incentive to raise their game to attract patients. Using individual patient-level claims data from a former large health insurer (Agis) and a mixed logit choice model, **chapter 2** examined the relationship between quality of care, hospital reputation, and patient choice for non-emergency angioplasty in the Netherlands in the first full year of public reporting of hospital quality. It was found that patients have a willingness to travel to hospitals with low readmission rates after treatment for heart failure and good reputations, both overall and for cardiology specifically. Simulations showed that by improving one of these quality measures a hospital can increase its market share substantially. Although we could not establish strict causality between releasing hospital quality ratings and patient choice with our cross-sectional analysis, the results presented in this paper suggest that a necessary condition for patient choice policies to improve quality seems to be fulfilled in this market; i.e., patients are sensitive to quality differences among hospitals. However, since readmission rates were not adjusted for patient case-mix hospitals may have been tempted to engage in risk selection to improve their rating. Considering readmission rates unadjusted for case-mix, the finding that patients are more likely to be treated in hospitals with low readmission rates may be particularly relevant if because of incentive-based healthcare reforms, competition among hospitals is increasing.

7.3 Effectiveness of awarding preferred providers a quality label to channel patient choice to high-quality hospitals

In a managed care setting, health insurers are attempting to shift patient demand to providers that offer lower prices and/or higher quality of care. However, using financial incentives to channel their enrolees' healthcare provider choices may cause large enrolee discontent and disenrollment. An alternative strategy of informing enrolees about high-value and low-value providers and guiding them to preferred provider options without using financial incentives may be a more attractive patient channelling strategy. **Chapter 3** investigated whether a large Dutch health insurer's strategy of designating preferred hospitals was effective in changing enrolees' hospital choices for two surgical treatments. The insurer (Menzis) developed and introduced a quality label, called 'TopCare', to guide its enrolees in choosing a hospital for breast cancer surgery and inguinal hernia repair. Using for example indicators from the Dutch government's quality management programme, hospitals were awarded as top-quality provider because of their high-quality performances in previous years. The insurer recommended these hospitals to enrolees without an accompanying financial incentive.

Using individual patient-level claims data from the insurer over a 5-year period and a conditional logit choice model, which controlled for pre-existing patient preferences, it was found that patient-decision-making before and after the launch of the TopCare label was not significantly different, despite the quality information that was provided through issuing this quality label for preferred hospitals. Among both patient groups there already was a certain preference for the preferred hospitals, even when considering possible additional travel time, before the insurer designated these hospitals as top-quality providers for breast cancer or inguinal hernia repair. The TopCare label evidently did not result in a significant additional number of patients choosing one of the preferred hospitals for surgical treatment. The channelling strategy might have been too weak to persuade patients to seek another provider, or patients might have ignored the new information as being not credible. The latter explanation is in line with the observed limited consumer trust in Dutch health insurers' purchasing role. Either way, the results suggest that a soft channelling strategy without financial incentives is not, per se, effective in shifting patient demand toward high-quality providers.

7.4 Effectiveness of a differential deductible to steer patient choice to high-quality providers

When attempting to influence enrolees' provider choices direct recommendations paired with a financial incentive may be a more effective strategy for health insurers than only designating preferred providers. In this thesis, it was empirically assessed whether a differential deductible was effective as financial incentive to steer provider choices of enrolees diagnosed with varicose veins or cataract during a 1-year experiment by a regional Dutch health insurer (De Friesland Zorgverzekeraar; DFZ). If enrolees selected one of the designated high-quality providers, the insurer would waive their deductible for the cost of treatment. Providers were designated because of their higher performance on guideline adherence, waiting time and patient satisfaction.

As a first step, **chapter 4** examined whether this channelling strategy was effective in shifting patient demand towards high-quality providers. Using 3-year data on the number of DFZ enrolees treated at the provider-level and a difference-in-difference approach, it was found that preferred providers of varicose veins treatments on average experienced an increase in patient demand relative to providers designated as lower performing. For cataract surgery no significant change in the allocation of enrolees across providers was found.

