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COSTS, BENEFITS AND EFFECTS ON PRESCRIBING OF A DRUG INFORMATION CAMPAIGN

An experiment with respect to Benzodiazepines

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Abstract

Changing the prescribing behavior of physicians in a medically and economically more appropriate direction, may be an important target for educational programs. We will investigate to which extent government initiatives in this area are cost-effective.

The focus in this paper is on two educational approaches, that sought to reduce the prescribing of benzodiazepines. Interventions consisted of, first, the mailing of three printed educational materials, informing physicians of the effectiveness of the drug and warning them for the side-effects, and second, a face-to-face visit by a practitioner, giving the same message.

A sample of 146 general practitioners of two provinces was randomized to control and experimental groups. In the control group, there was no intervention. The first experimental group received the mailings alone. The second experimental group received mailings and a visit. Prescriptions of the 146 physicians were collected during twelve weeks, including four weeks for, and four weeks after the intervention. In this way, the effect of the educational experiment could be measured.

Results indicate that expenditures for the target drugs reduced in each of the two experimental groups. The effect was largest in the face-to-face group. Under the most realistic hypothesis, expenditures of the drug reduced with 52 million BF. Since the costs of the campaign only amount from 26 million up to 36 million BF, the face-to-face information strategy seems appropriate. The reduction of expenditures for the written campaign is smaller and not statistically significant; it should not be recommended.

A simulation analysis confirms that the probability of a negative net benefit is small for the oral campaign. It also signals results are sensitive to the hypothesis concerning the willingness to pay of the patients for benzodiazepines .

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1. INTRODUCTION: OBJECTIVE AND METHODOLOGY

The objective of this paper is to investigate whether the prescribing habits of the general practitioner can be changed by providing him with neutral information, either in the form of a written mailing or by means of a neutral (or independent) representative[1]. More precisely, we will study to what extent an information campaign consisting of the mailing of printed educational materials alone, or in addition to a face-to-face visit by a neutral practitioner yields benefits to society that exceed the costs of such a campaign.

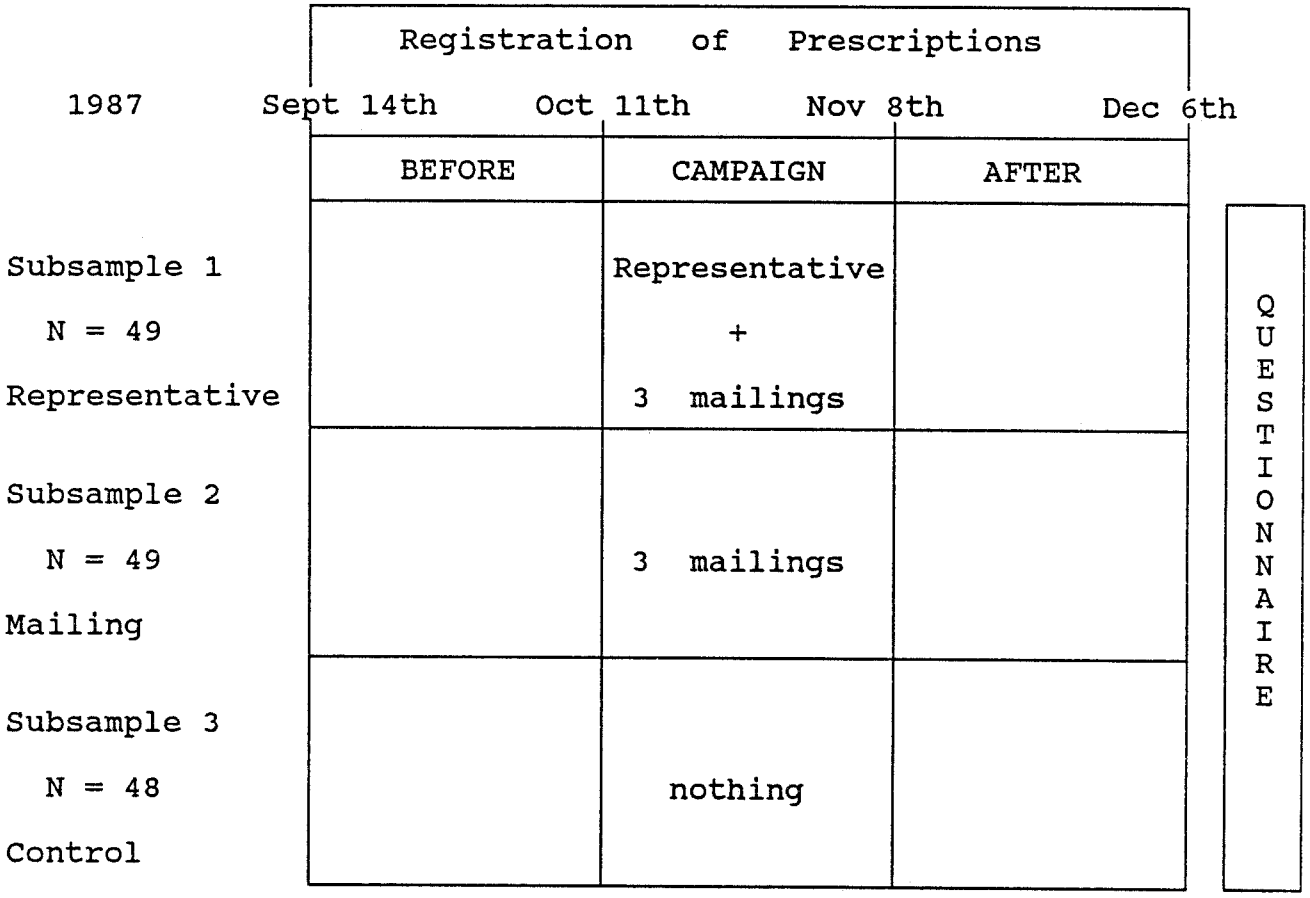
The effect of extra scientific information on the prescribing habits of the physician will be tested in a study[2] with respect to benzodiazepines[3]. 146 GPs from two provinces in the west of Belgium (Oost- and West-Vlaanderen) agreed to participate in the experiment[4]. After control for age, this total sample was split up randomly in three subsamples. The first subsample acted as a control group; physicians of this sample were not exposed to any intervention. The second subsample is called the 'mailing-group'. Physicians in this subsample received three mailings, informing them about the adverse effects, risk of dependence and effectiveness of benzodiazepines. The mailings were professionally designed. The responsible editors were the 'Werkgroep Gezondheidsvoorlichting' and the 'Huisartsencentrum Gent', two professional medical groups linked to the University of Ghent. The third subsample will be called the 'representative-group'. Physicians in this last group received the three mailings. In addition they received a visit from a neutral physician-representative who gave oral information about benzodiazepines.

