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High Cost Pool in a Health Status Based Risk Adjustment System – Some Conceptional and Empirical Considerations

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High cost pool in a health status based risk adjustment system – some conceptional and empirical considerations

Abstract

Competitive social health insurance systems (at least) in Western Europe have implemented systems of morbidity based risk adjustment to set a level playing field for insurers. However, many high cost insured still are heavily underfunded despite risk adjustment, leaving incentives for risk selection. In most of these health care systems, there is an ongoing debate about how to deal with such underpaid high cost cases. This study develops four distinct concepts by adding variables to risk adjustment or by setting up a high cost pool for underpaid insured besides the risk adjustment system. Their features, incentives and distributional effects are discussed. With a data set of 6 million insured, performance is demonstrated for Germany. All models achieve a substantial improvement in model fit, measured in terms of R^2 as well as CPM. As the results of the various models are different in different dimensions, the trade-offs that have to be dealt with and should be addressed, when implementing a model to reduce underfunding of high cost cases.

Introduction

A number of countries (e.g. Belgium, Switzerland, the Netherlands, Israel, and Germany) have established competition within social health insurance systems in the 1990s (van de Ven et al 2003). In all of these countries, the insured can switch regularly between health insurers, and a system of risk adjustment to arrange a level playing field for the insurers has been established. This is also true for Medicare and health insurance according to the Affordable Care Act in the US. Risk adjustment subsidies in these health insurance systems are differentiated according to the expected health expenditures of the insured, they are higher for the “chronically ill” than for the “healthy”. Normally risk adjustment pays standardized subsidies not related to actual expenditure. Therefore in spite of risk adjustment, a considerable number of insured remain severely “underpaid” as standardized subsidies do not cover their actual expenditure.

The question, how to deal with the topic of high cost cases remains therefore on the agenda. In the Netherlands for instance, a group of risk adjusters has been included in the risk adjustment model for which insured with high expenditures in the last three years qualify (van Kleef & van Vliet 2014). In the US in the context of the Affordable Care Act, in the introductory phase, so called “risk corridors” are implemented, which transfer payments from plans with low costs to plans with higher costs (Barry et al. 2012; Zhu et al. 2013).

In this paper we focus on the competitive social health insurance system in Germany where there is no relation to actual medical expenditure in the risk adjustment mechanism at the moment. Since 2009, insured and their employers pay a uniform contribution rate (at present 14.9 per cent) to a central health fund, and sickness funds receive risk adjusted subsidies from the central health fund (see Figure E-Component 1). On average, these subsidies do not cover total expenditure of a sickness fund, therefore sickness funds have to calculate additional sickness fund specific contribution rates which are to be paid by the insured in addition to the uniform contribution rate. As these sickness fund specific contributions are income related, the income base of the insured is equalized by the central health fund for the calculation of the sickness fund specific contribution rates, to avoid distortion of competition due to different income levels of the insured between the funds (Wasem et al. 2013).

When risk adjusted subsidies to the sickness funds were introduced in 1994, they were based on socio-demographic risk factors only; and it has been demonstrated that the performance of this scheme was poorly (Behrend et al 2007). By a reform, which came into effect in 2002, a mandatory “risk pool” was added to the system. The official name of the

mechanism is misleading as *expenditures* were pooled retrospectively, not *risks* (Barneveld et al. 2001): For insured with annual expenditure above 20,450 € (threshold), 60 per cent of the expenditure above the threshold were financed by the pool. The risk pool itself was financed equally among all sickness funds; as at that time the central health fund was not implemented yet and sickness funds received income related contributions from their insured, the financing of the risk pool was according to the income of the insured. The concept of the pool was based on an evaluation by a study group commissioned by the Ministry of Health (Jacobs et al. 2002), however the authors of that study had proposed a threshold of only 10,250 € and a reimbursement rate of 80 per cent for expenditures above the threshold.

In the course of this 2002 reform it was decided to complement the socio-demographic risk adjustment by morbidity based risk adjusters from 2007 onwards. The law established that with the switch from socio-demographic to morbidity based risk adjustment, the “risk pool” should be transformed to a “high risk pool”. However, when morbidity based risk adjustment finally was implemented with two years delay in 2009, parliament decided to cancel the “risk pool” altogether without replacing it by a “high risk pool”.

