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Published in:
Social Science & Medicine

Publication status and date:
Published: 01/01/1998

DOI (link to publisher):
10.1016/S0277-9536(98)00056-2

Document Version
Publisher's PDF, also known as Version of record

Pergamon

Soc. Sci. Med. Vol. 47, No. 2, pp. 223–232, 1998

Printed in Great Britain
PII: S0277-9536(98)00056-2
0277-9536/98 $19.00 + 0.00

MANDATORY POOLING AS A SUPPLEMENT TO RISK-ADJUSTED CAPITATION PAYMENTS IN A COMPETITIVE HEALTH INSURANCE MARKET

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Abstract—Risk-adjusted capitation payments (RACPs) to competing health insurers are an essential element of market-oriented health care reforms in many countries. RACPs based on demographic variables only are insufficient, because they leave ample room for cream skimming. However, the implementation of improved RACPs does not appear to be straightforward. A solution might be to supplement imperfect RACPs with a form of mandatory pooling that reduces the incentives for cream skimming. In a previous paper it was concluded that high-risk pooling (HRP), is a promising supplement to RACPs. The purpose of this paper is to compare HRP with two other main variants of mandatory pooling. These variants are called excess-of-loss (EOL) and proportional pooling (PP). Each variant includes ex post compensations to insurers for some members which depend to various degrees on actually incurred costs. Therefore, these pooling variants reduce the incentives for cream skimming which are inherent in imperfect RACPs, but they also reduce the incentives for efficiency and cost containment. As a rough measure of the latter incentives we use the percentage of total costs for which an insurer is at risk. This paper analyzes which of the three main pooling variants yields the greatest reduction of incentives for cream skimming given such a percentage. The results show that HRP is the most effective of the three pooling variants. © 1998 Elsevier Science Ltd. All rights reserved

Key words—competitive health insurance market, risk-adjusted capitation payments, cream skimming, mandatory pooling

INTRODUCTION

Risk-adjusted capitation payments to competing health insurers are an essential element of the market-oriented health care reforms in many countries, for instance Belgium (Nonneman and van Doorslaer, 1994; Kesenne, 1995), Germany (Von der Schulenburg, 1994; Wasem, 1995), Israel (Chinitz, 1994), Switzerland (Beck and Zweifel, 1996) and The Netherlands (Van de Ven *et al.*, 1994). In the Medicare program in the United States, at-risk health maintenance organizations (HMOs) receive risk-adjusted capitation payments since the early 1980s.

The main purpose of market-oriented reforms is to improve the insurers' incentives for efficiency and cost containment which were virtually lacking in the past. The capitation payments should account for predictable variations in annual per-person health care expenditures, as far as these are related to health status. Despite many studies that have shown that demographic capitation formulae are inadequate (e.g. Lubitz *et al.*, 1985; Ash *et al.*, 1989; Anderson *et al.*, 1990; Van Vliet and van de Ven, 1992), all countries mentioned above use a capitation formula mainly based on demographic variables. An obvious way forward is to improve the capitation formula by including more and better predictors of health care cost. However, in practice, the application of improved RACPs does not appear to be straightforward, at least not in the short run†. Given an inadequate capitation formula, insurers with many low-risk members will be overpaid whilst others will be underpaid. Furthermore, the insurers will have an incentive for cream skimming if the regulator requires that either RACPs are the entire revenue for the insurers or that the additional premium a member pays to his insurer is not allowed to be risk-rated‡. Cream skimming refers to an insurer's selection of so-called

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†The reason is that the regulator has to take into account the validity, reliability and feasibility of the risk adjusters involved. Furthermore, the risk adjusters should not be subject to manipulation and they should not conflict with the right to privacy of those insured and health care providers. Finally, the RACPs should not provide incentives for inefficiency.

‡In the Dutch reforms, the RACPs do not constitute the entire revenue for insurers. The RACPs are supplemented by flat-rate additional premiums (see Section 2). In this paper we assume this form of premium regulation for setting additional premiums.

preferred risks, that is members expected to be profitable given the RACPs and the regulatory regime for setting additional premiums. If cream skimming occurs, it is counterproductive with respect to supposedly positive effects of competition, that is, improving efficiency of care and becoming more responsive to consumer's preferences. Therefore it is necessary to prevent cream skimming in order to reap the fruits of a competitive health insurance market with a regulated premium structure.