A plausible explanation for the observed difference in effectiveness is that in the year prior to the experiment the providers designated as preferred option for cataract surgeries had a substantially higher joint market share than the preferred providers for varicose veins treatments. Consequently, the number of enrolees diagnosed with cataract that the insurer attempted to channel to higher quality providers was potentially considerably less than the number of enrolees diagnosed with varicose veins. Not only was the anticipated potential impact of the channelling strategy therefore small, but it probably also made it rather difficult to detect a statistically significant effect. In addition, the design of the differential deductible made the financial incentive in the market for cataract surgery services probably less effective. The deductible waiver was only applicable to the cost of cataract surgeries or varicose veins treatments which were provided by designated high-quality providers. Patients still needed to pay the cost of any other healthcare services up to their total deductible amount. Because cataract patients are relatively old and therefore more likely to suffer from chronic diseases many probably would not have a financial benefit of waiving the deductible for this particular treatment if they chose a designated provider, as they most likely would have to spend the deductible amount on other health services.

The effectiveness of the differential deductible on enrolees' provider choices for varicose veins treatments was further investigated in **chapter 5.** To assess how much the financial incentive itself affected patient choice behaviour a conditional logit choice model, which controlled for pre-existing patient preferences, was estimated using individual patient-level claims data from the insurer over a 2-year period. Since the deductible waiver only applied to the cost of varicose veins treatments or cataract surgeries which were provided by designated providers, the cost-sharing differential between the two provider tiers was not fixed but depended on each patient's expectation regarding his use of any other healthcare service in the policy year. Information on each patient's out-of-pocket payments in the year prior to the experiment was therefore used to proxy the financial benefit of choosing a provider in the higher performing tier.

There were two main findings from this study. First, it was found that patients were more likely to choose preferred providers relative to the year before. Hence, the choice model estimates confirmed that patient demand for the designated providers increased during the experiment. Second, varicose veins patients who, based on their out-of-pocket payments in the year before, could expect having a lower deductible amount if they chose a designated provider, were only slightly more likely to seek care at a designated provider. More than half of them did not respond to the cost-sharing differential offered. There might be different reasons for this. It could be that the benefits of choosing a preferred provider did not outweigh the extra travel costs. However, it could also be an indication that the incentive design was too complicated. Overall, from our modelling of the financial benefit it can be concluded that in this 1-year channelling experiment the insurer's direct recommendations had a much stronger impact on patient choice than the accompanying financial incentive.

7.5 Impact of centralizing cancer surgery services on patient travel times and equity in access

Centralization of complex surgery into high-volume units is occurring in most high-income countries because of a range of policies aiming to improve the quality and efficiency of these services. However, a consequence of centralization is that it may require patients to travel further for treatment, which potentially limits access to high-quality care. **Chapter 6** presented an innovative simulation approach to better understand the impact of service re-design on patient travel burden and equity in access to complex surgery. Compared to previous studies in this field of research, our approach explicitly considers patients' preferences revealed through their actual hospital selections by using data on patient visits to model patient choice. Previous studies simply assumed

that patients affected by centralization would go to their nearest alternative centre that would be still open.

In chapter 6, this simulation approach was applied to different centralization scenarios for concentration of prostate cancer surgery services into fewer surgical units in the English National Health Service. Using patient-level data on all men who underwent radical prostatectomy between 2010 and 2014, the results show how the additional travel burden associated with unit closures is regionally patterned and can widen inequities in access for particular patient groups, particularly those living in rural areas. Equally, it also demonstrates how certain scenarios with a strong centralization of the service – involving a closure of just over one-third of current providers – may have only a relatively small impact on patients' travel time.

Although the simulation approach presented in this chapter used data from a single-payer system, it is certainly applicable to other institutional settings as well. It shows how the impact of centralization options can be empirically assessed if relevant patient data are available. When further improved, this modelling and simulation approach could provide an atheoretical, data-driven comparator to the top-down approach that is mostly used for centralization policies. That is, it can contribute to optimising the centralization of complex surgeries, such that improvements in patient outcomes are maximised while at the same time the negative impact on patient travel burden and equity in access is minimalised.

7.6 Policy recommendations and suggestions for further research

Based on the research presented in this thesis the following policy recommendations and suggestions for further studies are offered:

1. Given the finding that patients are more likely to be treated in hospitals with high quality ratings (**chapter 2**), public ratings measuring hospital quality should be adjusted for differences in patient case-mix (like the Hospital Standardised Mortality Ratio) to prevent competing hospitals from manipulating their ratings through risk selection. Otherwise, competition among hospitals through patient choice will not be helpful for improving healthcare delivery. If adequate risk-adjustment is not feasible for individual quality measures, an alternative is to provide a single public measure of hospital quality summarizing a variety of measures across different areas of quality such as mortality, safety of care, readmissions, patient experience, and

timeliness and effectiveness of care. For example, by publishing an overall hospital quality star rating like the one used by the Centers for Medicare & Medicaid Services (CMS). Compared to individual quality measures, these overall ratings are harder to manipulate for hospitals and patients can more easily identify differences in quality. Such a system, however, requires continuous research aimed at (methodological) improvements. Using panel data, further research is also needed to investigate the (direct) impact on patient choice of releasing hospital quality ratings.