However, the discussion on re-establishing a high risk / high cost pool has never ended (Jacobs 2009; Repschläger et al. 2014). It is argued that a high risk / high cost pool may compensate for the shortcomings of the morbidity based risk adjustment system, especially it may eliminate that undercompensated insured are in danger of risk selection. Also, small sickness funds might face considerable financial problems, if they happen to have some extremely underfunded insured; this is seen as problematic, because financial problems of sickness funds should be tolerated only if they are caused by inefficient behaviour of the funds and not by the structure of their insured. If risk adjustment were perfect, the problems of small insurers could be dealt with by re-insurance, which would cover the risks of having high cost cases by chance; as long as it is not perfect, however, re-insurance is not a sufficient solution.

In this paper, we present the results of a study, with which the authors contribute to the discussion on the implementation of a special funding mechanism for high cost cases which are underpaid after risk adjustment. Although our empirical analysis is done for Germany, there is a clear relevance for other countries, as shown above. Especially our general approach to underpaid high cost cases and the four models we develop, the discussion of their advantages and disadvantages and their empirical features, is of a more general interest. The remainder of the paper is structured as follows: In section 2 we describe the models. In section 3 we present the data and methods. The empirical results are presented in section 4 and in section 5 we discuss the results and draw some conclusions.

Concepts for insured with high costs

When health based risk adjustment was implemented in Germany, a political compromise was made that the number of „diseases“ to be taken into account was to be limited to 50-80. The classification system established within these diseases, is fairly elaborated by using inpatient and outpatient diagnoses as well as information for drugs prescribed. The system leads to high risk adjusted subsidies for some insured. In 2013, for 23 of the 155 variables of morbidity (so called HMGs, Hierarchical Morbidity Groups), the incremental subsidy payment from the central health fund amounted to more than 10,000 € p.a., for the top 2 HMGs it was even more than 200,000 € (Bundesversicherungsamt 2014). Therefore, a simple model of a high cost pool which is based only on the actual costs and leads to subsidies for those insured generating costs above a certain threshold, as it was established from 2002 to 2008 in Germany (“classic high cost pool”), seems inadequate. The reason is that it may lead to additional subsidies even for insured with substantial overpayment through the risk adjustment system. Instead, models for dealing with high cost cases should address those insured with high expenditures who are still substantially underfunded under morbidity based risk adjustment as the subsidies from the central health fund are significantly lower than their expenditures. Therefore in this paper we propose to focus approaches of special treatment of high cost cases in health care systems with elaborated models of health based risk adjustment on those insured who after applying health based risk adjustment are still severely underpaid as these insured are vulnerable to risk selection by health insurers.

From this starting point, we studied two types of models (High Cost Group Models, HCG and High Cost Pool Models, HCP), each in two variants. In both models morbidity based risk adjustment is calculated first according to the status quo process. Then, insured with a high funding gap (FG) are identified and explicitly addressed in the models. The way we deal with these insured is, however, very different in both types of models. The High Cost Group (HCG) models augment the current German HMG risk adjustment model by including (one respectively three) dummy variables that equal one if ex post actual expenditure exceeds the risk adjustment target by more than (one respectively three) specified amounts. The two High Cost Pool (HCP) models use a risk pool approach: After initial risk equalization payments are calculated, sickness funds are partially compensated ex post for any funding gap when actual expenditure exceeds the risk adjusted target. Hence while both systems use ex post funding gap information to make payment adjustments, the HCG approach does this within the standard OLS-regression framework, while the HCP approach makes adjustments outside of the regression model. Table 1 presents the basic characteristics of both types of models.

Table 1

In the **High Cost Group Models** (HCG-models), the morbidity based risk adjustment model is expanded by specific variables for insured with a high funding gap. High funding gaps therefore are dealt with *within* the risk adjustment model. The risk adjustment model is run a second time, after the underpaid insured have been identified and after additional dummy variables have been included for the high cost cases.

In *HCG-1*, all insured who (after morbidity based risk adjustment has been calculated) had a FG > 30,000 € were grouped in one additional risk adjustment dummy variable. Then the basic model was recalculated including the additional dummy-variable. Using the resulting coefficients, subsidies were recalculated. The additional subsidy for insured within the high cost group was the same for all insured identified and was not related to the individual size of the funding gap.

HCG-2 differentiates those insured identified by *HCG-1* into three groups:

- HCG-2_30,000: insured with a FG between 30,000 € and 50,000 €
- HCG-2_50,000: insured with a FG between 50,000 € and 100,000 €
- HCG-2_100,000: insured with a FG > 100,000 €.

In *HCG-2*, the basic model was also recalculated including the three additional dummy variables for the three Funding Gap-groups. Using the resulting coefficients, subsidies were recalculated. Within each of the three new groups, the additional subsidy was therefore the same for all insured in the respective group, but different between these groups. On both *HCG-models* the additional subsidies for the insured with the new variables were financed through decreasing coefficients for the other variables.