Given imperfect RACPs, several mandatory pooling variants may reduce the disadvantages of the imperfect capitation formula. In a previous paper it was concluded that one specific variant of mandatory pooling, high-risk pooling, is a promising supplement to RACPs (Van Barneveld *et al.*, 1996). Based on a more comprehensive data set, we compare, in the present paper high-risk pooling with two other main variants of mandatory pooling. Moreover, the consequences of pooling for various cost categories are investigated as well as different selection strategies in the case of high-risk pooling.

Although the mandatory pooling variants could be used to supplement any RACP-formula, we restrict this paper to demographic RACPs because they are employed already in several countries and are generally available. The three main pooling variants include ex post compensations to insurers for some members which depend to various degrees on actually incurred costs*. Therefore, these pooling variants reduce incentives for cream skimming but they also reduce incentives for efficiency and cost containment. The purpose of this paper is to analyze which pooling variant might give the greatest reduction of incentives for cream skimming given a certain level of pooling. This paper does not discuss the desirability of the development of competition among insurers. Such discussions can be found, for instance, in the special issue "Forming and reforming the market for third-party purchasing of health care" of this journal (vol. 39, No. 10).

The paper is organized as follows. First we describe the background to our study. Then we will discuss the mandatory pooling variants. Thirdly, we present the data and methods used in the empirical analysis. Next the results of our analysis are presented. Finally the results are summarized and discussed.

BACKGROUND TO THE STUDY

The reforms that are being implemented in the Dutch public health insurance market form the background to our study†. The public health insurance system concerns a compulsory individual health insurance (not group health insurance). Direct government control over prices and productive capacities is going to make way for regulated competition among sickness funds and among health care providers. Sickness funds are expected to function as intermediaries between consumers and providers and they are allowed to contract selectively with providers. Furthermore, sickness funds are expected to become more responsive to consumers' preferences.

The benefits package covers non-catastrophic risks such as hospital care, physician services and prescription drugs. The sickness funds must have an annual open enrolment period and must follow other procompetitive regulation‡.

All people in the public health insurance market receive a subsidy toward their premium through one of the competing sickness funds. This subsidy comes from a Central Fund, supported by mandatory, income-dependent contributions paid through taxation. The per person subsidy is a risk-adjusted capitation payment (RACP) that does not vary by sickness fund. It equals the predicted per capita cost within the risk group to which the person belongs, minus a fixed amount. We will refer to predicted costs based on the capitation formula as the normative costs. The fixed amount is the same for all persons and is about 10% (in 1996) of the average predicted per capita cost of the public health insurance. The deficit generated by this deduction is filled by an additional premium that each person pays directly to the sickness fund of choice. Each sickness fund is free to set its own additional premium. However, government regulation requires that a sickness fund quotes the same premium to all

*In this paper we do not consider fixed payments for certain (medical) conditions that might occur during the year. Payment models that include such ex post payments are sometimes referred to as concurrent or retrospective risk adjustment models (see Ellis *et al.*, 1996) to distinguish them from the usual prospective risk adjustment models. Concurrent or retrospective risk adjustment models can also be seen as a form of pooling, i.e. a condition-specific pooling variant with payments for pooled members that are independent of their actual costs. Of course, condition-specific pooling could imply payments based on the actual costs of pooled members as well. However, any condition-specific pooling arrangements would create the potential for political battles over which conditions to admit to the pool, while those conditions that make members eligible for pooling might increase in popularity (Swartz, 1995). Therefore, in this paper we do not analyze condition-specific pooling arrangements.

†All employees (and their family members) earning an annual wage below a certain level are insured compulsory in the public health insurance sector. About two-third of the Dutch population is insured in the public health insurance sector. Except for a limited group of civil servants who have their own mandatory scheme, the remainder of the population, consisting mainly of self-employed and higher-income groups, can (and does) voluntarily buy health insurance from private health insurance companies.

‡Formerly, the contract period was 2 years. In 1996, the government changed this period to 1 year.

members choosing the same insurance option*. The additional premiums reflect the difference between capitation payments and actual costs, thus creating an incentive for competing sickness funds to be efficient.

In the period 1993 through 1996 the RACPs were based solely on demographic variables. If the sickness funds were fully at risk for the difference between their actual costs and normative costs, they would have a great incentive for cream skimming. To reduce this disadvantage of the crude RACP-formula, the Dutch government introduced a system of partial capitation. In 1993, 1994 and 1995, the sickness funds were at risk for only about 3% of the difference between their actual costs and normative costs. The remaining 97% was compensated retrospectively. In essence, this boils down to a blended payment system, as proposed by Newhouse (1994), in which the weight on current expenditures is 0.97 and the weight on normative costs is 0.03. Although the application of these weights reduces nearly all incentives for cream skimming, it also removes nearly all incentives for efficiency and cost containment. In 1996, the weight on normative costs is about 0.15†. This blended payment system can be seen as one specific variant of mandatory pooling. We will refer to this variant as proportional pooling. The Dutch government is considering replacing this system of proportional pooling by another variant of mandatory pooling.

