Marginal Physician Visits and the Diagnostic Case Mix

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Abstract

We develop a simple microeconomic framework for the analysis of health care utilisation levels for different medical conditions. Monthly panel data on different diagnoses registered in eight Swedish counties over three years is used to test the hypothesis that marginal appointments are disproportionately made for less serious medical conditions. We find significant evidence that contradicts our hypothesis, but does not hold up to closer scrutiny or a sensitivity analysis. We argue that weaknesses in the used data could be the cause, and suggest directions for further research.

Keywords: primary care, health care utilisation, diagnostic case mix
JEL-codes: I11, I12, I18

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We take full responsibility for any flaws or errors still present.

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1 Introduction

Going to the doctor is something that most people, if not all, have experiences from. In the developed world, many citizens view the possibility of seeing a physician quickly, at a subsidised price, as an entitlement. In economics, we study the allocation of scarce resources, and the question of whether this allocation with regards to health care services is efficient remains an open one. On the one hand, it can be argued that the productive time of physicians is better utilised in helping patients with serious illnesses than those with e.g. the common cold. On the other hand, if all severe cases are already treated, there is not necessarily anything that prevents visits for less severe conditions from being desirable.

In Sweden, the number of contacts with primary care in 2010 ranged from 1.96 per person in the county of Stockholm to 1.20 per person in neighbouring Östergötland. The number of visits per capita in Stockholm have increased by 34% since the introduction of its free choice reform less than 5 years ago.

Two years have passed since similar free choice reforms were implemented in all Swedish counties, and so far no clear conclusion has been reached regarding the effects of these reforms. One report that reviewed the impact of the reform after its first year in effect in Stockholm, found no changes in distribution of age, sex or main diagnosis among patients (Berggren et al., 2008). Later, during the fall of 2011 the Centre for Business and Policy Studies (SNS), published a study evaluating the outcome of all recently adopted free choice legislation (Hartman et al., 2011). The empirical findings of the report were inconclusive and could not identify any productivity gains from the different reforms. However, the report started an intense debate not only about the free choice reforms' raison d'être, but also about scientific freedom and independence from economic interests. Since then, many opinion pieces have been written on the topic, and as recently as February 2012, one text by Sarlöv et al. (2012) argued that the current system has led to an increase in unnecessary visits since physicians are encouraged to treat patients with less severe diseases, such as the common cold. Intuitively, the authors claim does make sense. When the total number of visits is higher and the general sickness level is not changing, the increase in visits should reasonably come from less serious conditions. In this thesis we present a microeconomic model that could explain such a phenomenon and use it to test whether there is some truth in the statement made by Sarlöv et al.

1.1 Purpose

The purpose of this thesis is to study the relationship between primary care utilisation and different conditions' share of the diagnostic case mix (i.e. the distribution of different diagnoses). By doing this we hope to help improve the understanding of issues that have recently been high on the public agenda.

Specifically, we develop a theoretical framework with the testable implication that a marginal increase in the total number of doctor's appointments will lead to a greater share of total diagnoses to be attributable to less severe conditions. We use available data from 8 different Swedish counties (Swedish: *Län*) in order to examine that hypothesis.

1.2 Delimitations

It is natural to limit the scope of this thesis to primary care, since it has been the target for recent privatisation reforms by the government. Furthermore, there are large differences in behaviour between primary and inpatient care usage, which would make inclusion difficult and counterintuitive.

The Swedish free choice reforms changed primary care in aspects ranging from remuneration and out-of-pocket fees, to data gathering procedures. Mainly due to the latter change, our time scope is limited to the year of 2009 and onwards for most counties. Lastly, due to limited data availability, we are constrained to study only 8 of Sweden's 20 counties.

1.3 Outline

After a short introduction to Swedish primary care, this thesis presents relevant previous research in the health economics field. We then aim to give the reader an insight into some aspects of the Swedish health care system and primary care reform, in order to provide context for the topic studied. In the subsequent section, we construct a theoretical framework which we then use to create a regression model to tests our hypothesis. Lastly we discuss our findings and propose directions for further research.

2 Background

2.1 History

Swedish primary care has undergone large changes during the last few years. However, facilitation of the establishment of private health care began more than 20 years ago. In the early 1990's, Swedish health care was in a crisis with much too long queues. The government of that time argued that through promotion of patient choice and encouragement of private competition, the free market would alleviate these issues. Some privatisation was carried out, but in the general election of 1994 political majority shifted and the new government, facing skyrocketing health care costs, retracted or halted many of the reforms (Anell and Rosén, 1996). In the late 2000's, some counties started to implement a collection of different free choice reforms in primary care, calling it *Vårdval*. A new government, perceiving the new system as successful and ideologically important, decided that all Swedish counties

should be required to implement their own version of Vårdval. From 1 January 2010, every Swedish citizen has a right to choose freely among all caregivers in their county, and county councils (Swedish: *Landsting*) are required to design their free choice-systems so that all performers are treated equally, if no motives to do otherwise exist (Justitiedepartementet, 2011).

2.2 International Comparison

Even after recent reforms, an international comparison puts Sweden in a rather unique position, where primary care is governed by county councils individually. Primary care is generally provided at care centres employing between four and ten general practitioners as well as several other professionals. By contrast, other countries in the OECD tend to rely to a larger extent on private caregivers, with general practitioners often working alone or in small groups (Anell, 2011a). While the Vårdval legislation has allowed for an increase in the number of private actors, funding sources have not changed and the Swedish health care system is almost completely funded by public means. This new system, partially inspired by reforms of the NHS in Britain during the last decade (Dixon et al., 2010), has had a significant impact on almost every aspect of primary care in Sweden.

2.3 Vårdval - the Swedish Health Care Reform

Since 2007, 267 new primary health care centres have opened in Sweden. Some have later been closed, but a net increase of 190 centres has been observed during the last five years (Jönsson et al., 2012). Almost all of the new primary care providers are private, and their establishment is a direct result of the Vårdval reform. Private providers are to a large extent located in densely populated areas, and the three largest firms (Praktikertjänst, Capio, and Carema) have nationwide presence and about 20% of the primary care market (Anell, 2011b).

Vårdval is based on the law *Lag om valfrihetssystem* (LOV) (Justitiedepartementet, 2009) which stipulates that private and public primary health care providers shall be treated equally and that patients shall be free to choose among them as they please. The county of Halland was the first Swedish county to implement their Vårdval system in January 2007. In the years to come, 8 out of the total 20 counties followed suit, before a requirement for Vårdval implementation was imposed on all Swedish counties, starting 1 January 2010 (Justitiedepartementet, 2011).

The purpose of the Vårdval system has been to improve performance and availability of Swedish primary care (Anell, 2011a). LOV stipulates how systems are to be constructed to offer citizens a choice between private and public care providers. However, county councils still have a rather large freedom in the construction of their respective systems. This has led to a great

variation in characteristics such as economic compensation, requirements for establishment, and patient registration (Lundvall, 2010). See Table 9 in the Appendix for a detailed comparison of primary care systems in all counties.