2. The effectiveness of a channelling strategy is not self-evident as shown by our empirical study of the impact of the TopZorg label introduced by health insurer Menzis (**chapter 3**). In general, key to the success of an insurer's channelling strategy is a high level of enrolees' trust in the recommendations put forth by the insurer. If the level of trust is low, it will be very difficult to influence enrolees' choices of provider. To enhance trust, insurers should always be transparent about the criteria used to designate providers as their preferred options as well as acquire reliable information to apply the criteria. In addition, informing and working cooperatively with GPs seems another promising strategy for insurers to steer patients to preferred providers, given the fact that over the years people have consistently far more trust in GPs than in health insurers.

3. Recommendations paired with a clear financial incentive may encourage patients more strongly to seek care from designated high-value providers. Empirical research presented in this thesis (**chapters 4 and 5**) has shown that the differential deductible offered during the experiment only slightly affected enrolees' provider choices for one specific procedure. Offering differential co-payments per tier may provide a more effective financial incentive. In this much simpler and therefore easy-to-understand benefit design, patients pay a guaranteed lower cost-sharing amount at the point of service if they choose providers in the higher performing tier. Since almost all empirical evidence is obtained in the typical context of the US health system with (very) high or even no out-of-pocket limits, new Dutch insurer experiments of this kind are wanted. Future studies could then assess the effectiveness of this type of financial incentive to channel patients to specific providers. In addition, it is important to investigate whether any changes observed in the allocation of enrolees also have an adequate impact on the bargaining leverage of insurers vis-à-vis healthcare providers.

4. To assess the impact of service re-design on patient travel burden and equity in access to complex surgery, a simulation approach that explicitly considers patient preferences for specific hospital characteristics as well as patient's own personal

characteristics is needed (**chapter 6**). Future research in this area should focus on a better understanding of the trade-offs between equity, travel burden, and patient outcomes to better inform healthcare services re-design. For instance, further simulations could estimate the expected improvement or worsening of patient outcomes that may result from centralization. Furthermore, in market-based health systems, it is also important to consider the (potential) trade-off between centralization and provider competition. A key question is to what extent changes in the configuration of complex surgery services have a negative impact on the strength of provider competition which could lead to less extrinsic motivation of providers to improve quality and efficiency.

Samenvatting

Onderzoekscontext

Patiënten met een planbare zorgvraag worden in Nederland van diverse kanten aangemoedigd om zelf weloverwogen een zorgverlener te kiezen. Ook in andere Europese landen krijgen patiënten steeds meer keuzevrijheid. Vrije keuze is heel wezenlijk vanuit het oogpunt van 'patient empowerment'. Het betekent dat patiënten een bepaalde autonomie en mate van controle over hun eigen zorgproces hebben. Door bewust een zorgaanbieder te kiezen kunnen patiënten actief bevorderen dat de zorg goed aansluit bij de eigen behoeften. Bovendien kunnen patiënten door het benutten van hun keuzevrijheid van zorgverlener de wachttijden in de zorg terugdringen. Het gebruik van de bestaande zorgcapaciteit is efficiënter als meer patiënten bewust kiezen voor verder weg gelegen zorgaanbieders vanwege een kortere wachttijd.

Keuzevrijheid voor patiënten kan daarnaast de kwaliteitsconcurrentie tussen zorgaanbieders verder aanjagen. Als patiënten kwaliteit meewegen in hun beslissing levert een kwaliteitsverbetering aanbieders meer patiënten op wat kan leiden tot hogere inkomsten. Met hun keuzes kunnen patiënten zorgaanbieders extra motiveren om de kwaliteit van de zorg te verbeteren. Verschillende partijen, waaronder de Nederlandse overheid en patiëntenverenigingen, investeren daarom in het beschikbaar maken van meer en betere publieksinformatie over de kwaliteit van zorg. Individuele patiënten kunnen daarmee voor hun specifieke behandeling inzicht krijgen in de kwaliteitsverschillen die tussen aanbieders bestaan. Patiënten die met deze informatie goed uit de voeten kunnen, zo is de gedachte, zullen hun keuze voor zorgverlener (mede) baseren op kwaliteit. En als dit zorgaanbieders motiveert om hun kwaliteit te verbeteren, kunnen hiervan ook patiënten profiteren die de vergelijkingsinformatie niet of minder goed kunnen interpreteren en gebruiken.