All the prescriptions of the physicians were gathered during a period of twelve weeks. The information campaign with the mailings and the representative took place from the beginning of the fifth week until the end of the eight week. Comparing the

prescribing behavior in the four-week period before the intervention with the four-week period after the intervention between the three different groups, the effect of the information campaign was measured.

The study ended with an oral interview held among all physicians, inquiring about physician and practice characteristics, knowledge and attitudes of the physician apt to influence prescribing habits with respect to benzodiazepines. The study design is presented in figure 1.

Figure 1 **Study design**



The structure of the paper will be as follows. In section two, costs and benefits of the campaign are calculated. Subsequently extrapolations to the total population of physicians in Flanders are presented. A simulation analysis is performed in the third section. It reveals the probabilities with which various results can be obtained, given certain hypotheses about the probability distribution of the magnitude and the duration of the benefits and of the magnitude of the costs. The main conclusions are summarized in the fourth section.

2. ECONOMIC ANALYSIS OF THE CAMPAIGN

2.1. Effects and benefits of the information campaign

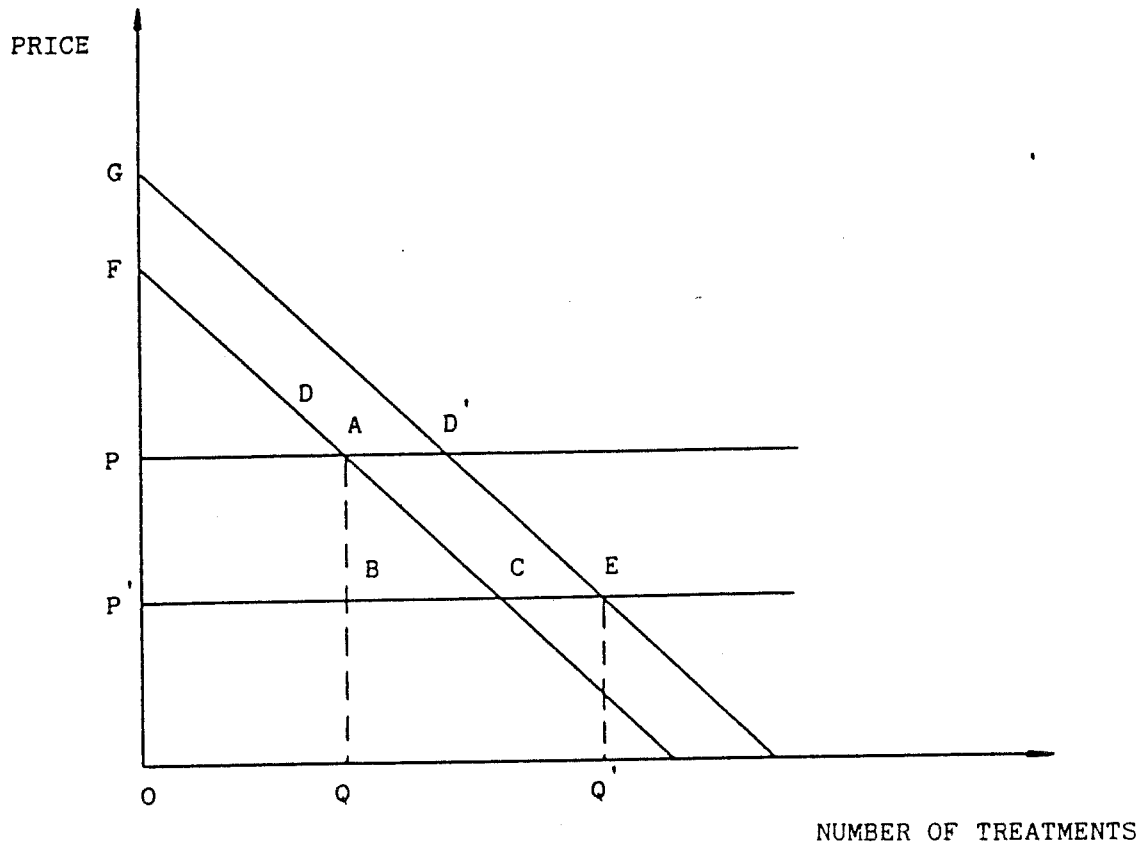
The aim of the information campaign is to induce the physician to prescribe fewer benzodiazepines. A number of authors (Catalan and Gath [1985], p 1375, Rooymans en Zitman [1982], p 64, Greenblatt and Shader [1973], p 265) state that the prescription volumes of benzodiazepines are too high. The reasoning is that for minor complaints, patients will be better off without benzodiazepines, because the side-effects such as drowsiness, somnolence, muscle weakness, confusion, vision problems and the development of dependence do not compensate for the moderate effectiveness of the drug. As a result, medical experts advise to reduce benzodiazepine prescribing in general practice. This recommendation also appears to be applicable to Belgium, since consumption is relatively high (Rooymans en Zitman [1982], p 112, Blondeel and Berings [1988], p 7).

Analytically the situation can be presented in figure 2. Before the information campaign the patient has a willingness-to-pay for the treatment of socio-psychological complaints, represented by the demand curve D. The total price of a treatment is P; it includes the fee of the physician consultation(s) and of the prescribed drugs. This results in a demand of Q units. After the information campaign, we may encouter the following effects.

The price of a treatment is now P', the resulting price reduction caused by a drop in costs of drug prescriptions. Secondly, health benefits could be higher (due to reduced side-effects, say), leading to an upward shift of the willingness-to-pay[5] curve to D'.

The benefits of the information campaign thus consist of the sum of the areas PP'AB (the cost savings on OQ episodes of treatment), ABC (the consumer surplus on the extra demand) and CEGF, the extra consumer surplus due to a perception of better health. Only the benefits PP'AB can be directly calculated from the experiment. They coincide with the reduced prescription costs (or cost savings). Thus note that neither the benefits of better health nor the net value of extra demand are taken account of in the present calculation of net benefits.

Figure 2 The benefits of the information campaign



Calculation of the benefits

First, for each physician, we calculate the average cost of benzodiazepines per patient[6] in the four-week period before and after the intervention. Secondly, we compute mean savings per patient in the three groups and perform an analysis of variance. The results are shown in table 1.