2.3.1 Compensation Levels

The major part of the reimbursement paid to a primary care centre is generally a capitation payment, remunerating the caregiver for every registered patient. Additionally, a fee for service is used as a variable payment for every item of care (e.g. visit) issued. A small part of funding also comes from out-of-pocket fees paid by the patient. These range between SEK 100 and 200 per visit and often include a surcharge for visits made to other primary care practitioners than the one the patient is registered with, as well as for visits to specialists without being referred (Anell, 2011a). All patients in Sweden are covered by high-cost protection, meaning that out-of-pocket costs for primary care will not exceed a certain sum that ranges from SEK 900 to 1100 per year depending on county (Karlsson Gadea, 2012).

Adjusted Clinical Groups (ACG) and Care Need Index (CNI) are two risk adjustment capitation methods used by some counties to increase accuracy in calculations of care costs of registered patients. These methods are in many ways similar to standard activity based costing methods. ACG is used to identify need of care based on illness affecting variables among patients listed, and draws on the similar Diagnose Related Groups system (DRG) used in Swedish inpatient care (Majeed et al., 2001) and the American Medicare system (Robinson, 2001). The compensation level is defined for every registered patient by evaluation of previously made diagnoses, age, and sex. CNI tries instead to estimate future care need and costs by including variables such as area of residence, income, education, and other socio-economic factors (Jönsson et al., 2012). In section 3.3.3, we will present research that has been done on the effects of different compensation systems.

3 Previous Research

3.1 The Demand for Health and Health Care

The study of the economics of health and health care was arguably initiated by Arrow (1963), who introduced the notion of health care as a good with special qualities that need to be studied accordingly. He outlines some of the features of medical care goods (e.g. physician visits) that are important for economic analysis, including the high degree of uncertainty on the part of the consumer towards the actual value of the treatment received. In many cases, a patient may need to see a doctor simply in order to determine whether or not she actually needs to see a doctor. The focus of this thesis requires an introduction to research on some specific aspects of health economics.

The demand for health care services such as doctor's appointments is inherently connected to the demand for good health. Grossman (1972) introduced a model of health using the theory of human capital. He argues that individuals possess a stock of health capital that can be invested in through various means, including medical care. The level of this investment is then decided by maximising its present value.

Grossman further identifies some factors that have impacts on the return on investment in health, and therefore also on the level of utilisation. The individual's age will influence the depreciation rate of the health stock. Older people tend to need a higher investment in health in order to keep it at the same level. Education is in this theory assumed to increase investment in health capital by improving the efficiency in producing health capital through e.g. better knowledge of how to improve one's health. Lastly, a higher wage income can influence the investment behaviour in three ways; firstly, through the income effect of the individual having more to spend, secondly through the higher opportunity cost of the time used to invest in health, and finally through the fact that health will actually enhance the individual's opportunity to keep earning this wage.

3.1.1 Consumer Price of Physician Visits

Two important distinctions need to be made when considering the cost to the consumer of making a doctor's appointment. Firstly, in almost every health care system, and certainly so in Sweden, the consumer does not bear the full monetary cost of each appointment herself. There is normally an out-of-pocket price to be paid directly by the patient (the exception being e.g. patients covered by high-cost protection in Sweden), with the rest of the payment covered by health insurance, either public or private. Adverse selection problems are common in health insurance, but are arguably irrelevant to this study due to mandatory insurance participation in Sweden and will not be discussed further. For research on these aspects, the interested reader is referred to e.g. Feldstein (1973). Secondly, the out-of-pocket price for the appointment only constitutes a part, and arguably a minor part, of the full consumer price. Acton (1975) suggests that the time cost of travelling to and waiting in line for an appointment constitutes a considerable portion of the full price. This does indeed seem like a reasonable claim since we do not observe extremely high utilisation rates even in health care systems where the consumer out-of-pocket price equals zero.

3.1.2 Agency Costs and Supplier Induced Demand

Since there is a large information asymmetry between physician and patient regarding the state of the patient's health and the necessity of different treatments, the physician can have an incentive to overstate the need for

medical care and thus induce an increased demand for appointments (Evans, 1974). The physician can in agency theoretic terms be said to act as a double agent, with both the patient and the funder (e.g. government or insurance company) acting as principals. Both of these aspects may cause the number of doctor's appointments made to be socially suboptimal, since self-interested care providers may use their information advantage for their own benefit, possibly to the detriment of the public good (Blomqvist, 1991).

3.2 Behavioural Economics in Health Policy

Health and behavioural economics are closely linked, something that can be observed as early as in Arrow's seminal 1963 article, in which he uses explanations that touch on behavioural theories (Arrow, 1963). Frank (2007) writes that as the health economics field developed, profit-maximisation theories had trouble explaining physician behaviour. It is possible that health policy could be enhanced by the application of behavioural theories. Behavioural economics has different implications for policy decisions regarding health insurance than do the standard the standard agency theoretic framework often used.

A behavioural approach to health care policy can also yield other types of productivity gains. Congdon et al. (2011) analyse public policy from a behavioural perspective, and show e.g. how patient behaviour can be explained through bounded self-control theories. For example, only one fourth of all diabetes patients take the recommended amount of medication, even though a failure to medicate could be fatal (DiMatteo, 2004). Furthermore, factors such as social norms and imperfect learning could also affect usage of primary care. Patients can for instance substitute secondary care for primary care, and do so to varying extents in different geographic regions, depending on, among other things, local norms (Fisher et al., 2003).

3.3 Impact of the Swedish Free Choice Reform

The new Swedish health care system is still not more than a few years old, and data recording structures are still not fully developed, which has hindered analysis greatly (Hartman et al., 2011). Nevertheless, some significant research has been done. A summary of research made on Swedish primary care, as well as international studies relevant to current circumstances, will be presented in this section.

The Swedish Competition Authority has analysed the reform, focusing on competition levels and factors driving new establishments (Lundvall, 2010). A clearly visible effect is how counties that implemented Vårdval voluntarily, i.e. before the government mandate in 2010, have seen a much greater frequency of new establishments.

3.3.1 Privatisation and Profits

According to LOV, counties are encouraged to treat private and public providers equally. In reality this is rarely the case. Public care centres generally do not report financial results separately and are often not required to carry over losses. Several counties give their primary care service a last resort responsibility, and centres are maintained to cover those geographic areas or medical treatments that yield low economic gains (Fagerhem and Lingqvist, 2012). Certain counties use compensation to encourage private as well as public providers to establish primary care centres in sparsely populated areas.

Some key differences in incentives also exist between for-profit and not-for-profit caregivers and have been examined thoroughly in American studies. A large meta study could not identify any increases in productivity from for-profit governance, but concludes that for-profit hospitals are better at generating income (Devereaux et al., 2004). A comparison between the American and Swedish systems will be inaccurate since almost all American not-for-profit care providers are private, while Swedish ones are generally public.