Naast keuzevrijheid voor patiënten bij het kiezen van een zorgverlener is in het Nederlandse gezondheidszorgsysteem keuzevrijheid voor burgers bij het kiezen van de verplichte zorgverzekering een belangrijk element. Deze keuzevrijheid moet ervoor zorgen dat zorgverzekeraars zich in onderlinge concurrentie actief inspannen om voor hun verzekerden gunstige financiële afspraken te maken met aanbieders over de hoeveelheid en kwaliteit van de te leveren zorg. Want hoewel een deel van de patiënten zich misschien laat leiden door de publieksinformatie over de kwaliteit van zorg, hebben individuele patiënten hoogstzelden inzicht in prijsverschillen, en bovenal zelf maar een beperkt financieel belang bij lagere prijzen. De rekening wordt immers grotendeels

gespreid over alle premiebetalers. Zorgverzekeraars hebben in het gezondheidszorgsysteem daarom de rol van kritische inkopers van de op genezing gerichte zorg.

Om ervoor te zorgen dat de totale zorguitgaven, en daarmee de verplichte zorgpremie, niet te hard stijgen proberen zorgverzekeraars het keuzegedrag van patiënten te beïnvloeden door hen in de richting te 'sturen' van zorgverleners die bereid zijn goede, toegankelijke zorg tegen een redelijke prijs te leveren. Hoe beter zorgverzekeraars in staat zijn om patiënten te geleiden naar de goede én goedkope zorgaanbieders, hoe beter de op genezing gerichte gezondheidszorg voor iedereen betaalbaar kan blijven.

Binnen de gezondheidszorg is de medisch specialistische zorg die ziekenhuizen, en in beperkte mate zelfstandige behandelcentra verlenen, van groot economisch belang. Van de totale zorguitgaven aan op genezing gerichte zorg, gefinancierd op grond van de Zorgverzekeringswet, komt ongeveer de helft voor rekening van de medisch specialistische zorg. Jaarlijks betreft dit ongeveer 25 miljard euro. Ieder jaar maakt zo'n 60% van de verzekerden gebruik van medisch specialistische zorg.[67]

Een recente ontwikkeling in de medisch specialistische zorg is toenemende specialisatie van zogeheten zeer complexe behandelingen. Voorbeelden hiervan zijn kinderhartchirurgie en oncologische behandelingen zoals prostaatkanker- en darmkankeroperaties. Concentratie van dit type zorg in enkele ziekenhuizen biedt kansen om de uitkomsten van zorg te verbeteren, onder meer doordat artsen meer patiënten met dezelfde aandoening zien en bepaalde moeilijke operaties vaker doen. Ook zijn kostenbesparingen mogelijk, bijvoorbeeld op de uitgaven aan dure medische apparatuur voor diagnostiek en robotchirurgie.

Met het centraliseren van zeer complexe ziekenhuiszorg neemt wel het aantal keuzemogelijkheden voor patiënten af en daarmee de geografische bereikbaarheid van dit type zorg. Sommige patiënten zullen na het concentreren van de zorg op minder plekken langer moeten reizen omdat zij niet terecht kunnen in een nabijgelegen ziekenhuis. In de beleidsdiscussie over concentratie van hoog complexe zorg ontbreekt het nog aan nauwkeurig inzicht in de gevolgen voor de reistijd van patiënten en daarmee de toegankelijkheid van zorg. Ook is er tot op heden amper aandacht voor de vraag hoe concentratie op grote schaal de machtsverhoudingen binnen het zorgveld zal veranderen en welke gevolgen dit mogelijkerwijs heeft voor de kwaliteit en betaalbaarheid van de medisch specialistische zorg.

67 Zie https://www.vektis.nl/intelligence/publicaties/factsheet-15-jaar-zorgverzekeringswet en Tweede Kamer (2021), Vaststelling van de begrotingsstaten van het Ministerie van Volksgezondheid, Welzijn en Sport voor het jaar 2022: voorstel van wet, 35 925 XVI, nr. 1, Den Haag.