Table 1 **Costs of benzodiazepines per patient with a drug prescription in BF: an analysis of variance**

period before the intervention (t-1)			
total sample	control group	mailing group	representative group
37.11	38.34	34.44	38.57
period after the intervention (t)			
total sample	control group	mailing group	representative group
32.03	37.37	29.88	29.17
c o s t s a v i n g s			
total sample	control group	mailing group	representative group
5.08	.98	4.56	9.40

There is a significant reduction in the benzodiazepine prescription cost per patient. Cost savings per patient in the mailing group and in the representative group amount to 4.56 BF and 9.40 BF, respectively. Compared to the control group, this is an extra reduction of 3.58 BF due to the mailing campaign and of 8.42 BF due to the campaign by the representative. A two by two comparison of the means of the different subgroups (Sheffé-procedure[7]), reveals that only the differences between the representative group, on the one hand, and the control group, on the other hand, are statistically significant ($p \leq .01$).

Given the number of patients the physician received during the four weeks after the intervention, total cost savings due to the campaign during this registration period, could be calculated. Of course, it is very much likely that the effect of the campaign does not stop after the registration period. We formulate three hypotheses about the duration of this effect:

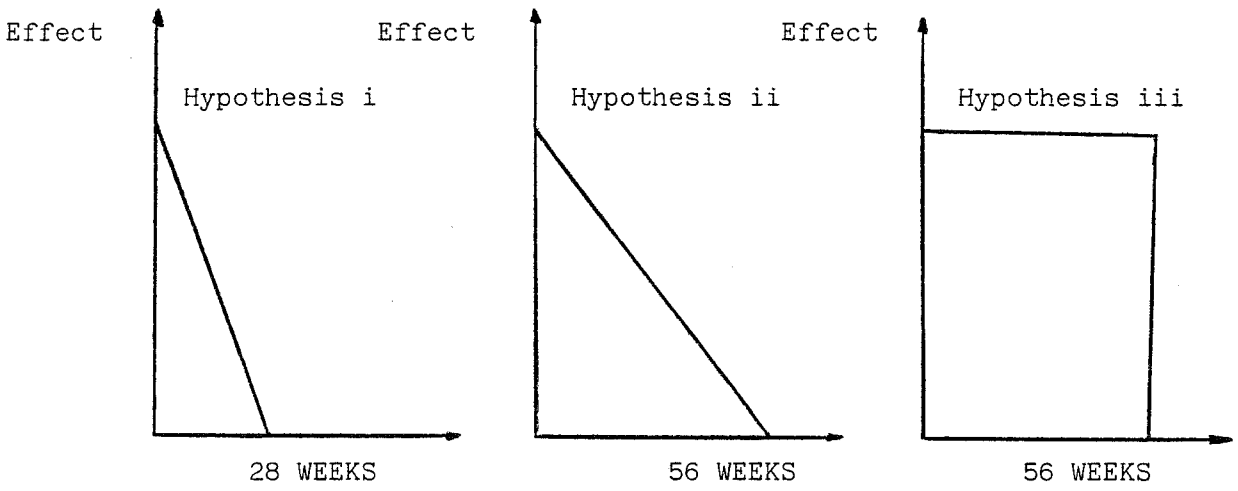
(i) the effect of the campaign gradually declines and vanishes after 28 weeks;

(ii) the effect of the campaign gradually declines and vanishes after 56 weeks;

(iii) the effect of the campaign lasts one full year.

We represent these different effects in figure 3. The hypothesized effects seem to be very conservative when compared with earlier studies on the effects of verbal information. Two studies showed a duration of the effect of a neutral representative of at least 9 months (Avorn [1983]) and 2 years (Ray [1985]).

Figure 3 Duration of the effect of the campaign



Savings realized in the sample, can now be extrapolated to the Flemish population of general practitioners. However, since our sample is non-random, ideally we have to take account of physician characteristics. Note that in a multiple regression analysis, we analyzed the effect of physician characteristics (age, sex, university of graduation) on cost reduction. None of them had a statistically significant effect[8]. We therefore do not hesitate to use the results obtained so far and extrapolate them to the total population of GPs (7000). We postulate furthermore that physicians see about 250 patients a week[9]. Total mean savings of a campaign in Flanders are presented in table 2.

Table 2. **Estimated total mean savings of an information campaign in Flanders in BF**

hypotheses	campaign with representative	mailing campaign
(i) effect diminishes in 28 weeks	51 572 500	21 927 500
(ii) effect diminishes in 56 weeks	103 145 000	43 855 000
(iii) effect during 56 weeks	206 290 000	87 710 000

Substitution to other drugs or therapies

Benzodiazepines could be substituted for other drugs or other therapies, of course. Extra costs of those (unintended) shifts should therefore be subtracted from our calculated savings.

Substitution to other drugs did not occur, however. We analyzed the effect of the campaign on all psychotropic drugs: barbiturates, meprobamates, stimulants, antidepressants and neuroleptics. The visit of the independent representative has no statistically

significant influence on the amount of those drugs prescribed per patient. The mailing campaign has a significant influence on the amount of antidepressants and neuroleptics. Both effects are even negative (27.7 percent less prescriptions per patient of antidepressants (sign: $p \leq .03$) and 23.5 percent less prescriptions of neuroleptics (sign: $p \leq .04$)). In other words, the present mailing campaign enhanced savings for other drug categories as well. The amount of these savings will not be calculated, however.

There could also have been a substitution to other therapies. Patients with psycho-social complaints who do not receive a drug treatment, could probably demand more time from the GP or from other medical personnel. This effect could not be monitored during the study. Besides, a controlled study of Catalan [1984] showed that neither the length of a visit per patient, nor the number of visits per patient, nor referral were significantly different for patients that received or did not receive drugs.

2.2. Costs of the information campaign

Costs in the experiment

Costs for design, printing and mailing of the mailings amounted to 314 192 BF. Costs of training of the representative and of his time amounted to 156 500 BF.

Costs of a campaign in Flanders

Spending for the campaign in the experiment cannot immediately be extrapolated. The salary of the physician-representative in our experiment was rather low. Moreover, when a permanent programme would be established, fixed costs of buildings, coordination etc would have to be allowed for. The calculation of a low and high cost scenario for a campaign in Flanders is presented in table 3. A detailed analysis is found in De Graeve [1989, appendix C].