3.3.2 Patient Registration

During the implementation of Vårdval, counties decided individually how to register patients, using either active or passive methods. In the active registration process, patients can choose whether and where to register themselves. By contrast, the passive registration process automatically registers all patients at either their nearest caregiver or the one they used last. Some counties that used passive registration methods, only distributed patients among already established providers, while others included new providers. Jönsson et al. (2012) show that the choice of distribution method greatly affected the number of new private establishments in a county. Counties with passive registration that included new providers have seen the largest increases, while those that did not include new providers have experienced much smaller increases. In both systems patients are allowed to change provider at will.

3.3.3 Payment Systems

Government funding requires sound incentives to achieve the desired quality of health care service. As is mentioned above, an agency problem exists in primary care, not only between patient and doctor but also between health care providers and the funder.

The problem is addressed through the different methods mentioned briefly in section 2.3.1, with compensation systems designed to incentivise care

providers correctly. This section presents research on the effectiveness of these different methods.

It seems that the structure of compensation systems has a strong effect on new establishments as well as on health care utilisation. A large American meta study finds that fee-for-service payments seem to increase total visits, while a capitation-focused system increases referrals to specialists (Gosden et al., 2000). These behaviours are typically expected for rational agents facing varying incentive structures imposed by policy makers. A fee-for-service system encourages short and cheap visits, while a capitation system gives the highest reward when revisits are avoided.

Robinson (2001) argues that neither capitation or fee-for-service are by themselves satisfactory payment methods, and that they need to be combined, as well as complemented with other qualitative measurements, in order to achieve good results. While capitation discourages physicians from treating the chronically ill, fee-for-service does not sufficiently distinguish between appropriate and inappropriate treatments. Robinson studies payment incentives through an agency theoretic model and argues that different goal-fulfilment measures could be useful, since the main problem with capitation and fee-for-service is their focus on the primary care providers' costs, rather than on their performance. In a report to the Swedish Ministry of Finance, Anell (2010) analyses whether goal-fulfilment measures should be used in Swedish primary care, and concludes that it could indeed increase quality, but only if used correctly. Such a pay-for-performance-system would need very clear targets and a well defined strategy to function correctly.

4 Theory and Predictions

Variation in the number of visits to primary health care can theoretically depend on a number of factors, as described in the previous section. An interesting question, and the one we will try to answer, is whether this variation can be disproportionately attributed to certain groups of medical conditions. Let us first consider the microeconomic foundations for such a hypothesis.

4.1 Formulation of Model

As discussed above, the demand for health care is derived from the demand for good health. We can assume that the individual consumer receives marginally diminishing utility from each physician visit she makes. This standard economic assumption is arguably valid in the case of doctor's appointments because not every appointment is equally effective in improving the health of the patient. We expect rational consumers to only make those appointments for which the benefit exceeds the price. The aggregate demand curve for doctor's appointments (Figure 1) would therefore be downwards

sloping, meaning that the desired number of appointments increases as the price of making them decreases (Rosett and Huang (1973) estimated the own-price elasticity of the demand for different hospital and physician services to range from -0.35 to -1.5). Note that this price is not limited to the out-of-pocket price of the appointment, which is regulated at a low price for every visit to a primary care practitioner, but also includes e.g. the travel and time costs of making and waiting for the appointment (as discussed in section 4.3.3).

In line with standard economic reasoning, a decrease in the full price of making an appointment (from P to $P\prime$) will result in an increase in the total quantity of appointments demanded (from Q to $Q\prime$), as shown in Figure 1.

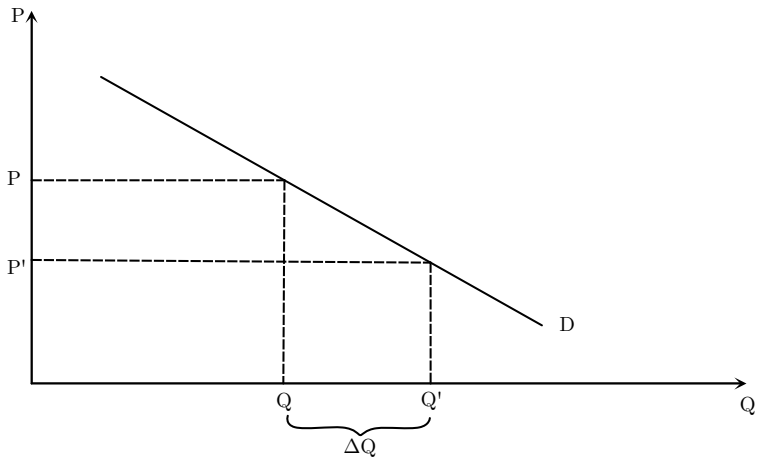

Figure 1: Impact of a price decrease on the quantity demanded

Consider now the different reasons a patient may have for making a doctor's appointment. As stated above, the benefit received by the consumer from an appointment is naturally not equal for every appointment. We postulate that the price elasticity of demand for appointments varies across different medical conditions, such that appointments for less severe conditions have systematically higher elasticities. To see why this is a reasonable assertion, consider the substitutability of doctor's appointments with other goods and services. For severe conditions, the treatment provided by the physician can often be the only feasible option available to improve the health state of the patient. By contrast, consumers with milder conditions can more easily substitute the physician's service for e.g. self-medication or rest. This difference is represented graphically in Figure 2, where D_{Severe} and D_{Mild} represent the demand curves for appointments pertaining to more severe and less severe conditions respectively.

The consumer price of visits is assumed to be equal across different conditions. Since Swedish primary care providers are legally prohibited from

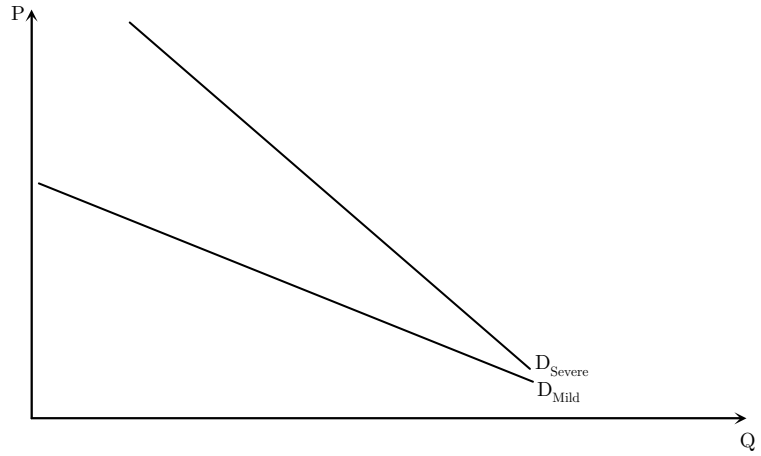

Figure 2: Price elasticities for different conditions

charging different consumer out-of-pocket prices for appointments for different conditions, and since different conditions are generally treated at the same care centre, we argue that this is a reasonable assumption. For a discussion of what happens when we relax this assumption, refer to section 4.3.3 below.