Whereas the *HCG-models* expanded the basic morbidity based risk adjustment and added (one or three) variables for insured with a high funding gap into the risk adjustment scheme, in the **High Cost Pool Models (HCP-models)** subsidies for insured with a high funding gap were made separately from the risk adjustment mechanism from a distinct pool.

HCP-1 simulates a high-cost-pool, in which subsidies were triggered by FGs exceeding a predefined threshold. In our study, the high-cost-pool encompassed all insured with a funding gap larger than 15,000 € in the basic risk adjustment model. In our model, the reimbursement rate was staggered in two steps:

- for funding gaps between 15,000 € and 30,000 € the reimbursement rate was fixed at 60%;
- for funding gaps above 30,000 € the reimbursement rate was fixed at 80%.

As the subsidies out of the high-cost-pool have to be financed, it has to be decided, where the contributions to the pool come from. In our study, we deducted the revenues from the

pool from the expenditures of the insured who got pool subsidies and recalculated the basic risk adjustment system using these reduced expenditures as dependent variable. Therefore, the coefficients in the risk adjustment system change and the final subsidies within the risk adjustment mechanism were based on these new coefficients.

The second variant of a high cost pool (*HCP-2*) works differently: whereas the amount of resources financed by *HCP-1* is variable and the result of the values for threshold and reimbursement rate, the pool budget was fixed ex ante in *HCP-2*. In our study, for reasons of comparability we fixed this budget for the pool at the level of the net redistributed volume of the HCG-models (which actually was 12.23% of total expenditures). The resources needed for the pool are financed by a flat reduction of all subsidies for all insured.

All insured with funding gaps were ranked according to the size of their funding gap in the status quo model. The funding gaps of the insured were “filled-up” until the fixed budget was eaten up. The reimbursement rate used was 60%, resulting in a co-payment rate of 40% for the sickness funds. The model works with an iterative process of including insured and filling up of their costs (see a sketch of the idea in Figure 1). The threshold in this case was not fixed ex ante (as in *HCP-1*) but resulted implicitly when the budget was eaten up. In case of a reimbursement rate of 100%, the pool budget would determine a maximum individual funding gap.

Figure 1

Data and Methods

1.1 Data

For this study we used a sample of about 6.5 million insured of a large nationwide sickness fund with health status data from 2012 and expenditure data from 2013. The mean expenditures were 2,449 € p.a., and the median was 694 € p.a. (see Table E-1 in the E-Component material; the negative expenditures in that table result from the fact that in certain cases, expenditures of sickness funds of one year are refunded to them in the next year, for instance from a liability insurance, if the expenditures were caused by a car accident).

1.2 Methods

For all models we calculated their statistical performance on the individual level. We compared the models among each other and also with the risk adjustment model in the German social health insurance system of 2013 as calibrated with our data set (“Status Quo”). With regard to model performance, HCG models can be measured with the usual R^2 , as they simply add a variable to the risk adjustment model. In case of HCP models, performance is relevant for both elements together, risk adjustment as well as pooling of high costs; Geruso & McGuire (2014) propose the term “fit” for the performance of the total arrangement, and a Pseudo- R^2 can be used to evaluate model fit. We also show two further measures of accuracy: CPM (Cumming’s Prediction Measure) and MAPE (Mean Absolute Prediction Error). Unlike R^2 , both do not square the deviations but are based on absolute values. MAPE sums up the absolute deviations from predicted values for all observations and divides the result by the number of observations. For MAPE a lower value means a smaller prediction error and therefore a better model (Drösler et al. 2011). CPM standardizes the mean absolute prediction error, dividing it by the mean absolute deviation of the observations from the average. This results usually in a range of values between 0% and 100% (Cumming et al. 2002; Schäfer 2011). As with R^2 , a CPM value closer to 100% indicates a better fit of the model.

We also performed calculations for the performance at group level. Here the performance of the model can be evaluated by calculating predictive ratios for subgroups of insured defined by criteria sickness funds could use for risk selection. The predictive ratio is the ratio of the sum of subsidies after risk adjustment and risk pool allocations to the sum of expenditures for a group of insured.

We also calculated the distributional effects of the models. If additional subsidies are paid for high cost cases, the question of interest is: Where do these subsidies come from? This is of importance in order to see if other groups now are in an unfavorable position so that risk selection against these groups would be a plausible strategy for sickness funds. We calculated the share of subsidies distributed according to age, invalidity pension status and morbidity in the present risk adjustment system and compared it with the figures when adding the high cost models to risk adjustment.