MANDATORY POOLING VARIANTS

The purpose of mandatory pooling is to reduce incentives for cream skimming, given a system of crude RACPs, while preserving incentives for efficiency and cost containment as much as possible. Besides improving the RACP-formula and introducing mandatory pooling variants, the following forms of additional procompetitive regulation can also be considered as tools to prevent cream skimming: risk-related additional premiums, qualification of insurance contracts, no direct interaction between an insurer's sales representative and a potential insured in the enrolment process, monitoring the quality of services and ethical codes for insurers (Van de Ven and van Vliet, 1992).

Here, we will analyze empirically the consequences of three main variants of mandatory pooling namely: high-risk pooling, excess-of-loss and proportional pooling as a supplement to a demographic RACP-formula. The RACP-formula and some procompetitive regulations are taken as given in this analysis.

First, a sickness fund receives RACPs as in the situation without pooling. At the end of the pooling period, the sickness fund receives an ex post compensation for its pooled members depending on their actual costs. To finance the pool, each sickness fund has to pay a certain percentage of its normative costs‡. In the empirical analysis, this percentage is calculated afterwards such that each pooling variant is budget neutral.

(1) High-risk pooling (HRP)

With HRP, each sickness fund is permitted periodically, e.g. each year, to predetermine a small fraction of its members whose costs then are (partially) pooled (Van Barneveld *et al.*, 1996). This fraction may be the same for each sickness fund or it may vary over the sickness funds. In the latter case, the percentage would depend preferably on the risk that a fund represented as far as this risk was not reflected in the RACPs. Pooling can apply to all costs of a pooled member, can be limited to the costs above the member's RACP, or can be limited to the costs above a certain threshold. In each of these three variants, it also can apply to a certain percentage of the costs involved, for example 80 or 90%. In this paper, we focus on the first variant with 100% of the costs involved because it seems easiest to implement. At the end of the pooling period, a sickness fund receives for the group of pooled members the difference between their actual costs and normative costs. A consequence is that if a pooled member's actual costs are lower than it's normative costs, the pool takes the difference.

Under HRP, before the start of the pooling period, sickness funds inform the pooling organization which of their members will be pooled that period. It is up to the sickness funds themselves to determine which members are pooled. In the empirical analysis, we will assume that the pooling period is 1 year and that the sickness fund would select for pooling those members who have had the highest costs in the year immediately preceding. Although in practice, this strategy can not be employed exactly, it provides a good illustration of the possible consequences of HRP (see further comments in Section 5, Table 2).

(2) Excess-of-loss (EOL)

Under excess-of-loss, sickness funds receive a full compensation of a member's costs above a preset threshold. The percentage of members who have

*Because insurers are allowed to contract selectively with providers, they are allowed to offer different insurance options. However, each insurance option has to cover all types of care specified in the benefit package.

†In 1996, the government decided to divide the costs of hospital care into fixed costs (about two-third of the hospital costs) and variable costs (about one-third of the hospital costs). The sickness funds are at risk for 5% of the fixed hospital costs only.

‡An alternative to finance the pool might be a flat-rate contribution per member as applied in Van Barneveld *et al.* (1996). The finance mechanism should be such that for an individual insurer, the cost of pooling is (largely) independent of the risk of its pooled members, because otherwise the insurer's incentives for cream skimming would not be reduced.

costs above the threshold will probably not be the same for each sickness fund. Beebe's outlier pool proposal, in which HMOs receive a partial compensation of a member's costs above a preset threshold (45%), is a small modification of EOL (Beebe, 1992). Another difference is that EOL is budget neutral whereas Beebe's proposal is not.

Because contracts for reinsurance in the health insurance industry are typically written on an excess-of-loss basis, this mandatory pooling variant can be seen as a mandatory reinsurance program with a regulated reinsurance premium (Bovbjerg, 1992).

(3) Proportional pooling (PP)

Under proportional pooling a sickness fund receives at the end of the pooling period a% of the difference between the total costs it has incurred and the total normative costs of its members. This is a blended payment system, as proposed by Newhouse (1994), in which the weight on current expenditures is a% and the weight on normative costs is $(100 - a)$%. It can be seen as a mandatory reinsurance program with a regulated reinsurance premium in which a% and $(100 - a)$% come to the account of the reinsurer and sickness funds respectively ("quota share").