If we introduce a downwards price shift to this model, we would see that the quantity of appointments for the less severe condition increases at a faster rate than the more severe equivalent (Figure 3). If the out of pocket price remains constant through regulation while the number of caregivers increases, we might reasonably expect a resulting decrease in the full consumer price due to improved availability.

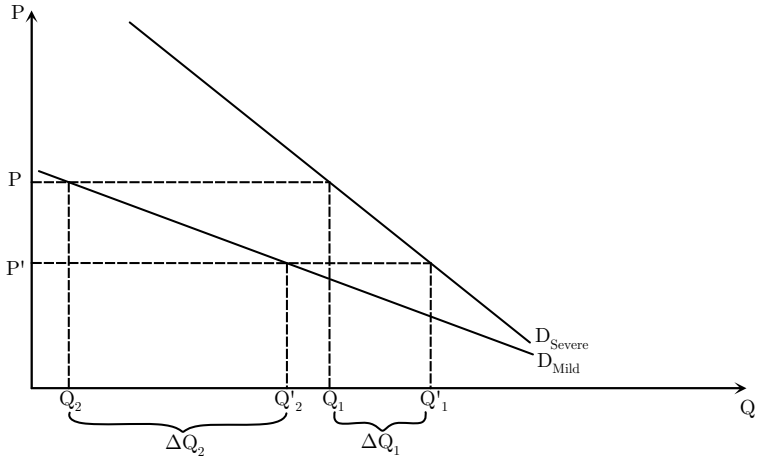

Figure 3: Impact of cost decrease with different elasticities

4.2 Predictions

The theoretical model outlined above gives rise to two clear predictions of the impact of a change in the consumer price of making doctor's appointments. Firstly, it would increase the total number of appointments made, as shown in Figure 1. Secondly, it would increase the proportion of the appointments that are made for medical conditions on the lower end of the severity spectrum, due to elasticity differences as shown in Figure 3. This is only the case if the price level is within a range where visits for less severe conditions are at all considered by the consumer. We argue that the consumer price of doctor's appointments in Swedish primary care is generally within this range, since prices are heavily subsidised through the social health insurance system. The system is indeed constructed with the intention to make sure that most sick people get access to care, at the risk of unnecessary visits being made. For this reason, we expect the price to stay within a low range, and thus predict that the proportion of the total appointments pertaining to a less severe condition should be negatively correlated with the consumer price of appointments.

This second prediction would be apt for testing given data on the full price experienced by the consumer. However, we are not in possession of such data, and an indirect approach is needed. We instead suggest a combination of these two predictions. If a price decrease leads to a simultaneous increase in both the total number of appointments made and the proportion of low-benefit appointments, we would expect the latter two variables to be positively correlated, holding other factors constant. As will be explained in the empirics section, this is the prediction we use to construct a regression model.

4.3 Limitations

4.3.1 Incomplete and Asymmetric Information

It can easily be argued that consumers do not possess complete information as to the actual benefit they receive from an appointment, and even less so ex ante. This is not necessarily problematic for the model, since it can easily be adjusted to regard the perceived benefit as it appears before the visit is made. In fact, this uncertainty can be used to explain why many people make doctor's appointments for conditions that turn out not to need any treatment. Alternatively, we could view the information received from the physician regarding the health state of the patient as part of the consumer benefit from the visit. With that reasoning, it can be argued that many doctor's appointments that do not conclude with a medical treatment, are nonetheless valuable since they improve the patients' information about their own health state.

The notion of asymmetric information is rather more problematic. The model does not account for the unequal distribution of information between

the patient and the physician. This does not have to make a difference so long as we assume a passive role for the caregivers. However, if self-interested physicians or other health care operators leverage their information advantage to their own benefit, we could see effects that are not incorporated in the model. For example, caregivers could maximise their profits by encouraging visits for conditions where the profit margins, determined by the difference between compensation and production cost, are the highest. This can be achieved either through altering the price (full price, including e.g. queue times) across conditions, or through inducing demand by prescribing physician visits or revisits to potential patients who are undecided about making appointments. If compensation system incentives favour visits for either type of condition, it could have implications for the predictions of the model, by shifting the demand curves.

4.3.2 Dynamic Effects

One limitation of the model presented above is that it does not account for dynamic effects resulting from exogenous shifts in demand. Such a shift, e.g. caused by an epidemic, could possibly cause longer queue times and thus increase the price of appointments. This would work in the opposite direction of the effect predicted by the model and bring about a negative correlation between total number of visits and the share of visits for less severe medical conditions. To see this explained graphically, refer to Figure 4. In the short run, the number of primary care facilities is fixed, leading the queue times and thus the consumer price to increase as the number of appointments increases (indicating an upwards sloping supply curve S). An outward shift in the demand curve (from D to $D\prime$) would then mean a simultaneous increase in price and quantity, which is contradictory to the predictions derived from the model.

4.3.3 Equal Price Assumption

When constructing the model we assumed that the consumer price of making a doctor's appointment is equal across medical conditions. However, there is certainly a case to be made against the plausibility of this assumption. Consider for example a possible scenario where certain conditions can only be treated at specific care facilities, thus incurring greater travel costs on average. Such variation in price across conditions does not necessarily constitute a problem for the implications of the model. Since the consumer decision of whether to make an appointment is based on the relative level of the benefit and price, the model would work just as well with different price levels for different conditions, so long as changes in price apply equally to all conditions. However, the model will not be able to account for the possibility that prices can change for some conditions, while others are held constant, e.g. through

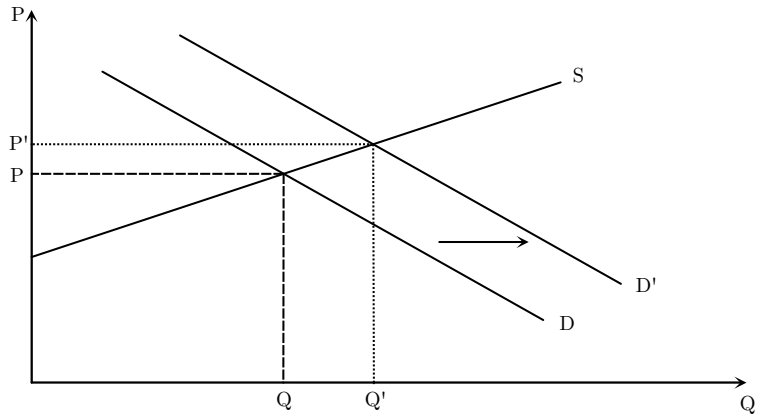

Figure 4: Impact of demand shift with upwards sloping supply curve

deliberate action by caregivers as suggested above

4.3.4 Behavioural Effects

The model constructed above does not take any behavioural economic theory into account, because of the limited scope of this thesis. It is possible that a behavioural approach would affect the predictions of this model. If for example patients' estimates of the net benefit of appointments are biased upwards or downwards for different diseases, utilisation for less serious conditions could behave like utilisation for more serious ones and vice versa. This could happen if for example bounded self control effects increase the perceived price for some conditions where the treatment is very demanding, like the aforementioned diabetes case, where patients skipped recommended medication even though it could be fatal to do so.