Table 3. **Total costs of a campaign in Flanders (in BF)**

Cost categories	Low cost scenario	High cost scenario
MAILING	4 400 000	4 400 000
REPRESENTATIVE		
salary of representative	14 400 000	21 600 000
transportation cost	1 120 000	1 680 000
coordination, training, secretary	3 400 000	3 400 000
overhead	3 804 000	5 336 000
total	21 758 000	32 016 000
REPRESENTATIVE + MAILING	26 158 000	36 416 000

A final remark about the campaign is that pharmaceutical firms will sell less benzodiazepines. This may lead to reduced profitability in the pharmaceutical sector and possibly to reduced employment. In an economic analysis, we need not allow for these effects (Mishan [1982], p 14-15): the means freed from the production of benzodiazepines can be channelled to an alternative.

2.3. Comparison of costs and benefits

Table 4 summarizes the cost and benefits of the campaign in Flanders. For each of the two interventions, benefits are greater than costs. Net benefits are greater for the group of physicians receiving the representative. From these figures, it follows that the latter approach is to be followed.

Moreover, the duration of the effect of a verbal campaign will certainly be higher [Avorn et. al., 1987] than that of a mailing campaign. This consideration strengthens the preference for a verbal campaign.

Table 4 **Costs and benefits of an information campaign in Flanders (x 1000 BF)**

hypotheses	campaign represent. and mailing	campaign mailings alone	extra effect of represent.
BENEFITS			
a) effect declines gradually in 28 weeks	51 572.5	21 927.5	29 645.0
b) effect declines gradually in 56 weeks	103 145.0	43 855.0	59 290.0
c) steady effect during 56 weeks	206 290.0	87 710.0	118 580.0
COSTS			
1) most favorable hypothesis	26 158.0	4 400.0	21 758.0
2) least favorable hypothesis	36 416.0	4 400.0	32 016.0
NET-BENEFITS			
hypotheses a) and 1)	25 414.5	17 527.5	7 887.0
hypotheses b) and 1)	76 987.5	39 455.0	37 532.0
hypotheses c) and 1)	180 132.0	83 310.0	96 822.0
hypotheses a) and 2)	15 156.5	17 527.5	-2 371.0
hypotheses b) and 2)	66 729.0	39 455.0	27 274.0
hypotheses c) and 2)	169 874.0	83 310.0	86 564.0

3. A SIMULATION ANALYSIS

To be able to calculate the costs and savings of the information campaign, we had to formulate a number of hypotheses. We should also not forget that some of the parameters used are estimates and hence are subject to variation. In the present simulation analysis, we deal explicitly with this uncertainty: it comprises four stages. First, for each parameter influencing costs or benefits such as the reduction in prescribing, the number of patients per physician, the duration of the effect of the campaign etc., we adopt a probability distribution, reflecting the assumed probabilities of the different possible values of the parameters. These distributions are called the input probability distributions. Secondly, we randomly draw a value from each of those input probability distributions[10]. One set of parameter values represents a possible combination of parameters. We use this sample of values to calculate the output variable, the net benefit of the campaign. Thirdly we repeat steps 1 and 2 a thousand times and calculate the corresponding net benefits. Fourthly, we construct an output distribution that reveals the values of the net benefit with their respective probability of occurrence.

3.1. Baseline simulation

In the baseline scenario, we implement the same hypotheses as in the preceding part of the study. Net benefits (NB) are defined as:

$$NB = [\ (R^E - R^C) \times PAT \times PHY \times WEEK\ ] - C$$

where R^E = the reduction in the cost of benzodiazepines per patient in the experimental group
R^C = the reduction in the cost of benzodiazepines per patient in the control group
PAT = the number of patients per week per physician
PHY = the number of physicians
WEEK = the number of weeks during which the campaign has an effect
C = the costs of the campaign

Most of the above mentioned parameters used in the calculation are subject to uncertainty. Hence, we define probability distributions accordingly. For example, we estimated the mean cost reduction for benzodiazepines due to the campaign with a neutral representative: it amounts to 9.42 BF per patient and is associated with a standard error of 2.12. In the simulation we take account of such a variation. In fact, we enter the cost reduction as a normal distribution with the above cited mean and standard error.

In a similar fashion probability distributions for the other parameters are built into the analysis. They are summarized in table 5. The resulting distribution of the net benefit is represented in figures 4 and 5 for the representative group and for the mailing group, respectively. The statistics of these distributions are presented in tables 6 and 7.

Table 5 **Hypotheses used in the baseline simulation**

	campaign with representative	campaign with mailings
reduction in benzodiazepine cost per patient in the experimental group (R^E)	normal distr. mean=9.4024 s.e.=1.4521	normal distr. mean=4.5626 s.e.=2.0012
reduction in benzodiazepine cost per patient in control group (R^C)	normal distr. mean=.9774 s.e.=2.1191	normal distr. mean=.9774 s.e.=2.1191
number of patients per physician (PAT)	triangular distribution min=50; max=75 mostlikely=62.5	triangular distribution min=50; max=75 mostlikely=62.5
number of physicians (PHY)	7000	7000
duration of the effect of the campaign in weeks (no decay) (WEEK)	triangular distribution min=14; max=56 mostlikely=28	triangular distribution min=4; max=28 mostlikely=8
costs of the campaign (C)	uniform distr. 26 158 000 36 416 000	4 400 000
net benefits (NB)	(R^E-R^C) x PAT x PHY x WEEK - C	

Figure 4 **Distribution of net benefits of a campaign with a neutral representative**