Onderzoeksdoelen

Binnen deze context probeert dit proefschrift een bijdrage te leveren aan een beter begrip van het keuzegedrag van patiënten in markten voor medisch specialistische zorg. In vijf hoofdstukken komen de volgende vier onderzoeksdoelen aan bod:

1. Onderzoek hoe gevoelig patiënten zijn voor kwaliteitsverschillen tussen ziekenhuizen zoals gerapporteerd in publieke informatiebronnen (*hoofdstuk 2*).
2. Onderzoek of zorgverzekeraars door het toekennen van een kwaliteitslabel aan goed presterende ziekenhuizen de keuzen van patiënten kunnen 'sturen' in de richting van deze ziekenhuizen (*hoofdstuk 3*).
3. Onderzoek of zorgverzekeraars door het hanteren van een gedifferentieerd eigen risico de keuzen van patiënten kunnen 'sturen' in de richting van goed presterende ziekenhuizen (*hoofdstukken 4 en 5*).
4. Onderzoek de mogelijke gevolgen die centralisatie van oncologische operaties heeft voor de reistijden van patiënten (*hoofdstuk 6*).

Onderzoeksbevindingen en aanbevelingen voor beleid en onderzoek

Hoofdstuk 2 onderzoekt hoe gevoelig patiënten zijn voor kwaliteitsverschillen tussen ziekenhuizen zoals gerapporteerd in publieke informatiebronnen. In het bijzonder is econometrisch onderzocht of de ziekenhuiskeuzen van individuele dotterpatiënten samenhangen met de reputatie van het gekozen ziekenhuis alsook het aantal heropnames na behandeling van hartfalen als indicator voor de kwaliteit van zorg. Het blijkt dat ziekenhuizen met een goede algemene reputatie meer dotterpatiënten behandelen dan ziekenhuizen met een mindere reputatie. Ook lijken patiënten een voorkeur te hebben voor ziekenhuizen met weinig heropnames na behandeling van hartfalen dan ziekenhuizen met een hoger heropnamecijfer. De bereidheid die patiënten lijken te hebben om langer te reizen voor een betere reputatie en een lager heropnamecijfer vormt een indicatie dat keuzevrijheid voor patiënten de kwaliteitsconcurrentie tussen ziekenhuizen verder kan versterken.

Maar er schuilt in dit geval wel een addertje onder het gras. De toen beschikbare openbare informatie over heropnames gaf de dotterpatiënten in die tijd geen inzicht in de samenstelling van de patiëntengroep waarop de afzonderlijke ziekenhuisscores zijn gebaseerd. Het ontbreken van een correctie voor de zorgzwaarte van het patiëntencohort ('case-mix') vormt een risico. Ziekenhuizen die onderling concurreren om patiënten kunnen hier misbruik van maken door patiënten te selecteren met de grootste kans op een goede zorguitkomst (gunstige risico's) om daarmee direct de eigen kwaliteitsscore te verbeteren.

Een algemene aanbeveling om dit denkbare ongewenste strategische gedrag van ziekenhuizen tegen te gaan is kwaliteitsinformatie zo goed mogelijk te corrigeren voor case-mix. Goede voorbeelden hiervan zijn het zogeheten gestandaardiseerde sterftecijfer op ziekenhuisniveau ('Hospital Standardized Mortality Ratio') en gestandaardiseerde sterftecijfers voor specifieke diagnose- en patiëntengroepen ('Standard Mortality Ratios'). Ondanks de (methodologische) stappen die al zijn gezet, is meer onderzoek nodig om ook voor andere kwaliteitsaspecten een adequate correctie voor case-mix toe te passen.

Een deugdelijke correctie voor case-mix zal niet voor alle relevante kwaliteitsaspecten haalbaar zijn. Onderzoek zou zich dan kunnen richten op het samenvoegen van verschillende kwaliteitsindicatoren tot één totaalbeoordeling. Verschillende aspecten van de kwaliteit van zorg, zoals mortaliteit, veiligheid van zorg, heropnames, patiëntervaring en tijdigheid en effectiviteit van de zorg zouden daarbij meegenomen kunnen worden. In de Verenigde Staten ontwikkelt en publiceert het federale zorgagentschap, genaamd 'Centers for Medicare & Medicaid Sevices' (CMS), totaalbeoordelingen in de vorm van een vijf-sterrenwaarderingssysteem onder meer voor ziekenhuizen en verpleeghuizen.[68] Een totaalbeoordeling van de kwaliteit is door ziekenhuizen moeilijker te manipuleren dan de afzonderlijke deelscores. Bijkomend voordeel is dat voor patiënten het verschil in kwaliteit in brede zin tussen ziekenhuizen makkelijker zichtbaar is.