5 Empirics

5.1 Description of Data

Swedish counties use a variant of the International Classification of Diseases (ICD) to code diagnoses made in primary health care. The classification system has been simplified for usage in Swedish primary health care under the abbreviation KSH97-P (Socialstyrelsen, 1996). We have gathered data from eight Swedish counties on every diagnosis registered in primary care in monthly segments during the period January 2009 through December 2011, coded with KSH97-P or ICD-10 codes.

It is important to note that more than one diagnosis can be registered for a patient at a given doctor's appointment. The data recovered from

each county is the monthly sum of diagnoses registered for each diagnosis code, with no consideration of whether the diagnosis is of main or secondary character. This could create a bias in the sum of all diagnoses since more severe diseases include several secondary conditions that are all diagnosed, and thus influence the total number of diagnoses by a larger amount per visit. We will use the total number of diagnoses to construct a proxy for the total number of visits, meaning that such a bias could be problematic, since it will make the proxy more sensitive to changes in visits for severe conditions than those for less severe conditions.

Since LOV came into effect, discrepancies in diagnosis reporting across counties are diminishing, but some do still exist. The frequency of reporting varies somewhat between counties, and while many counties aim for complete diagnosis reporting coverage none have yet achieved this target. In reality, somewhere between 70 and 95% of all visits yield one or more recorded diagnosis. Furthermore, the spectrum of services included in the free choice system varies to some extent. Some counties include maternal health and rehabilitation services, while others do not. However, diagnoses from these services only make up a diminutive part of the total distribution of cases and can thus be disregarded.

5.1.1 Data Problems

Since no national record on primary care utilisation at the diagnose level exists, separate contact with each county was required when collecting data. Not all counties use the same database system for recording diagnoses, which could make the data less reliable because of difficulties when comparing data sets. Below, we will discuss different problems identified in the data.

Figure 5 shows how the total number of diagnoses registered has varied over time (2009-2011) in different counties. As can be discerned from the graphs, a high variation between the first year and the other two years seems to exist. The inclusion of the year 2009 could possibly be problematic. Since not all of the counties had implemented Vårdval by then, it is possible that the change in legislation has affected reporting. Furthermore, Kalmar did not record any visits at all during 2009 while Västra Götaland only started recording in October.

Data from Kalmar as well as Västra Götaland possesses some problematic characteristics during the other two years as well. Three counties (Blekinge, Dalarna, and Kalmar) have a higher than normal variation in the total amount of diagnoses registered per month during the whole period (as can be seen in Table 6 in Appendix A), probably due to sharp increases in reporting frequency. For Blekinge and Dalarna, the shift occurs between December 2009 and January 2010, while for Kalmar it occurs during 2010. Therefore, when leaving out 2009, Blekinge and Dalarna display more normal values of coefficients of variation (Table 7), while Kalmar remains unusually high.

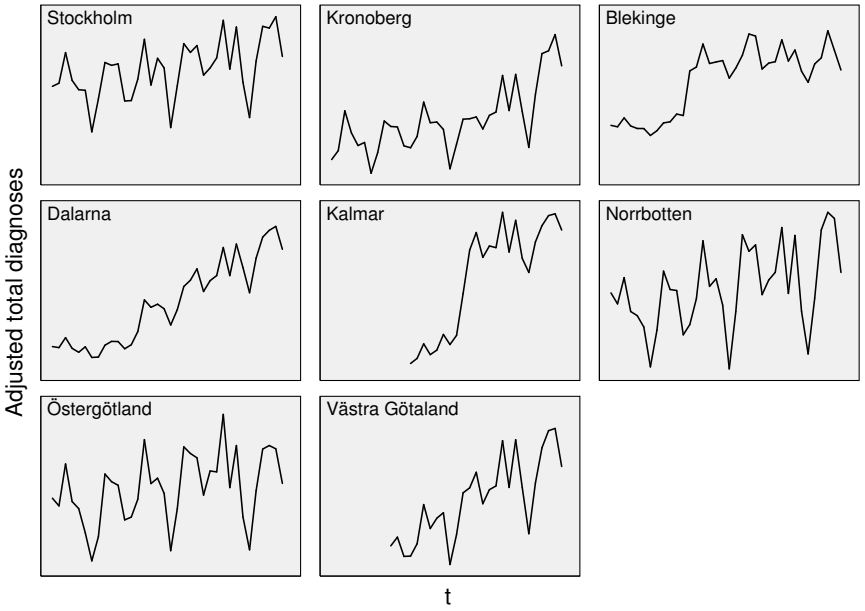

Figure 5: Total number of diagnoses registered per county (2009-2011)

Västra Götaland, on the other hand has only made data available on the less accurate two-digit ICD10 level, forcing inclusion of conditions that are not necessarily very similar. As can be seen in Table 1, Västra Götaland's code usage is very low, with fewer codes used than counties with much fewer inhabitants, where we would expect a smaller number of fringe conditions.

Table 1: Number of different diagnoses registered

County	Different codes used
Stockholm	6365
Kronoberg	2425
Blekinge	2866
Dalarna	3192
Kalmar	4495
Norrbotten	2324
Östergötland	4280
Västra Götaland	1594

5.2 Methodology

5.2.1 Regression Model

In line with the predictions in section 4.2, we construct two ideal log-log regression models where visits for mild conditions (Equation 1), as well total visits (Equation 2) are dependent on the total consumer price of visits (including e.g. time price), controlling for fixed effects from temporal as well as geographic variation using dummy variables. In this model, the coefficient β_1 can be interpreted as the price elasticity. Our model predicts that the elasticity will be higher in Equation 1, i.e. β_1 will be more negative.