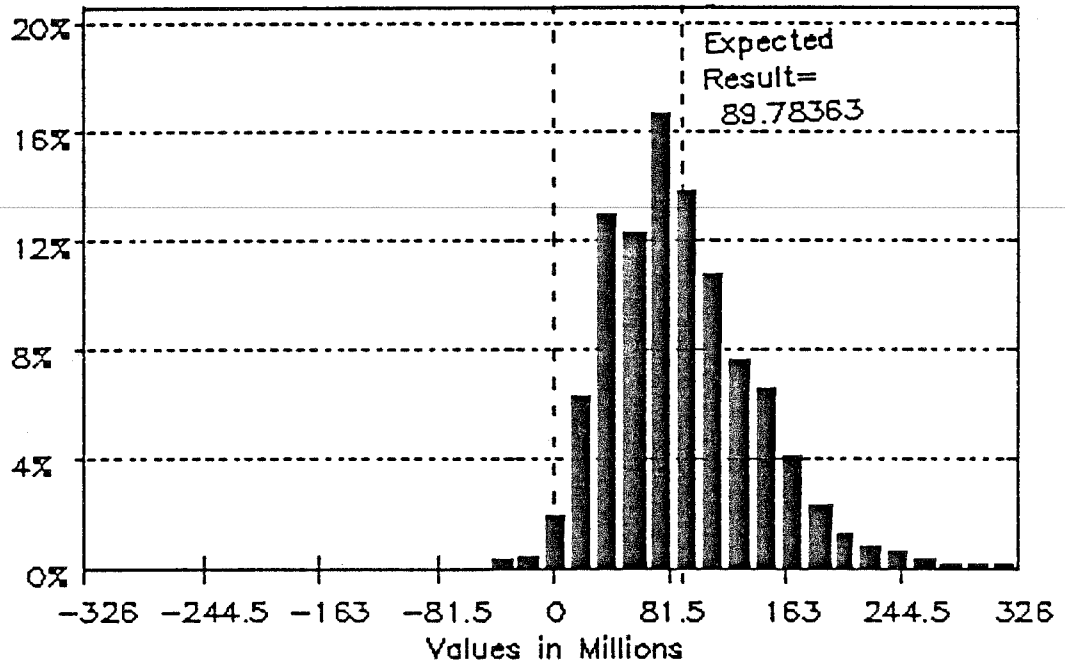


Table 6 **Statistical parameters of the distribution of net benefits of a campaign with a neutral representative**

Statistical parameters		Probability of net benefit	
Mean net benefit	= 89 783 630	< -16 300 000	= .5%
Maximum net benefit	= 325 245 100	> 0	= 98.5%
Minimum net benefit	= -45 642 490	> 51 652 200	= 75%
Standard deviation	= 52 058 220	> 83 011 300	= 50%
Skewness	= .75	> 119 232 800	= 25%
Kurtosis	= 3.94	> 182 302 100	= 5%

Figure 5 **Distribution of net benefits of a mailing campaign**

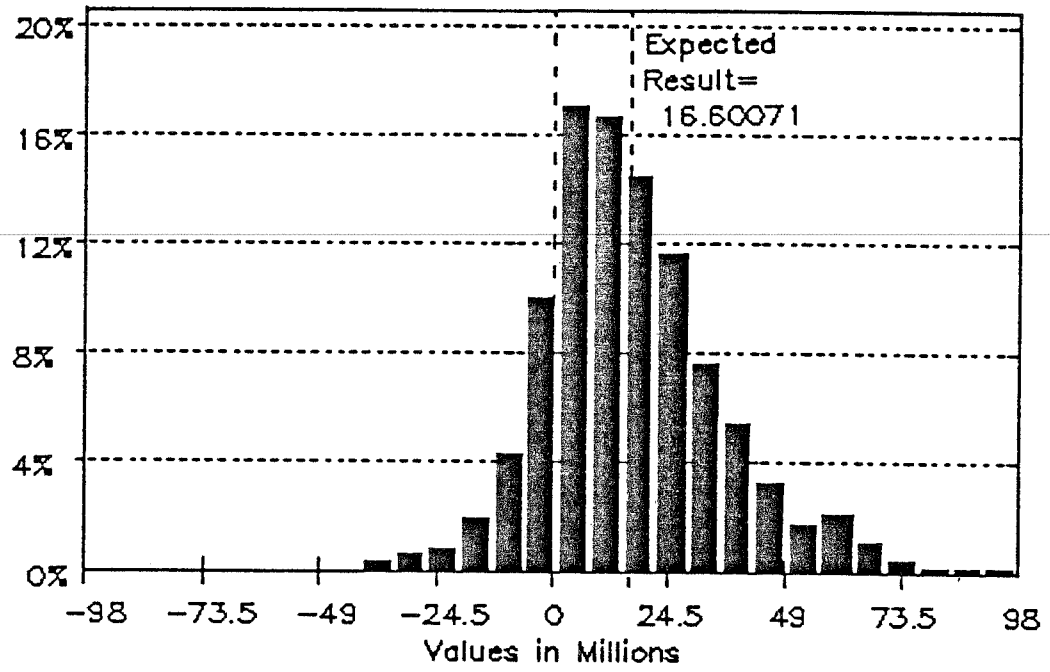


Table 7 **Statistical parameters of the distribution of net benefits of a mailing campaign**

Statistical parameters		Probability of net benefit	
Mean net benefit	= 16 600 710	< -10 273 000	= 5%
Maximum net benefit	= 97 677 490	> 0	= 82.9%
Minimum net benefit	= -40 464 610	> 3 894 900	= 75%
Standard deviation	= 19 127 840	> 14 106 400	= 50%
Skewness	= .60	> 27 333 700	= 25%
Kurtosis	= 3.82	> 53 766 500	= 5%

The simulation analysis shows that a campaign with an independent representative and mailings, nearly always results in net benefits. Given our hypotheses, we only encounter a probability of 1.5 percent that net gains will be absent. The expected mean gain is 90 million BF; there is a 50 percent probability that the net gain will be between 52 and 120 million BF. Thus this information campaign seems to be a highly beneficial project.

Although the simulation analysis does not preclude a positive net gain for the mailing campaign, this strategy seems less desirable. The probability of a positive net gain is smaller now (83 percent). Moreover the level of net gains is also reduced. A mailing campaign cannot be recommended unless the Minister of Public Health has a tight budget constraint.

3.2. Less favorable simulation scenario

In this section, we formulate alternative hypotheses, leading to a scenario that produces 'less favorable' outcomes for the information campaigns. The most important modification is that we drop the hypothesis that the reduction in benzodiazepines does not affect patients' willingness-to-pay for a treatment. We now assume there is a willingness-to-pay for the drugs itself, although this willingness-to-pay is smaller than the actual costs. The latter corresponds to a situation of overconsumption due to inadequate information about benzodiazepines. The situation of overconsumption is represented in figure 6. The true demand curve under perfect information is represented by the curve D^{11}. The price (or marginal cost) of the drugs is p. The optimal consumption is thus oq. Because the consumer does not have perfect information, he consumes oq', however. The resulting loss of consumer surplus is the area abc. It is equal to the difference between the true or theoretical willingness-to-pay and the price of the drug. Given that the information campaign reduces the consumption of benzodiazepines from q' to q, the triangle abc can be considered as the gain of the information

campaign. If the information campaign only reduces the consumption to m, the trapezium befc represents the gain.

Overconsumption could be much larger, of course. One could even think of an amount as large as oq'' (fig 6). In this case, the willingness-to-pay for the last dq'' units is negative, implying that the consumer wants a compensation if he is to consume this extra quantity. We grant the latter is only a theoretical concept; in reality, negative drug prices are never observed. Concerning severe overconsumption, the medical literature cites many undesired side-effects of the consumption of benzodiazepines, and mentions that the long-term effectiveness of the drug is not proven. Despite the latter knowledge, more than 80 percent of the prescriptions in our sample appear to be repetitions, prescribed for chronic complaints. It might well be that a number of patients do experience the negative effects of the drug, without any beneficial effect. They are in such a case worse off when they consume the drug, even when given freely. We think of two reasons why such a situation would occur: (i) neither the physician nor the patient are aware of this situation; they have no information concerning the patients well-being without the drug; (ii) the patient may be addicted to the drug; we posit then that he is no longer in a position to exert his true willingness-to-pay.