Empirical results

With the threshold chosen, 0.50% of the insured were eligible in the HCG models. In the HCP models 1.51% and 4.01% of the insured were eligible, only a small share of 0.05% has a FG of higher than 100,000 € (see Table E-2 in the E-Component material).

If we add any of the high cost models to the present risk adjustment system (Status quo), all of them perform better on the individual level with regard to all three statistical measures (Table 2). Both models with partial reimbursement of the actual funding gap (HCP models) outperformed the models which generated a lump sum payment for high cost cases (HCG models) irrespective of the actual size of the costs with regard to R^2 . The picture was less clear-cut with regard to CPM and MAPE statistics.

Table 2

With regard to analysis on group level, we did two calculations: We studied the predictive ratios of those insured, who were identified as underpaid high cost cases by the models versus those insured, who were not identified as underpaid high cost cases. For both groups we calculated the predictive ratios before the implementation of the high cost model ("PR ex ante") and after the implementation of the high cost model ("PR ex post") (see Table E-3 in the E-Component material). The underpaid high cost cases were seriously underfinanced before the implementation of the models (the funding gap being the criterion for identifying the cases), they remained underfinanced in the high cost pool models (as there is only partial reimbursement of the funding gap), whereas there has to be a predictive ratio of 100% in the high cost group models since the variables are included in the regression itself. Vice versa, insured not identified as underpaid high cost cases, as a group were overfinanced before the implementation of the models. They remained overfinanced, however to a reduced extent, when applying the high cost pool models, whereas using the high cost group models results in a 100% predictive ratio for those not involved.

In another calculation we estimated the predictive ratios according to the number of morbidity variables (Hierarchical Morbidity Groups; HMG) which individuals got assigned by the German risk adjustment model (Table 3). In the status quo model, insured with no HMG were overcompensated by about 4%, whereas most groups of insured with one or more HMGs were undercompensated; which is in our data set not the case for the insured with 4 or more HMGs. All models dealing with high cost cases reduced the overpayment for those with no HMG; the HCP-2 model even turned the overpayment into a small underpayment for this group and lead to overpayment for multi-morbid insured. Slight overpayments for some groups of multi-morbid insured were also a result of applying the other models.

Table 3

When adding a high cost group dummy variable to the model (HCG-1), 12.6% of the subsidies were distributed by this variable; this was partly financed by lower subsidies according to age (share down by 4.6%), but to a larger extent by reduced subsidies for the morbidity variables (HMGs; share down by 7.5%) (see Table E-4 in the E-Component material). We saw a very similar picture using three variables instead of only one variable for high cost groups (HCG-2); here the additional resources for the high cost groups were distributed relatively equally between the three new groups. By and large, the picture was relatively similar for the HCP-models; in HCP-1, with the parameters chosen, the redistribution towards the high cost cases is smaller however than in the other models, with only 8% of the subsidies being distributed towards

Discussion and conclusions

To keep incentives of efficiency for health insurers, risk related subsidies to health insurers in competitive (social) health insurance markets are standardized: They are targeted to systematically reflect expected costs (usually measured by the mean of incremental costs for a given risk adjuster), not to reflect actual costs of an individual insured. Standardized subsidies paid by a risk adjustment mechanism to health plans create undesirable problems of underpayment of high cost cases, if subsidies are not sufficiently differentiated with regard to these high cost cases. As a consequence those systematically underpaid insured are at risk of being selected against by health insurers. The situation is similar in the case of capitated health care providers, if capitation inadequately pays for the resources needed for severely ill patients, so that providers hesitate to enrol these patients.

As Newhouse (1996) has pointed out, this trade-off between efficiency and fairness makes an argument for “mixed systems”. Special approaches to deal with high cost cases are an attempt of these mixed systems. In this study we presented different approaches for dealing with high cost cases. The new element in our approach is that we focussed on those high cost cases which still are heavily underpaid even *after risk adjustment*. The motivation is twofold: Those insured are at the highest risk of being selected against although risk adjustment is implemented. And approaches which identify high cost cases retrospectively on the base of the actual costs of the year could lead to overpayment of these high cost cases as a group because adequate subsidies from the risk adjustment system are paid for some of them. This would be especially the case within advanced risk adjustment systems which pay high subsidies e.g. for morbidity groups with high average expenditure.