Hoofdstuk 3 onderzoekt of zorgverzekeraars door het toekennen van een kwaliteitslabel de keuzen van patiënten kunnen 'sturen' in de richting van goed presterende ziekenhuizen. Meer specifiek is onderzocht of een grote landelijke Nederlandse zorgverzekeraar met een kwaliteitslabel meer van haar verzekerden voor een borstkanker- of liesbreukoperatie naar de geselecteerde kwalitatief betere ziekenhuizen kon geleiden. Een econometrische analyse van de individuele ziekenhuizenkeuzen van beide patiëntengroepen laat zien dat het keuzegedrag na de introductie van het kwaliteitslabel niet wezenlijk anders was dan de situatie zonder de aanbevelingen van de zorgverzekeraar. Dit betekent dat het beïnvloeden van het keuzegedrag van patiënten via kwaliteitsinformatie afkomstig van zorgverzekeraars niet als vanzelf hoeft te gaan.

Te weinig vertrouwen in de aanbevelingen van de zorgverzekeraar is één van de aannemelijke factoren die kan verklaren waarom niet meer patiënten naar geselecteerde goed presterende zorgverleners zijn gegaan. Een algemene aanbeveling om het vertrouwen hierin te vergroten is dat zorgverzekeraars transparant(er) zijn over de kwaliteitsinformatie die zij gebruiken bij het selecteren van zorgverleners. Daarnaast kan het voor

68 Zie www.medicare.gov/care-compare/

verzekeraars interessant zijn om meer samenwerking met huisartsen te zoeken. Huisartsen genieten onder patiënten meer vertrouwen en veel patiënten hechten waarde aan het advies van de huisarts bij een doorverwijzing naar de medisch specialistische zorg. Door informatie over de kwaliteitsverschillen tussen zorgaanbieders met huisartsen te delen en te bespreken, adviseren mogelijk meer huisartsen de door de zorgverzekeraar geselecteerde zorgverleners aan patiënten.

Hoofdstukken 4 en 5 analyseren of zorgverzekeraars door het hanteren van een gedifferentieerd eigen risico de keuzen van patiënten kunnen 'sturen' in de richting van goed presterende ziekenhuizen. In het bijzonder is een experiment van een grote regionale Nederlandse zorgverzekeraar uitvoerig bestudeerd waarin de aanbevelingen van de verzekeraar voor een zorgverlener gekoppeld waren aan een financiële stimulans. Als de verzekerde voor een spatader- of een staarbehandeling een van de geselecteerde zorgverleners koos, kwamen de gemaakte kosten voor deze behandelingen niet voor rekening van het eigen risico. Voor de toepassing van het eigen risico maakte de verzekeraar dus onderscheid tussen twee groepen aanbieders om daarmee patiënten te 'sturen' naar een geselecteerde groep zorgverleners. Bij de keuze voor een geselecteerde aanbieder ging het overigens niet om een kwijtschelding van het eigen risico. Dus als de verzekerde andere zorgkosten maakte, kwamen deze gewoon voor rekening van het eigen risico. Het financiële voordeel dat verzekerden moest stimuleren om te kiezen voor de geselecteerde groep aanbieders hing daardoor af van hun andere zorggebruik gedurende het jaar.

Econometrische analyses van de zorgaanbiederskeuzen zowel voor als tijdens het experiment wijzen uit dat de financiële stimulans alleen in de groep spataderpatiënten een klein effect had op het keuzegedrag. Staarpatiënten lieten zich niet beïnvloeden door het mogelijke financiële voordeel gekoppeld aan de keuze voor een door de verzekeraar geselecteerde zorgverlener. Een aannemelijke verklaring is dat staarpatiënten vaak ouder zijn en mede hierdoor veel andere zorgkosten gedurende het jaar hebben waardoor zij in de praktijk niet of nauwelijks in financiële zin profijt hadden bij een andere keuze. Nadere bestudering van het gedifferentieerde eigen risico laat zien dat onduidelijkheid over het precieze financiële voordeel op het moment van kiezen de effectiviteit van dit instrument sterk ondermijnt.

Een mogelijk beter instrument, waarvoor een verandering in wet- en regelgeving nodig is, is het hanteren van een vaste eigen bedrage per behandeling die lager is bij zorgaanbieders die de zorgverzekeraar aanwijst. Dit is een financiële stimulans die verzekerden goed zullen begrijpen en zorgverzekeraars daardoor waarschijnlijk veel effectiever

kunnen inzetten bij het 'sturen' van patiënten in de richting van de goed presenterende ziekenhuizen.