We now preceed with the calculation of the net benefit. It consists of:

$$NB = Cs \times PAT \times PHY \times WEEK - C$$

where Cs = the gain in comsumer surplus per patient
PAT = the number of patients per week per physician
PHY = the number of physicians
WEEK = the number of weeks during which the campaign has an effect
C = the costs of the campaign

To calculate the gain in consumer surplus per patient, we need to know the 'correct'[12] amount of benzodiazepines demanded at price

p (that is the value of q), the true willingness to pay for the amount q' actually consumed and the reduction in consumption due to the campaign. A basic assumption is that the amount of benzodiazepines consumed after the information campaign with the neutral representative, coincides with the so-called correct amount q[13]. The true willingness to pay for the amount q', consumed before the information campaign can be derived after defining the price elasticity of the demand curve[14].

The calculation of the gain in consumer surplus due to the campaign by the representative, is now straightforward. It is equal to (p - p') x (q - q') / 2, that is the area abc (fig 6). Since the mailing campaign is less effective, the gain in consumer surplus is on average smaller. When the mailing campaign reduces the consumption of benzodiazepines to m, we have to subtract the area aef from the area abc. The area aef can be calculated since we know the distance ae and the angle α [15].

All hypotheses used for the simulation analysis are presented in table 8. The resulting distributions of the net gain for the campaign with the representative and fot that with mailings are presented in figures 7 and 8, respectively. Summary statistics of the distributions are found in tables 9 and 10.

figure 6 Gain in consumer surplus

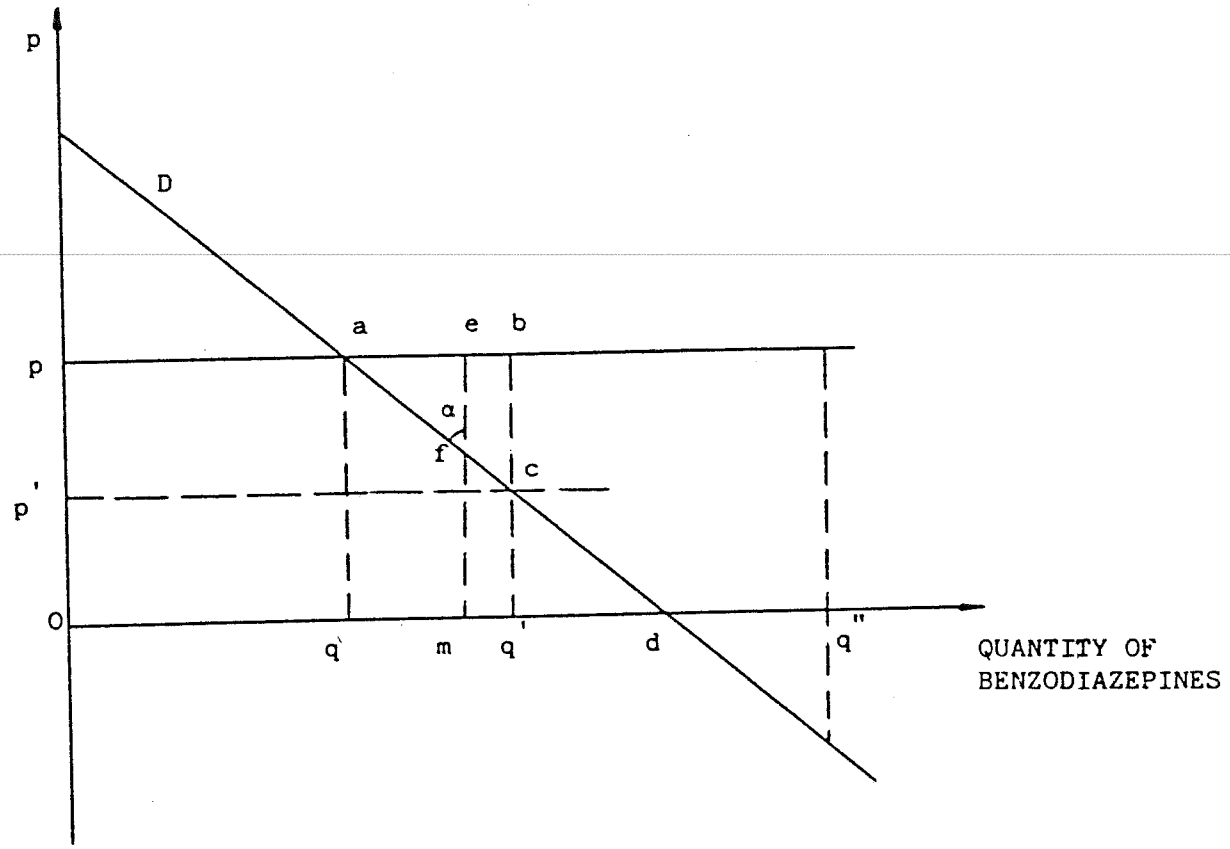


Table 8 Hypotheses used in the less favorable simulation

	campaign with representative	campaign with mailings
extra reduction in benzodiazepine prescribing per patient (in comparison with control	normal distr. mean=0.02812 s.e.=0.00919	normal distr. mean=0.01336 s.e.=0.00924
price elasticity of demand	normal distr. mean=-0.15 s.e.=0.1	normal distr. mean=-0.15 s.e.=0.1
price of benzodiazepines	267 BF	267 BF
benzodiazepine consumption per patient prior to the campaign	0.141	0.130
number of patients per physician	triangular distribution min=50; max=75 mostlikely=62.5	triangular distribution min=50; max=75 mostlikely=62.5
number of physicians	7000	7000
duration of the effect of the campaign in weeks (no decay)	triangular distribution min=14; max=56 mostlikely=28	triangular distribution min=4; max=28 mostlikely=8
costs of the campaign	uniform distr. 26 158 000 BF 36 416 000 BF	4 400 000 BF

Figure 7. **Distribution of net benefits of a campaign with a neutral representative (less favorable scenario)**