We also introduce variables that control for demand variation that stemming from other sources than the price of the visit. The Grossman model explained in section 3.1 identifies three major factors that can shift the demand for health and consequently for doctor's appointments, namely age, education, and income levels. With control variables for these factors included (denoted as C_i), the proposed model reads as follows.

$$log(Mild_i) = \alpha + \beta_1 log(P_i) + \sum_{j=2}^{4} \beta_j C_{ij} + \sum_{j=1}^{35} \lambda_j t_{ij} + \sum_{j=1}^{7} \gamma_j County_{ij} + \epsilon_i \quad (1)$$

$$log(Total_i) = \alpha + \beta_1 log(P_i) + \sum_{j=2}^{4} \beta_j C_{ij} + \sum_{j=1}^{35} \lambda_j t_{ij} + \sum_{j=1}^{7} \gamma_j County_{ij} + \epsilon_i \quad (2)$$

Since we do not have access to data on the price variable, we instead use a more indirect approach. Our model predicts that variation in price will affect both (a) the proportion of less severe visits and (b) the total number of visits. If it is true that the price elasticity for less severe conditions is stronger than for total visits, it would imply that as total visits increases due to changes in the price level, the share of those visits that pertain to milder conditions will increase. We therefore propose a regression of (a) on (b), with the proportion of visits for less severe conditions as dependent variable and total visits as independent variable using the same controls as in the equation above. In this regression we expect the coefficient β_1 to be positive. To control for variation in population we use total visits per capita.

$$\frac{Mild_i}{Total_i} = \alpha + \beta_1 Total_i + \sum_{j=2}^{4} \beta_j C_{ij} + \sum_{j=1}^{35} \lambda_j t_{ij} + \sum_{j=1}^{7} \gamma_j County_{ij} + \epsilon_i \quad (3)$$

Age distribution is included through two variables representing the proportion of county population in age groups 0-19 years and 65+ years respectively. Education level is proxied using a variable describing the share of population that has initiated or completed tertiary education. Lastly, as income variable

we use price-adjusted median disposable income. For descriptive statistics of these variables, refer to Table 3.[1]

Since no monthly data exists on the total number of primary care practitioner visits, we use the total number of diagnoses made, corrected for reporting frequency, as a proxy for that variable. For a discussion on the construction and properties of this proxy, refer to section 5.2.2 below. The final regression model that we arrive at, and will use to test our hypothesis, is presented below. It includes the adjusted variable $TotDiag_i$ as a proxy for $Total_i$.

$$\frac{Mild_i}{TotDiag_i} = \alpha + \beta_1 TotDiag_i + \sum_{j=2}^{5} \beta_j C_{ij} + \sum_{j=1}^{35} \lambda_j t_{ij} + \sum_{j=1}^{7} \gamma_j County_{ij} + \epsilon_i \quad (4)$$

In order to test our hypothesis we need to identify diagnoses that are less severe. The perceived severity of a condition is ambiguous and can vary between patients. We therefore limit our test to two diagnoses identified as clearly less severe; the first being the common cold (J06-P), appropriate since it has been used as an example in the debate, and the other being the code registered when a patient arrives with a feared complaint but is not diagnosed with a condition by the physician (Z711). Since it is not possible to find an exact cardinal severity measure, we refrain from including other diagnoses as no other diagnosis can be defined as less severe with absolute certainty. Table 3 shows descriptive statistics for all variables in the regression. Note that the diagnosis codes signify the two different dependent variables used and that these are divided by $TotDiag$.

Table 2: Description of used diagnosis codes

KSH97-P	ICD10	Description
J06-P	J00, J06	Acute nasopharyngitis (common cold)
Z711	Z71.1	Person with feared complaint in whom no diagnosis is made

English descriptions from WHO (2010). In results some grouping of KSH97-P and ICD10-equivalents has been made when appropriate with the help of Socialstyrelsen (1996).

[1] Data for all control variables is on a yearly basis and has been gathered from Statistics Sweden (SCB)

Table 3: Variables in regression (observations per county and month)

Variable	mean	min	max	sd
J06-P	4.98%	0.97%	16.49%	0.020
Z711	1.40%	0.20%	3.41%	0.006
TotDiag	0.117	0.036	0.230	0.038
Age0-19	0.227	0.212	0.243	0.009
Age65+	0.575	0.557	0.610	0.016
Disposable Income	5.046	4.700	5.700	0.231
Education	0.297	0.239	0.413	0.048

J06-P, Z711: Dependent variables, number of diagnosis for the specified code divided by adjusted total diagnosis.

TotDiag: Adjusted total diagnoses per capita.

Age0-19: Share of population aged between 0 and 19 years.

Age65+: Share of population more than 65 year old.

Disposable Income: Disposable income per household in number of price base amounts.

Education: Share of population that completed or initiated tertiary education.

5.2.2 Proxy for Total Visits

Since no monthly data on the total number of visits to primary care practitioners is recorded by any Swedish agency, a proxy variable is needed. We argue that the total number of diagnoses registered in a given month and county is a sufficiently accurate proxy for the number of visits made, albeit with certain issues that will be presented and partially corrected for below.

One such issue is the less-than-perfect reporting frequency, described in section 5.1. There are two aspects to consider regarding reporting frequency when creating a proxy for total visits. The first is the variation in reporting for different conditions. It is difficult to make any a priori assertion whether any specific condition is over-represented among omitted reports. Practitioners could be inclined not to report less severe conditions due to their simplicity. On the other hand, they might omit more severe cases due to higher stress levels or since they opted not to add a new diagnosis record for a revisit.

The second aspect comes from the variation in reporting frequency that exists across counties. This aspect is corrected for in the proxy variable used. Using yearly data on total visits[2] we calculate a yearly reporting frequency. Assuming that reporting frequency is constant over the year we use this frequency to adjust our proxy.

As mentioned above, our data on diagnoses includes not only primary but also secondary diagnosis. The proxy variable used will possibly be biased

[2]Yearly data on total visits to pr4imary care per county from Socialstyrelsen.

due to the presence of secondary diagnoses, which may lead the variable to be disproportionately affected by conditions where several diagnoses are registered during the same visit. Since this problem exists mainly for more severe conditions, the regression could underestimate β_1. In future studies, a more efficient proxy should be constructed by only including main diagnosis, which was not possible within the scope of this thesis.

6 Results

Table 4 shows the results from running the regression specified in Equation 4. We run this regression with the diagnoses specified in Table 2 as dependent variables. The model is estimated both with and without controlling for fixed effects from county differences, and presented with robust standard errors in parentheses. As is evident from the table, coefficients are significantly negative for both diagnoses, although slightly less significant when controls are made for county fixed effects than without such controls, which indicates that these effects counteract some of the variation in the adjusted total diagnoses variable. Since we only use data from the three most recent years, the fixed county effect variable will include not only demographic factors, but also most of the variation in free choice system characteristics across counties.

Table 4: Main regression

	J06-P	J06-P	Z711	Z711
TOTDiag	-0.163**	-0.262***	-0.0221*	-0.0907***
	(0.0541)	(0.0380)	(0.00967)	(0.0121)
Constant	-0.155	0.241**	0.0130	0.428***
	(1.153)	(0.0903)	(0.268)	(0.0305)
Age Effects	Yes	Yes	Yes	Yes
Income Effects	Yes	Yes	Yes	Yes
Education Effects	Yes	Yes	Yes	Yes
Monthly Effects	Yes	Yes	Yes	Yes
County Effects	Yes	No	Yes	No
Observations	267	267	267	267
R^2	0.752	0.703	0.874	0.628

Robust standard errors in parenthesis.