Important aspects of all pooling variants in this paper are that pooled members have the same benefits package and pay the same premium. In fact, pooled members would be typically unaware that their costs are pooled. Each sickness fund is obliged to contribute to the financing of the pool. The variants are budget-neutral from the regulator's point of view, they would only shift money from one sickness fund to another.

DATA AND METHODS

The empirical analysis is based on panel data from "Zorg en Zekerheid", a sickness fund working in the western part of the Netherlands with about 420,000 members. The portfolio of this sickness fund is globally representative for all 9,4 million Dutch sickness fund members. The data set represent all, 245,720 individuals that were continuously enroled with Zorg en Zekerheid during the 4 year period 1988–1991*. Not all of these were actually included in the data set. All individuals hospitalized in 1988 (about 19,000 individuals) are included, supplemented by a random sample of about 31,000 persons from the group of individuals not hospitalized that year. The reason for this stratification is to get an over-representation of people with relatively poor health status, which is the most interesting group in the context of capitation payments. All results presented are corrected for the stratification, by means of weighing for age/sex and yes/no hospitalization in 1988.

For each member the data set comprises for 5 years, from 1988 to 1992, administrative information on annual health care expenditures and on hospitalizations. The annual per-person health care expenditures include the costs of inpatient room and board, inpatient and outpatient specialist care, dental care, physical therapy and ancillary services. The costs of drugs prescribed by physicians are available for 1992 only. The costs of care provided by the general practitioner (GP) are excluded because Dutch GPs receive a uniform annual fee for each patient on their list who is enroled with a sickness fund, regardless of medical consumption. All cost data refer to actual charges. The mean total costs per member in 1992 equals Dfl. 1,643. This can be divided into Dfl. 734 for inpatient care, Dfl. 546 for outpatient care and Dfl. 363 for prescribed drugs†.

For each hospital admission in 1988, 1989, 1990 and 1991 the diagnosis is known in the form of the relevant code from the ICD-9-CM coding system (International Classification of Diseases, 9th edn, Clinical Modification). In principle, the disease is recorded that is diagnosed on admission because when a member is hospitalized the sickness fund has to be notified of the reason for admission. However, notification is often delayed until after the discharge, in which case the more informative discharge diagnosis is recorded. According to these diagnoses, members are classified on an annual basis into one of the nine original diagnostic cost groups (DCGs) developed by Ash *et al.* (1989). About 6.5% of the members is hospitalized in a certain year. Members without hospital admission are classified into DCG 0.

The empirical analysis starts with the estimation of two regression models, the RACP-model and the prediction-model. The RACP-model resembles a version of the demographic capitation formula that is employed in The Netherlands in 1996. It is based on age, gender, region and disability. With the prediction-model we attempt to predict the costs of individual members as good as possible given the available information on prior hospitalizations and prior costs in the three preceding years. The models are assumed to be linear in the coefficients and they both include an intercept. They are estimated by

*Because we compare the consequences that the three pooling variants would have had in 1992, the members must be enroled on January 1, 1992. Since 1992 members can leave the panel data set, because of deaths and changes of insurer. About 3.1% of the members left the panel data set. All results presented are corrected by means of weighing for the number of months that members were enroled in 1992.

†In August 1997, one Dutch florin was worth about 0.50 U.S. dollar.

Table 1. Description of regression models to predict costs in 1992

Model	Risk-adjusters	R^2
RACP	35(2*18 − 1) age/sex dummies + 1 dummy for disability + 4 dummies for urbanization	0.05
Prediction	RACP-adjusters + 3*4 dummies for DCGs in 1991, 1990, 1989 + 3 continuous variables for costs in 1991, 1990, 1989	0.15

$N = 49{,}518$.

To mitigate the influence of outliers in the prediction-model, we truncated the independent variables (= risk adjusters) "costs in 1989, 1990 and 1991" at Dfl. 50,000 per member. The dependent variable "costs in 1992" is *not* truncated.

The 4 dummies for DCGs contain DCG 1 and 2, DCG 3 and 4, DCG 5 and DCG 6–9, respectively.

A table with the estimated coefficients for both models is available from the authors upon request.

means of ordinary least squares*, with an individual's annual health care expenditures in 1992 as dependent variable and the various sets of risk adjusters as independent variables (see section "Results", Table 1). These two models give us two costs predictions for each member. Subsequently, we define "good risks" as those members for whom the cost prediction based on the RACP-model is higher than that based on the Prediction-model. The others are referred to as "bad risks".