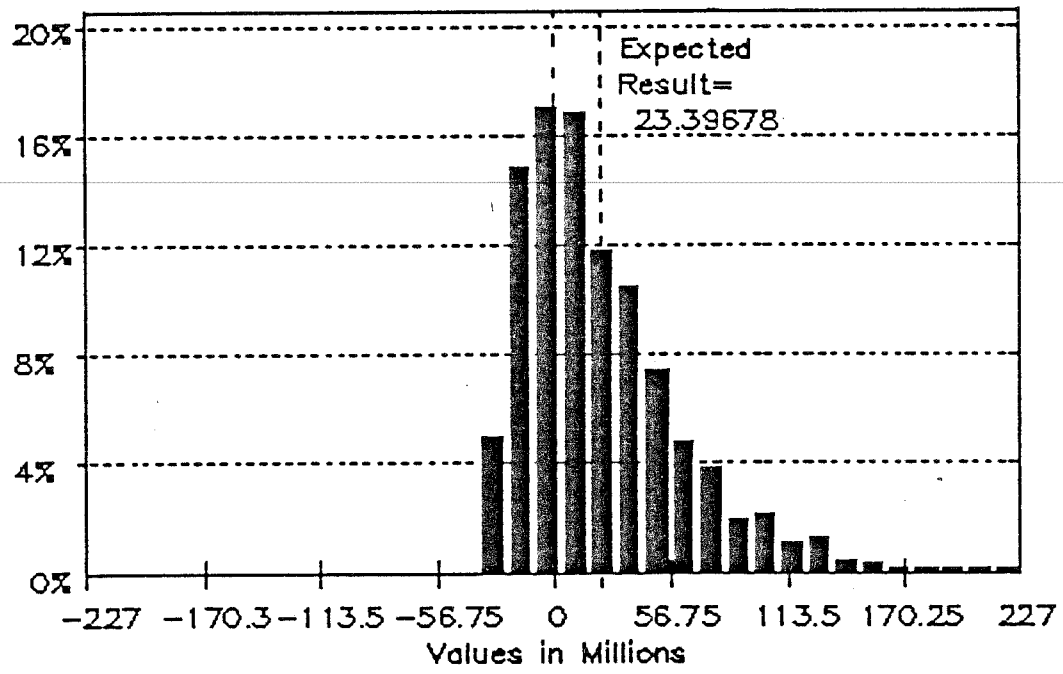


Table 9. **Statistical parameters of the distribution of net benefits of a campaign with a neutral representative (less favorable scenario)**

Statistical parameters		Chance of net benefit	
Mean net benefit	= 23 396 780	≤ -17 377 800	= 10%
Maximum net benefit	= 226 624 600	≤ -9 694 700	= 20%
Minimum net benefit	= -36 223 460	> 0	= 67.4%
Standard deviation	= 40 396 930	> 13 758 900	= 50%
Skewness	= 1.45	> 42 349 100	= 25%
Kurtosis	= 5.86	> 103 934 100	= 5%

Figure 8. **Distribution of net benefits of a mailing campaign (less favorable scenario)**

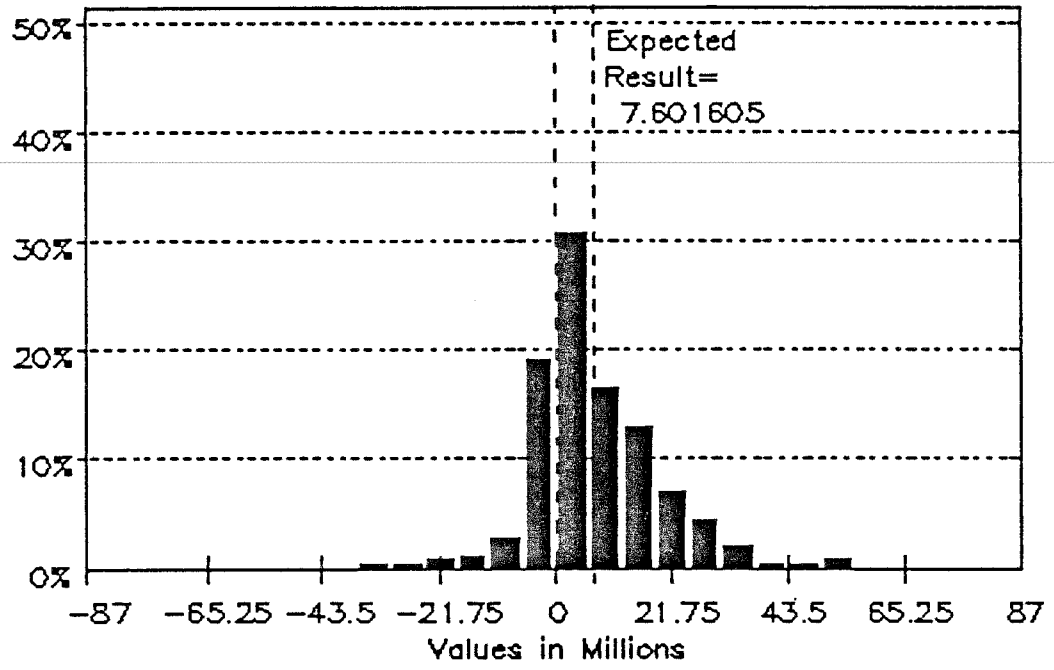


Table 10. **Statistical parameters of the distribution of net benefits of a mailing campaign (less favorable scenario)**

Statistical parameters			Chance of net benefit		
Mean net benefit	=	7 601 605	≤	-6 344 500	= 5%
Maximum net benefit	=	86 696 140	≤	-994 900	20%
Minimum net benefit	=	-37 217 950	>	0	= 75.5%
Standard deviation	=	12 326 080	>	5 068 300	= 50%
Skewness	=	1.16	>	13 336 900	= 25%
Kurtosis	=	7.11	>	29 700 600	= 5%

The hypotheses presently adopted, make the two campaigns less desirable. A campaign with an independent representative has a probability of 32.6 percent of a non-positive result and a mean net benefit of 24.4 million BF. The mailing campaign has a probability of 24.5 percent of a non-positive result and a mean net benefit of 7.6 million BF. The results are thus quite sensitive to the formulated hypotheses with respect ot the true willingness to pay. When we take, for example, a normally dsitributed price elasticity with a mean of -.2 and a standard deviation of .1, results change again (see table 11).