J06-P: Common cold, Z711: No diagnosis made

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.1 Sensitivity Analysis

Due to the data problems discussed in section 5.1.1, we run another regression where we omit the year 2009 and counties Kalmar and Västra Götaland. The results from this regression are presented in Table 5. These omissions yield intriguing results. β_1 for J06-P is still negative and significant, but β_1 for Z711 is actually highly significant in the opposite direction.

Table 5: Sensitivity analysis

	J06-P	J06-P	Z711	Z711
TOTDiag	-0.245**	-0.300***	0.0486*	0.0952***
	(0.0802)	(0.0355)	(0.0240)	(0.0267)
Constant	1.943	0.112	0.431	0.604***
	(1.775)	(0.0991)	(0.539)	(0.0535)
Age Effects	Yes	Yes	Yes	Yes
Income Effects	Yes	Yes	Yes	Yes
Education Effects	Yes	Yes	Yes	Yes
Monthly Effects	Yes	Yes	Yes	Yes
County Effects	Yes	No	Yes	No
Observations	144	144	144	144
R^2	0.905	0.896	0.952	0.883

Robust standard errors in parenthesis. 2009, Kalmar and Västra Götaland omitted.
J06-P: Common cold, Z711: No diagnosis made
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7 Discussion

7.1 Analysis

The main regressions for both chosen diagnoses produce results that directly contradict our predictions. β_1 is negative and highly significant for both J06-P and Z-711, implying that these diagnoses would constitute a smaller part of total visits when the total number of appointments increases. The results are significant, but do not fully withstand a sensitivity analysis. It is thus possible that the positive results from our regression are only the effect of inherent problems with the data used. More studies with larger and better structured data samples are required to reject or confirm our hypothesis. Possible directions for these are presented below. In this section we present some possible explanations of the contradictory results.

7.1.1 Visits for the Common Cold

β_1 in the J06-P regression is negative and significant in all four variations run. It actually becomes more negative when put through a sensitivity analysis. The reason we decided to include this diagnosis is that the condition has often been mentioned in the debate, where it is sometimes claimed that visits for the common cold have increased in recent years. Figure 6, which describes the total amount of diagnoses made for the common cold in all counties over time, does not seem to confirm this claim. One possible explanation is that the number of physician visits for the common cold has actually not increased, but that Sarlöv et al. (2012) are making a sampling error. It is also possible that the number of visits has increased, but that these visits have been registered with other codes than J06-P, since the difference between a bad case of the common cold and a light influenza will not always be noticed.

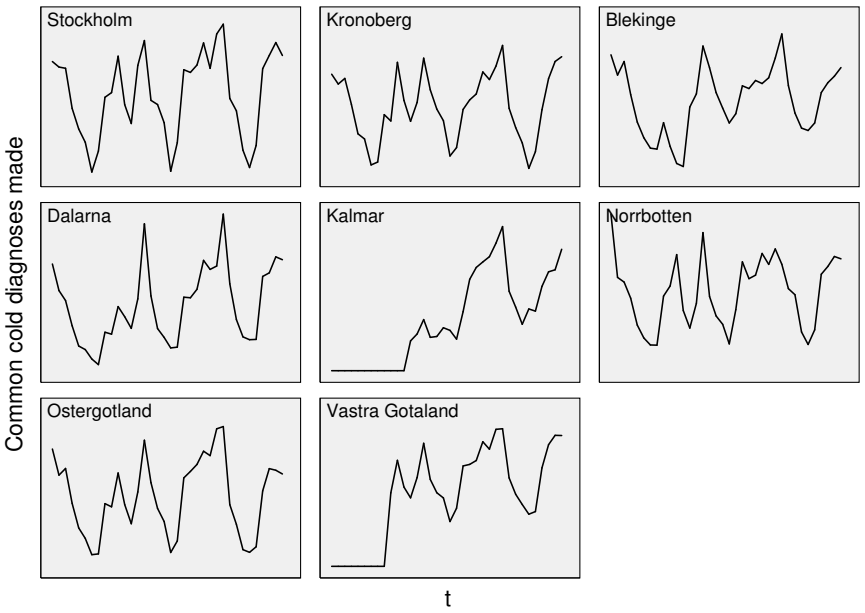

Figure 6: Number of common cold diagnoses registered (2009-2011)

7.1.2 Biased Proxy

In section 5.2.2 we argued that our proxy for total visits may be biased in such a way that visits for more severe conditions would have a disproportionate effect on the proxy variable, because of the assumed skewness in secondary diagnosis registration towards severe conditions. It is possible that this bias is so strong that it explains the negative coefficients in the regression results.

7.1.3 Insufficient Controls

The prediction derived from the theoretic framework and formalised in the regression model could possibly have some inherent problems. We predict a positive correlation between the total number of visits and the share of visits pertaining to less severe conditions. However, since variation in total visits does not exclusively stem from price variation, we need to control for other variables that affect utilisation. It is possible that our model does not successfully control for these effects. If variables not included in the regression have an effect on the total number of visits, this may lead to a spurious negative correlation because the dependent variable contains the total visits in its denominator. Thus, specific demand or supply effects that do not affect mild conditions may explain the negative coefficients received. For instance, if there is a demand shock resulting from an epidemic of a severe condition, we would expect the total visits to increase, resulting in a decreased share of visits for milder conditions. Furthermore, such a shock could also increase the consumer price through longer queue times (as explained in section 4.3.2), thus causing a further decrease in that share.

7.2 Further Research

The process of collection and preparation of data for this thesis was rather troublesome, due to aforementioned reasons. The new health care system is not much older than two years, and still suffers from many teething troubles. This could explain some of our empirical issues. As these issues are solved, future research should reasonably achieve more accurate results.

The lack of a good data source with detailed data on individual patients is problematic. The patient register managed by the National Board of Health and Welfare (Socialstyrelsen) provides such data on secondary care patients, but as of yet not on primary care. The inclusion of primary care in this database would allow for much more detailed analysis of all aspects of primary care. Luckily, Socialstyrelsen is aware of this and have recently published a report where such an inclusion is suggested (Socialstyrelsen, 2012).

Using data on individual patients, an actual price variable could be constructed to test the validity of the framework presented in this thesis. Such data could also be used to identify other explanations of variation in the diagnostic case mix. Ideally, this data would allow for the construction of a regression model based on the relationship between supply and demand for physician visits (Equation 1 and Equation 2 in the Methodology section). Using such a model, it would be possible to determine the price elasticities of visits for different conditions, which would be a more effective and comprehensive way to answer the research question posed in this thesis.

7.3 Unnecessary Appointments?

In the introduction to this thesis, we pose a fundamental question about the necessity or social value of doctor's appointments for less severe medical conditions. While we study some economic aspects of these visits, we do not make any claim as to their desirability. In the public debate it is sometimes argued that visits for milder conditions can often be redundant. However, this is not necessarily the case. In a large review of primary care systems, Lamarche et al. (2003) define the main goals for primary care to be effectiveness, productivity, accessibility, continuity, quality, and responsiveness. It is possible that as medical care becomes more productive, focus will shift from only treating the ill towards accessibility and care for the healthy. If all severe medical conditions are treated efficiently, there may be a higher marginal utility from a visit for the common cold than for an extra revisit for a more severe condition. In such a situation a shift towards a diagnostic case mix with a larger proportion of less severe conditions could be desirable.