Of course, the results of the pooling variants depend on the degree of pooling. In this paper we use four degrees of pooling. These so-called pool levels are based on the HRP-variant with 1, 2, 3 and 4% pooled members, respectively. Using another data base, Van Barneveld *et al.* (1996) showed that the effectiveness of HRP quickly drops as the fraction of pooled members increases. It was concluded that HRP of less than 4% of the members would be most meaningful†. The parameters of the other variants are chosen so that the sickness fund would be at risk for the same percentage of total costs. We use this percentage as a rough measure of the incentives for efficiency and cost containment.

We mainly use two criteria to compare the pooling variants given a certain level of pooling. First, the reduction in financial risk for the sickness fund for three types of care. The higher this reduction, the lower the incentives for efficiency and cost containment. This gives an indication of the reduction of the incentives for efficiency for these types of care that would come along with a pooling variant. Second, the extent to which the demographic RACPs supplemented with pooling are able to adequately compensate the sickness fund for various subgroups of members, for example the good risks and the bad risks. The lower the predictable losses/profits for various subgroups of members, the lower the incentives for cream skimming. This gives an indication of the reduction of the incentives for cream skimming that would result when using a certain pooling variant.

*Although our health care expenditure data are highly skewed, OLS estimation does not seem to cause estimation problems. For instance, Lamers and van Vliet (1996) have used the two-part model developed by Duan *et al.* (1983) to capture skewness. The predictive accuracy of this two-part model was comparable to that of the more simple linear model which is in line with the findings of Duan *et al.* (1983).

†The same analysis applied in the present data set leads to the same conclusion.

RESULTS

Table 1 presents the R^2-values of the two regression models, the RACP-model and the prediction-model. The R^2-value of the RACP-model is 0.05. This value is about one-third of the R^2-value of the prediction-model, which could be used by sickness funds to calculate cost predictions for their members. The predictive power of the prediction-model is high. It has been estimated that for the types of health care expenditures we are analyzing here at most about 20% of the variance among individuals of all ages in annual expenditures is predictable (Newhouse *et al.*, 1989; Van Vliet, 1992). Therefore, we believe that the prediction-model represents a model that can hardly be improved upon, given the available data.

Comparing the two cost predictions for each member, about 81% of the members appear to be good risks and 19% bad risks. Without pooling, the mean predictable profit on good risks would be Dfl. 472 and the predictable loss on bad risks would be Dfl. 2,065. This finding is in line with previous research showing that RACPs based on demographic variables leave ample room for cream skimming.

To analyze HRP empirically, we have to make an assumption about the selection strategy that will be employed by sickness funds to select members for pooling. Table 2 shows the consequences of two selection strategies that could be employed.

If the sickness fund selects those members for HRP (for 1% of the members) who have the highest predictable losses (cost prediction via the prediction-model minus cost prediction via the RACP-model), the pooled members account for 10.2% of total costs. Their normative costs are only 1.9% of total costs. Thus the difference is 8.3% of total costs.

If the sickness fund selects those members who have had the highest costs in the previous year, the pooled members account for 9.5%, the normative costs are 1.9% and the difference is 7.6% of total costs. Improving the latter, simple selection strategy in this case would increase the sickness fund's revenue by about 0.7% (8.3–7.6%) of the total costs.

Table 2. Actual and normative costs as a percentage of total costs for pooled members under HRP, 1992

	1%	2%	3%	4%
Pooled members selected on the basis of their predicted loss				
Actual costs	10.2	15.1	19.2	22.3
Normative costs	1.9	3.7	5.3	6.8
Difference	8.3	11.4	13.9	15.5
Pooled members selected on the basis of their total costs in 1991				
Actual costs	9.5	14.2	17.7	20.4
Normative costs	1.9	3.7	5.3	6.7
Difference	7.6	10.5	12.4	13.7

N = 49,518.
Overall mean costs in 1992 are Dfl. 1,643.
The normative costs equal the predicted costs via the RACP-model.
The predicted loss for a member is calculated as the predicted costs via the prediction-model minus the predicted costs via the RACP-model.

Table 3. Description of mandatory pooling variants

Pool level	Reduction in financial risk (%)	High-risk pooling (HRP) (%)	Excess-of-loss (EOL)	Proportional pooling (PP) (%)
1	9.5	1	Dfl. 33,000	9.5
2	14.2	2	Dfl. 23,300	14.2
3	17.7	3	Dfl. 18,700	17.7
4	20.4	4	Dfl. 16,000	20.4

N = 49,518.
Overall mean costs in 1992 are Dfl. 1,643.
Under HRP, the pooled members are selected on the basis of their costs in 1991.
Under HRP, the reduction in financial risk is calculated as the actual costs of the pooled members as a percentage of total costs.
Under EOL, the reduction in financial risk is calculated as the actual costs above the threshold as a percentage of total costs.