Table 11 **Summary results of a simulation analysis with a mean price elasticity of -.2.**

campaign with representative
mean net benefit: 11 753 510 BF
standard deviation: 30 673 120 BF
probability of positive result: 56.8%
campaign with mailings
mean net benefit: 6 778 974 BF
standard deviation: 12 102 810 BF
probability of positive result: 72.2%

4. CONCLUSIONS

The physician does not always take the best decisions from a clinical point of view. Inappropriate prescribing behavior does occur. Education seems an appropriate instrument to influence the decision-making process of the physician. The purpose of the present study was to analyze whether an information campaign with an independent representative and/or mailings is an effective instrument to alter prescribing behavior. This was tested in an experiment in which 146 general practitioners participated.

The most important conclusion of the study is that the oral information campaign did incite physicians to ameliorate their prescribing behavior. After GPs received three mailings and a neutral representative, informing them about the minor effectiveness of benzodiazepines, the side-effects and the risk of habituation, they significantly reduced the prescriptions of benzodiazepines. Physicians that only received three mailings also prescribed less benzodiazepines, but the reduction was not statistically significant.

From an economic point of view, an information campaign is beneficial when the costs of such a campaign are smaller than its benefits. We take the total reduction in the costs of benzodiazepines as a benefit. This implies that part of the benzodiazepines prescribed is of no value in the treatment of minor psychological disorders. Costs are set equal to the expenditures related to the organization of the information campaign itself.

The data show that the conversation with an independent representative yields benefits that are considerably larger than the costs. Under the most realistic hypotheses, benefits amount to 52 million BF. The costs of the campaign vary between 26 and 36 million BF. The benefits of the written information campaign are smaller and are not statistically significant. The latter strategy seems less appropriate.

The simulation analysis confirms our initially stated priority for the oral campaign. The probability of a negative net benefit is negligible in this case, whereas there is a 17 percent chance for a negative benefit as a result of the mailing campaign.

A major caveat needs to be signalled, however. The results prove to be sensitive to the hypotheses concerning the willingness to pay of the patients for benzodiazepines. When we reject the hypothesis that the patients' value attached to overprescribed benzodiazpines is zero, results become less favorable. The

simulation analysis shows that both campaign strategies now have a greater probability of a negative result (respectively 32.6 percent and 24.5 percent for the representative and the mailing group). This warrants further investigation. We therefore suggest that a further analysis should address the true (with perfect information) willingness to pay for the drugs. Only then can we be very formal about a decision to launch an oral information campaign. In view of the medical literature, suggesting that non-drug treatment is as good as drug treatment, we attach more value to the baseline scenario, however.

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NOTES

1. The study is a supplement to a research project of Mr. D. Berings and Dr. L. Blondeel. We thank Berings and Blondeel for the preparation of the information campaign, and the gathering of the data. Thanks are also due to mrs. W. Demeester for financial support and to Mr. G. De Bruyne, Mr. K. Torfs and Dr. P. Van Damme for inciteful comments on earlier drafts of the study.

2. In order to avoid Hawthorne-effects, we did not inform the physician about the real purpose of the study. Physicians did not know we were only interested in the prescribing of benzodiazepines.

3. Benzodiazepines are psychotropic drugs used in general practice as antianxiety drug, as antidepressant, as hypnotic and for sedation.

4. The sample is non-random. Physicians in our sample were on average younger. For sex and university of graduation, there were no statistically significant differences between the sample and the population.

5. This implies that treatment without benzodiazepines has the same value for the patient as treatment with benzodiazepines (unshifted demand curve) or even has a greater value (upward shift of the demand curve).

6. In fact we did not have the number of patients per time-period. We only have the number of patients who received a (at least one) prescription. We took this number as an approximation.

7. The Sheffé test is a multiple comparison test, for determining which population means are different from each other. The Sheffé method is conservative for pairwise comparison of means. It requires larger differences between means for significance than most of the other methods. See also Norusis [1984], p B134-B135.

8. The results of the regression analysis are presented in appendix A.

9. Based on data by Kesenne and Feltesse (1988), we computed an average of 3 467 consultations per physician in 1986. Of course not all consultations result in a prescription. On the other hand only 85% of the population is insured under the general scheme. We hypothesize that both effects compensate and take an average of 3500 consultations with a prescription per physician per year (250 per four weeks). In our sample we had an average number of patients of 320.

10. The sampling method used in this simulation analysis, is Monte Carlo sampling. This is an entirely random sampling technique - that is, any given sample may fall anywhere within the range of the input distribution. Samples, of course, are more likely to be drawn in areas of the distribution, which have higher probabilities of occurence. The computer programme @Risk, a risk analysis and simulation add-in for Lotus 1-2-3, was used.

11. We only consider the case where the demand curve is a straight line.

12. By correct we mean the amount for which the willingness to pay is exactly equal to the price.

13. In reality, it is more plausible that this consumption level is still one of 'overconsumption'. In that case we have underestimated the benefits of the campaign. The hypothesis constitutes a lower limit for the true benefits.

14. p' is derived from the formula

$$e = \frac{(q - q')/((q + q')/2)}{(p - p')/((p + p')/2)} = \frac{T}{N}$$

where e = the (arc) price elasticity of demand. For e, we hypothesize a normal distibution with a mean of -0.15 and a standard deviation of 0.1.

$$p' = p + \frac{2\,p}{(e/T) - 1}$$

In the simulation analysis, e and T are drawn independently; this could result in a situation where $e \approx T$. In such a case p' would become extra-ordinary large. To avoid this we restricted the range of p' to (-267 bf, 267 bf).

15. $\text{tg}\ \alpha = ab / bc = (q - q') / (p - p')$
and $\text{tg}\ \alpha = ae/ef = (m - q) / ef$
or $ef = (m - q)\ (p - p') / (q - q')$
and the area $aef = (m - q)\ [\ (m - q)(p - p')/(q' - q)\ ] / 2$

Appendix

table 1. Definition of the variables

definition of the physician characteristics
experience: number of years since graduation man: binary variable; takes the value of 1 when the physician is a man; takes the value 0 otherwise RUG: binary varible; takes the value of 1 when the physician graduated at the university of Ghent; takes the value 0 otherwise

table 2. Regression analysis: influence of physician characteristics on cost savings per patient with a prescription (experimental group 2 (mailings))

independent variables	coefficient	level of significance
constant	-2.75	.60
experience	.27	.20
RUG	-4.06	.31
man	7.09	.21
$\bar{R}^2$	.06	.15
number of observations = 43		

table 3. Regression analysis: influence of physician characteristics on cost savings per patient with a prescription (experimental group 1 (representative))

independent variables	coefficient	level of significance
constant	8.73	.07
experience	.12	.49
RUG	-3.43	.28
man	1.17	.79
$\bar{R}^2$	.00	.42
number of observations = 44		