Hoofdstuk 6 onderzoekt de mogelijke gevolgen die het centraliseren van oncologische operaties heeft voor de reistijden van patiënten en welke verschillen in reistijdverandering tussen groepen patiënten zijn te verwachten. Het hoofdstuk presenteert hiervoor een nieuwe methode die in kaart brengt wat het effect op de reistijden van individuele patiënten is als minder ziekenhuizen complexe operaties zouden aanbieden. Een econometrisch model van het keuzegedrag van patiënten met daarin meegenomen het belang dat (groepen van) patiënten hechten aan specifieke verschillen tussen ziekenhuizen, wordt gebruikt om na te bootsen welk ziekenhuis elke patiënt zou kiezen na concentratie van de zorg. Eerdere studies hanteerden de simpele aanname dat alle patiënten na de zorgconcentratie zullen kiezen voor het ziekenhuis met de kortste reistijd.

De nieuwe methode is toegepast voor prostaatkankerpatiënten in het gezondheidszorgsysteem van Engeland ('The National Health Service in England'). Voor de gekozen concentratiescenario's resulteerde dit in een adequate schatting van het gemiddelde effect van zorgconcentratie op reistijd voor groepen patiënten met gelijke achtergrondkenmerken.

Het verdient aanbeveling om het inzicht dat met deze methode kan worden verkregen mee te laten wegen in de beleidsdiscussies rondom concentratie van hoog complexe zorg. Voor een goede beleidskeuze zouden beleidsmakers de verwachte verbetering in kwaliteit en de verwachte besparing in kosten moeten afzetten tegen de mogelijke verslechtering van de toegang tot zeer complexe zorg.

About the author

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Education

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2001	Master of Science in Economics, Erasmus School of Economics / EUR

Work

2014 – present	Assistant professor at ESHPM / EUR
2009 – 2014	Academic researcher at ESHPM / EUR
2004 – 2009	Academic researcher at SEOR BV / EUR
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2001 – 2004	Academic researcher at OC*f*EB / EUR
1999 – 2001	Research assistant at OC*f*EB / EUR

Current teaching

"De Nederlandse gezondheidszorg" (in Dutch), lecturer, Bachelor Health Policy & Management, ESHPM / EUR

"Marktordening in de zorg" (in Dutch), lecturer and course coordinator, Bachelor Health Policy & Management, ESHPM / EUR

"Algemene Economie van de Gezondheidszorg" (in Dutch), lecturer and course coordinator, pre-Master Health Policy & Management, ESHPM / EUR

"MSc thesis" (in English), supervisor and co-evaluator, Master Health Economics, Policy & Law / Health Economics (HEPL/HE), ESHPM / EUR

Publications in international peer-reviewed journals (selection)

Schut, F.T., F.M.E. Franken, S.A. van der Geest and M. Varkevisser (2024), Financing COVID-19-related health care costs in the Dutch competitive health system during 2020 and 2021: Overall experiences and policy recommendations for improving health system resilience, *Health Policy*, 141: 104969

Varkevisser, M., F.M.E. Franken, S.A. van der Geest and F.T. Schut (2023), Competition and collaboration in health care: reconciling the irreconcilable? Lessons from The Netherlands, *European Journal of Health Economics*, 24(7): 1019-1021

Aggarwal A., L. Han, S.A. van der Geest, D. Lewis., Y. Lievens, J. Borras, D. Jayne, R. Sullivan, M. Varkevisser and J. van der Meulen (2022), Health service planning to assess the expected impact of centralising specialist cancer services on travel times, equity, and outcomes: a national population-based modelling study, *Lancet Oncology*, 23(9): 1211-1220

Aggarwal*, A., S.A. van der Geest*, D. Lewis, J. van der Meulen and M. Varkevisser (2020), Simulating the impact of centralization of prostate cancer surgery services on travel burden and equity in the English National Health Service: A national population based model for health service re-design, *Cancer Medicine*, 9(12), 4175-4184 (* joint first authors)

Van der Geest, S.A. and M. Varkevisser (2019), Patient responsiveness to a differential deductible: empirical results from the Netherlands, *European Journal of Health Economics*, 20(4): 513-524

Van der Geest, S.A. and M. Varkevisser (2016), Using the deductible for patient channeling: did preferred providers gain patient volume?, *European Journal of Health Economics*, 17(5): 645-652