In the situation of HRP for 2, 3 and 4% of the members, this increase in revenue would be about 0.9, 1.5 and 1.8% of total costs, respectively.

We will assume in the empirical analyses that sickness funds would select for HRP those members who have had the highest costs in the year immediately preceding. This way, we slightly *under*estimate the potential of HRP because a sickness fund could employ better selection strategies. On the other hand we slightly *over*estimate the potential of HRP because lags in claims processing would prevent sickness funds from employing this strategy exactly and because they have no claims history of new enrollees. However, sickness funds might use the most recent claims history available for their members and for new members some relevant indicator of the claims history might be passed from one insurer to another*. Based on these considerations, we believe that our empirical analysis provides a good illustration of the possible consequences of HRP.

Given the HRP-variants with 1, 2, 3 and 4%, respectively, we looked, by trial and error, for variants of EOL, that would leave the sickness fund at risk for the same percentage of total costs. Table 3 presents these pooling variants.

*If insurers update their claims files every month, they can use information from the first 10 or 11 months of a year to decide whether members are pooled for the next year. With respect to new enrollees an alternative might be to pass on from one insurer to another information whether a member was pooled in the previous year.

In the case of HRP for 1% of the members, the sickness fund is not at risk for 9.5% of the costs. The same percentage is reached with EOL using a threshold of Dfl. 33,000. In the four pool levels the sickness fund is not at risk for 9.5, 14.2, 17.7 and 20.4% of the costs respectively. Although these pooling variants reduce the incentives for efficiency, they certainly do not eliminate them. The sickness fund would remain at risk for about 80 to 90% of its expenditures.

The activities of sickness funds to promote efficiency might be different for different types of care. Therefore, Table 4 presents the percentage of costs for which the sickness fund is not at risk for three types of care.

Table 4 shows that given a certain pool level, EOL would result in a relatively high reduction of the sickness fund's financial risk for inpatient care. With HRP this reduction would be lower. The opposite holds for outpatient care and prescribed drugs.

In sum, Tables 3 and 4 show that all pooling variants reduce the incentives for efficiency, but they would keep the sickness funds responsible for the vast majority of their expenditures. Next, we will analyze which pooling variant leads to the largest reduction in incentives for cream skimming given a certain pool level.

Table 5 presents predictable profits and losses per member for various subgroups, without pooling and with pool level 2 and 4.

About 36% of the members had no costs in 1991. Without pooling the predictable profit in 1992

Table 4. Reduction in financial risk (%) for inpatient care, outpatient care and prescribed drugs

Pool level	Inpatient care		Outpatient care		Prescribed drugs		All types of care
	HRP	EOL	HRP	EOL	HRP	EOL	
1	12.8	16.6	8.0	4.3	5.1	2.6	9.5
2	19.3	24.9	11.0	6.3	8.9	4.3	14.2
3	23.5	30.8	13.4	8.0	12.2	5.8	17.7
4	26.7	35.0	15.9	9.3	14.6	7.4	20.4

N = 49,518.
HRP = high-risk pooling, EOL = excess-of-loss.
Under EOL, the costs above the threshold for a member are divided into inpatient care, outpatient care and prescribed drugs in proportion of the total costs for these types of care for the member involved.
Under proportional pooling (PP), the reduction in financial risk for inpatient care, outpatient care and prescribed drugs are the same as the reduction in financial risk for all types of care.

for this subgroup is Dfl. 783 per member. All pooling variants reduce this profit. Given pool level 2, the biggest reduction is achieved by EOL (to Dfl. 622) and the least by PP (to Dfl. 672). For the 2% group with the highest costs in 1991 the predictable loss in 1992 without pooling is Dfl. 8,796 per member. Given pool level 2, HRP reduces this loss to Dfl. 442, which equals the mean pool contribution for the members involved that would be charged to finance the pool. This result is caused by the assumption we made that under HRP the sickness fund would select for pooling those members with the highest cost in the preceding year. For the other variants the remaining predictable loss in 1992 for those with the highest costs in 1991 is at least Dfl. 4,997 per member.