In all approaches presented to deal with underpaid insured, health based risk adjustment is first run according to the status quo process. It is then identified, which insured are heavily underpaid after risk adjustment. With the High Cost Group (HCG) approach, the risk

adjustment model was expanded and additional variables were implemented for insured with high underpayments after risk adjustment; here, the additional payment which is going to underpaid high cost cases is standardized and does not follow the actual costs of each specific insured identified. Therefore, depending on the number of high cost groups implemented in the model, the highly underpaid insured will remain underpaid, whereas those who are only slightly above the threshold will be overpaid afterwards.

In contrast, in the High Cost Pool (HCP) approach, the funding gap beyond a threshold was partially (according to the reimbursement rate) compensated, thus individual subsidies were provided. Therefore, there is a tendency that HCP models are better suited for closing the funding gap of highly underpaid insured; they are weaker with respect to incentives however, as they are linked to actual expenditures of sickness funds. Therefore with regard to the trade-off between fairness and efficiency, the HCP approach is tipping more on the fairness side than the HCG approach.

The introduction of a model dealing especially with underpaid high cost cases, adds a new perspective to a prospective risk adjustment system. A considerable share of those insured whose funding gap shrank by this approach were underpaid before because they either had acute episodes or were in the first year of a chronic disease. It can be discussed controversially whether acute high cost cases should be subsidized, as health insurers may not be able to risk select against them. However, as these acute cases may be distributed unevenly among the health insurers, such a model increases fairness between them.

The study also has demonstrated that there are two options with regard to how the additional subsidies for high cost cases might be financed (if one does not think about external revenues, coming for instance from government): Either there is a decrease of risk adjustment-subsidies for all insured by a flat-rate amount; we used this option for the HCP-2 model. Or, in the other models, we recalculated the risk adjustment and the additional subsidies for underpaid high cost cases were financed by reduced regression coefficients of the respective risk adjustment groups. The redistributive effects were larger when using flat rate reduction of RA subsidies for all insured to finance the additional subsidies for high cost cases.

As we have noticed, there is a tendency especially of the HCP-2 model to create overpayments for insured with multiple HMGs, the multi-morbid insured. According to the discussion on “optimal risk adjustment” this can be an adequate feature of risk adjustment (Glazer & McGuire 2000; van Kleef et al. 2015): Due to higher uncertainty with regard to the actual expenditures of high cost cases, risk adverse health insurers might risk select against these insured as long as the subsidy for these insured is not larger than their expected expenditures. This is especially relevant as the core of a competitive health insurance system is to achieve more efficient and cost-effective care for those really ill, who should

therefore not be selected against (van de Ven et al. 2013). Reducing overpayments for the healthy by creating small overpayments for the multi-morbid chronically ill might therefore be a desirable result in order to shift the focus of health insurers from competition on price, which primarily the healthy react on (Andersen & Grabka 2006), to competition on quality of care.

Sometimes it is discussed whether a reinsurance system would be an adequate answer to the issue of high cost cases, and in fact the mechanisms studied in this paper resemble those found in reinsurance. A commercial reinsurance system would, however, charge risk related premiums to the health insurer so that those with above average sick insured would have to pay higher reinsurance premiums – especially for the chronically ill high cost cases. From the perspective of a social health insurance system this seems unacceptable, from an equity perspective. More important: Risk related premiums to reinsurance will not eliminate incentives for risk selection, as social health insurers can gain competitive advantages if they keep reinsurance premiums low by avoiding to insure bad risks. At least the fill-up model can be seen as mandatory reinsurance with community rated premiums by the insurers into the reinsurance scheme.

Summing up, the study demonstrates that different models can deal with the undesirable fact of high funding gaps in competitive health insurance systems with morbidity based risk adjustment. There are a number of decisions to be made, when implementing a scheme to deal with underfunded high cost cases: not only with regard to the basic type of model, but also concerning the setting of parameters, e. g. the threshold or a reimbursement rate or (in case of HCP-2) the size of an ex ante fixed budget for a high cost pool. These decisions lead to different distributional effects, but also different incentives for the sickness funds. Therefore, they are not just different in technical terms but also different value judgments are embedded. The latter ones cannot be decided by researchers but need a discussion in society. As there is a trade-off between efficiency and fairness with underpaid insured and the respective consequences in health care provision, society has to decide how much efficiency they are willing to sacrifice in order to gain at fairness. And as the issue is relevant in quite a number of countries, preferences and solutions thus may be different. Altogether, HCP-2 model can be recommended, as financing the additional subsidies for the highly underpaid by a flat reduction of the subsidies of all insured resulting in a slight overpayment for multi-morbid is a desirable feature of that model.

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