Varkevisser, M., S.A. van der Geest and F.T. Schut (2012), Do patients choose hospitals with high quality ratings? Empirical evidence from the market for angioplasty in the Netherlands, *Journal of Health Economics*, 31(2): 371-378

Varkevisser, M., S.A. van der Geest and F.T. Schut (2010), Assessing hospital competition when prices don't matter to patients: the use of time-elasticities, *International Journal of Health Care Finance and Economics*, 10(1): 43-60

Boonen, L.H.H.M., S.A. van der Geest, F.T. Schut and M. Varkevisser (2010), Pharmaceutical policy in the Netherlands: from price regulation towards managed competition, in A. Dor (ed.), 'Pharmaceutical markets and insurance worldwide', *Advances in Health Economics and Health Services Research*, volume 22: 53-76

Varkevisser, M. and S.A. van der Geest (2007), Why do patients bypass the nearest hospital? An empirical analysis for orthopaedic care and neurosurgery in the Netherlands, *European Journal of Health Economics*, 8(3): 287-295

Publications in national journals (selection)

Franken, F.M.E., S.A. van der Geest, R.C.M.H. Douven en M. Varkevisser (2023), Prijsverschillen in ziekenhuiszorg nemen af, maar blijven groot, *ESB*, te verschijnen (online: 13 september 2023)

Van der Geest, S.A., F.T. Schut en M. Varkevisser (2022), Maakt Rutte IV de stevige keuzes die nodig zijn voor een toekomstbestendige gezondheidszorg?, *TPEdigitaal*, 16(1): 43-52

Van Velzen, N., S.A. van der Geest en M. Varkevisser (2022), Ziekenhuiskeuze kan niet volledig worden gestuurd via financiële prikkel, *ESB*, 107(4806): 86-88

Van Velzen, N. en S.A. van der Geest (2020), Patiënt kiest niet vanzelf het voorkeursziekenhuis van de zorgverzekeraar, *ESB*, 4785: 212-214

Van der Geest, S.A., J. Rijken, F.T. Schut en M. Varkevisser (2018), Beheersing zorguitgaven via macrobeheersinstrument is riskant, *ESB*, 4764: 364-367

Van der Geest, S.A. en M. Varkevisser (2018), Sturing via eigen risico heeft beperkt effect, *ESB*, 4757: 22-23

Schut, F.T., M. Varkevisser en S.A. van der Geest (2017), Vertrouwen in de toekomst van de zorg?, *TPEdigitaal*, 11(3): 21-25

Van der Geest, S.A. en M. Varkevisser (2013), Fusies van maatschappen bedreigen zorginkoop, *ESB*, 4668: 544-546

Van der Geest, S.A. en M. Varkevisser (2012), Zorgconsumenten en kwaliteitsinformatie, *ESB*, 4631: 174-175

Van der Geest, S.A. en M. Varkevisser (2010), Keuzebeïnvloeding via eigen risico werkt, maar kan beter, *TPEdigitaal*, 4(4): 34-48

Van der Geest, S.A. en M. Varkevisser (2010), Winstverbod ziekenhuizen onder voorwaarden loslaten, *ESB*, 4580: 152-154

Varkevisser, M., S.A. van der Geest, M. Appelman en J. Struijs (2009), Regionale machtspositie zorggroepen baart zorgen, *ESB*, 4572: 701

Van der Geest, S.A. en M. Varkevisser (2008), Kwaliteitsinformatie en de marktaandelen van IVF-centra, *ESB*, 4549: 756-758

Van der Geest, S.A., I. Mosca, F. Pellikaan en M. Varkevisser (2007), In beweging voor de fysiotherapeut, *ESB*, 4516: 506-508

Varkevisser, M., S.A. van der Geest, E. Maasland en E. Schut (2007), Opleiden medisch specialisten moet transparanter, *ESB*, 4511: 340-342

Varkevisser, M., N. Polman en S.A. van der Geest (2006), Zorgverzekeraars moeten patienten kunnen 'sturen', *ESB*, 4478: 38-40

Van der Geest, S.A., F.T. Schut en M. Varkevisser (2003), Eerlijk prijzen in de zorg, *ESB*, 4415: 470-472

Varkevisser, M., R.F.T. Aalbers, E. Dijkgraaf, S.A. van der Geest en F.T. Schut (2003), Deregulering zorgaanbod vereist maatwerk, *Tijdschrift voor Openbare Financiën*, 35(3): 98-108