Almost 80% of the members had no hospitalization in the previous 4 years. Without pooling the predictable profit for this group is Dfl. 432 per member. Given pool level 2, the biggest reduction is achieved by HRP (to Dfl. 274) and the least by PP (to Dfl. 371). About 0.2% of the members had at least one hospitalization in each of the previous 4 years. Without pooling the predictable loss for this group is Dfl. 16,889 per member. Given pool level 2, HRP reduces this loss to Dfl. 3,730. For EOL the remaining predictable loss is more than twice as high (Dfl. 8,428). For PP the remaining predictable loss is almost four times as high (Dfl. 14,491).

Using pool level 4 instead of pool level 2 would further reduce the predictable profits and losses.

Table 5. Mean costs and mean results in 1992 per member for various subgroups (Dfl.)

Subgroups	%	Mean costs 1992 (Dfl.)	Mean result 1992 (Dfl.)			
			Without pooling	HRP 2%	EOL Dfl. 23,300	PP (a = 14.2)
Total costs in 1991						
0	36.4	741	783	623	622	672
1–4,946	59.6	1,733	–99	–271	–143	–85
4,947–9,853	2.0	5,060	–2,546	–2,811	–2,066	–2,185
> 9,853	2.0	11,974	–8,796	–442	–4,997	–7,547
No. years with hospitalization						
0	79.7	1,074	432	274	300	371
1	15.6	2,970	–933	–764	–694	–801
2	3.7	5,586	–3,020	–1,866	–2,200	–2,591
3	0.8	11,024	–7,987	–3,276	–4,764	–6,853
4	0.2	20,156	–16,889	–3,730	–8,428	–14,491
				HRP 4%	EOL Dfl. 16,000	PP (a = 20.4)
Total costs in 1991						
0	36.4	741	783	575	567	623
1–4,946	59.6	1,733	–99	–322	–153	–79
4,947–9,853	2.0	5,060	–2,546	–431	–1,793	–2,027
> 9,853	2.0	11,974	–8,796	–434	–3,967	–7,002
No. years with hospitalization						
0	79.7	1,074	432	210	255	344
1	15.6	2,970	–933	–639	–611	–743
2	3.7	5,586	–3,020	–1,356	–1,847	–2,404
3	0.8	11,024	–7,987	–2,121	–3,871	–6,358
4	0.2	20,156	–16,889	–1,238	–6,541	–13,443

N = 49,518. Overall mean costs are Dfl. 1,643.
HRP = high-risk pooling, EOL = excess-of-loss, PP = proportional pooling.
Without pooling, the result per member is calculated as normative costs minus actual costs.
With pooling, the result per member is calculated as normative costs plus reimbursement from the pool minus the contribution which is used to finance the pool.

Table 6. Percentage drop in predictable losses for the bad risks

Pool level	HRP	EOL	PP
1	25.9	19.8	9.5
2	36.0	28.1	14.2
3	42.4	33.4	17.7
4	46.7	37.2	20.4

N = 49,518. Overall mean costs are Dfl. 1,643.
HRP = high-risk pooling, EOL = excess-of-loss, PP = proportional pooling.
Bad risks are defined as those members for whom the cost prediction based on the prediction-model is higher than that based on the RACP-model.
Without pooling the predictable loss for bad risks (19% of the members) is Dfl. 2,066 per member, the predictable profit for good risks (81% of the members) is Dfl. 472 per member.

Although even with pool level 4 there remain predictable profits and losses for the various subgroups, Table 5 shows that the addition of pooling to demographic RACPs may substantially reduce predictable profits and losses for the investigated subgroups. This implies that the addition of pooling will substantially lower the incentives for cream skimming which are inherent in a demographic RACP-formula.

Of course many other subgroups could be added to Table 5. However, in order to give an indication of the incentives for cream skimming in just one figure, we divide the members in good risks and bad risks with the regression models of Table 1. Without pooling predictable profits will be made on good risks while predictable losses are incurred on bad risks. Table 6 presents the percentage drop in predictable losses for the bad risks. This percentage is the same as the drop in predictable profits on the good risks.

Table 6 clearly shows that given a certain pool level, HRP leads to the largest and PP to the smallest drop in predictable losses.

In sum, Tables 5 and 6 show that all pooling variants reduce predictable profits and losses for subgroups of members. Therefore, all variants reduce the incentives for cream skimming which are inherent in demographic RACPs. Given a certain pool level, HRP gives the best results.

CONCLUSIONS

This study shows that, as a supplement to demographic RACPs, various mandatory pooling variants may substantially reduce the incentives for cream skimming which are inherent in such crude RACPs. For example, without pooling, the mean predictable loss in 1992 for the 0.2% members who have had at least one hospitalization in each of the previous 4 years is about Dfl. 17,000 per member. Given pool level 2, HRP reduces this loss by 78%, EOL by 50% and PP reduces this loss by 14%.