8 Summary

Our empirical findings are statistically significant but contradict the hypothesis generated through the theoretical framework. However, a sensitivity analysis indicates that data problems, in conjunction with a bias created by the proxy variable used, could be the reason. The thesis' findings are therefore inconclusive and the regression cannot clearly reject or confirm our hypothesis. However, we would not completely reject the accuracy of the model and argue that better empirics are needed to reliably test it.

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Appendices

A Descriptive Statistics

Table 6: Statistics of adjusted total diagnoses per county (2009-2011)

County	Sum	Mean	Min	Max	Coeff. of Var.
Stockholm	11,332,470	314,790	234,060	382,846	11.72%
Kronoberg	769,821	21,383	14,591	32,025	19.42%
Blekinge	485,857	13,496	5,508	20,770	36.20%
Dalarna	1,044,696	29,019	15,655	47911	35.04%
Kalmar	876,194	36,508	13,895	53,552	39.24%
Norrbotten	1,021,707	28,380	21,057	35,184	12.82%
Östergötland	1,349,096	37,474	27,903	47,140	12.08%
Västra Götaland	5,743,704	212,729	149,870	280,984	18.28%

Table 7: Statistics of adjusted total diagnoses per county (2010-2011)

County	Sum	Mean	Min	Max	Coeff. of Var.
Stockholm	7,779,256	324,136	239,638	382,846	11.66%
Kronoberg	545,586	22,733	15,156	32,026	18.76%
Blekinge	400,504	16,688	13,260	20,771	12.03%
Dalarna	827,590	34,483	18,775	47,911	23.01%
Kalmar	876,195	36,508	13,896	53,552	39.24%
Norrbotten	704,511	29,355	21,057	35,184	12.86%
Östergötland	927,431	38,643	29,240	47,140	11.66%
Västra Götaland	524,197	218,416	149,871	280,985	17.12%

B County Characteristics

Table 8: Top 5 most used diagnosis codes during 2009-2011

County	Most common			Less common	
Stockholm	J06-P	I10-	Z54-P	Z03-	I48-
Kronoberg	I10-	J06-P	E119	F32-	Z03-
Blekinge	Z54-P	I10-	Z27-P	J06-P	M791
Dalarna	I10-	Z54-P	J06-P	Z760	Z719P
Kalmar	I10-	E119	J06-P	N30-P	R52-
Norrbotten	I10-	J06-P	Z03-	Z769P	N30-P
Östergötland	J06-P	I10-	M255	E14-P	N30-P
Västra Götaland	I10-	J06-P	E119	F32-	F41
Total	Z54-P	I10-	J06-P	Z03-	E119

Codes for Västra Götaland are converted from a higher level and do also include other diagnoses.

E119: Non-insulin-dependent diabetes mellitus

E14-P: Unspecified diabetes mellitus

F32-: Depressive episode

F41: Other anxiety disorders

I10-: Essential (primary) hypertension

I48-: Atrial fibrillation and flutter

J06-P: Acute nasopharyngitis (common cold)

M255: Pain in joint

M791: Myalgia

N30-P: Cystitis

R52-: Pain, not elsewhere classified

Z03-: Medical observation and evaluation for suspected conditions

Z27-P: Need for immunization against combinations of infectious diseases

Z54-P: Convalescence, Surgery, etc

Z719P: Counselling, unspecified

Z769P: Person encountering health services in unspecified circumstances

Table 9: Vårdval in different swedish counties

		Number of care centers							Compensation				
		Before		2010		2011							
County	Start	Tot	Priv	Tot	Priv	Tot	Priv	Listing*	Age	ACG	CNI	Per visit	% Fixed
Stockholm	2008-01-01	167	91	200	127	199	129	A	Yes	No	No	Yes	0-50%
Uppsala	2009-01-01	40	16	41	17	42	18	A	Yes	No	No	Yes	70-90%
Sörmland	2010-01-01	22	4	23	7	26	9	P+D+I	Yes	No	Yes	Yes	70-90%
Östergörland	2009-09-01	43	6	45	8	43	8	P+X+E	Yes	No	Yes	Yes	70-90%
Jönköping	2010-06-01	39	6	55	21	56	22	P+X+I	Yes	No	Yes	Yes	70-90%
Kronoberg	2009-03-01	27	5	31	9	33	11	P+X+E	No	Yes	Yes	Yes	70-90%
Kalmar	2010-01-01	34	6	34	6	35	7	P+X+I	Yes	No	Yes	Yes	70-90%
Gotland	2010-03-23	8	2	8	2	8	2	A	Yes	No	No	Yes	70-90%
Blekinge	2010-01-01	21	6	24	9	24	9	P+X+I	Yes	No	No	Yes	90-100%
Skåne	2009-05-01	136	48	158	70	159	71	P+X+I	No	Yes	Yes	No	90-100%
Halland	2007-01-01	38	13	49	24	50	25	P+X+I	Yes	No	No	Yes	70-90%
Västra Götaland	2009-10-01	151	33	208	91	211	95	P+X+I	Yes	Yes	Yes	No	90-100%
Värmland	2010-05-03	33	3	40	10	38	9	P+X+I	Yes	Yes	Yes	No	90-100%
Örebro	2010-01-01	30	4	30	4	31	4	P+D+E	Yes	No	Yes	Yes	70-90%
Västmanland	2008-01-01	30	18	32	20	31	19	P+X+E	Yes	No	Yes	Yes	70-90%
Dalarna	2010-01-01	33	1	35	3	36	4	P+D+E	No	Yes	Yes	Yes	70-90%
Gävleborg	2010-01-01	38	9	41	12	42	14	P+X+I	Yes	No	Yes	Yes	70-90%
Västernorrland	2010-01-01	28	5	30	7	33	10	P+X+E	Yes	No	Yes	Yes	70-90%
Jämtland	2010-01-01	27	3	27	3	29	5	P+D+E	Yes	No	Yes	Yes	90-100%
Västerbotten	2010-01-01	35	2	35	2	40	7	P+X+E	Yes	No	Yes	Yes	70-90%
Norrbotten	2010-01-01	35	2	37	4	39	6	P+D+E	Yes	No	Yes	Yes	90-100%

Counties in boldface are used in regression. For explanation of compensation variables see section 2.3.1

* A: Active listing principle, no automatic listing, P: Automatic listing of all inhabitants

D: Passive listing made according to initial distribution (before Vårdval), X: Passive listing made based on closest primary care center

I/E: Inclusion of newly established primary care centers in the passive listing

Sources: Anell (2011a,b); Jönsson et al. (2012); Lundvall (2010)