Because these three main pooling variants include ex post compensations to sickness funds, they also reduce the incentives for efficiency and cost containment. In the above mentioned example, the sickness funds are at risk for about 86% of their expenditures.

In this paper, we used four levels of pooling whereby the sickness funds are at risk for about 80 to 90% of their expenditures. Therefore, the analyzed variants, although they reduce the sickness funds' incentives for efficiency and cost containment, certainly do not eliminate these incentives.

With EOL the reduction in predictable losses for bad risks, i.e. those members expected to be unprofitable given the RACPs without pooling and the regulatory regime for setting additional premiums, varies from 20% to 40%. With HRP this reduction varies from 26% to 47%. With PP, the reduction would be 10% to 20% only. Therefore, we conclude that HRP is the most effective of these three main pooling variants.

DISCUSSION

In this paper we used the percentage of total costs for which an insurer is at risk as a rough measure of incentives for efficiency and cost containment. Of course, the incentives for efficiency and cost containment will not be exactly the same given such a percentage. For example, Table 4 shows differences in the percentage of costs for which an insurer is at risk for different types of care. The following qualitative considerations seem relevant as well.

With HRP, the lower the ratio of unpredictable users and predictable users of specific, expensive types of care, the lower the incentives for efficiency and cost containment for these types of care.

Further research focusing on the consequences of pooling variants for the incentives for efficiency and cost containment concerning specific, expensive types of care seems worthwhile.

With EOL, the insurers have an incentive for efficiency and cost containment as long as it is uncertain whether a member will have costs above the threshold. Because for some members it is certain at the start of the pooling period that they will have costs above the threshold, we seem to have underestimated the reduction of incentives for efficiency and cost containment in the case of EOL. The extent of this underestimation is a topic for further research.

If the additional premiums that health insurers collect themselves were allowed to be risk-rated, they might adjust a member's additional premium to its expected costs minus the risk-adjusted capitation payment. In that case, cream skimming is not likely to emerge as a serious problem. However, such premium differentiation may have socially undesirable effects. Therefore, without any regulation with respect to the additional premium, it seems useful to study the extent of premium differentiation faced by members given some premium calculation formula used by health insurers and given the RACP-formula. If the extent of premium differentiation faced by members is considered to be too large, it can be mitigated by EOL and PP. It is not clear how to use HRP in this situation, because it is not clear which risk-rated premium a health insurer should quote to members who are likely pooled. Before calculating risk-rated premiums, an insurer has to know for which part of future expenditures of a potential member it is at risk. But with HRP an insurer will select members for pooling after it knows all the members in its portfolio for the upcoming pooling period. However, the calculation of risk-rated premiums has to be done much earlier. In the situation where a health insurer has to quote the same premium to all members, problems with the calculation of this premium hardly arise.

In this paper we analyzed three main variants of mandatory pooling separately. We assumed that the regulator's objective with pooling is to reduce the incentives for cream skimming which are inherent in demographic RACPs. Given the large sickness funds in The Netherlands, offering protection against the risk of an unexpected high proportion of high-cost members is not the regulator's objective. In other situations where capitation does not involve large insurance companies but relatively small GP-fundholders (United Kingdom) or HMOs (United States), it could be the regulator's objective to prevent cream skimming and, at the same time, to protect the fundholders' or HMO's solvency. In that case a combination of HRP and one of the two other pooling variants could be useful. Another option could be to use HRP in combination with voluntary risk-rated reinsurance techniques.

Many countries have implemented RACPs to competing health insurers as a part of market-oriented health care reforms. RACPs can constitute the entire revenue for insurers, as is the case in Israel, or the RACPs can be supplemented with additional premiums. In the latter case, this study assumes that government regulation requires a sickness fund to quote the same premium to all members choosing the same insurance option. This assumption is satisfied in, for example, Belgium, Switzerland and The Netherlands. Currently these countries use a demographic RACP-formula. The implementation of improved RACPs appears to be a long way from theory to practice. Therefore, we recommend these countries to supplement their crude RACPs with an extensive form of mandatory pooling. Besides trying to improve the RACP-formula, further research on and experimentation with forms of mandatory pooling seems a promising way forward.

Acknowledgements—The authors thank the health insurance organization "Zorg en Zekerheid" for providing the data set. The opinions expressed in this paper are solely those of the authors and do not necessarily reflect those of the afore-named organization.

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