THE CHOICE BETWEEN FAMILY AND INDIVIDUAL DEDUCTIBLES IN HEALTH INSURANCE

PREPARED UNDER A GRANT FROM THE DEPARTMENT
OF HEALTH, EDUCATION, AND WELFARE

EMMETT B. KEELER,
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JOHN E. ROLPH

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PREFACE

This report was supported by grants from the National Center for Health Services Research and Development and the Office of Economic Opportunity for studies of medical care financing and the demand for medical care. It is one of several that explore the effects of deductibles. These effects are treated theoretically in E. B. Keeler, C. E. Phelps, and J. P. Newhouse, *Deductibles and Demand for Medical Services: The Theory of a Consumer Facing a Varying Price Schedule under Uncertainty* (Rand Report R-1514-OEO/NC, December 1974), and empirically in J. P. Newhouse and others, *An Empirical Estimate of the Impact of Deductibles on the Demand for Medical Services* (Rand Report R-1661-OEO/NC, forthcoming).

The present report focuses on the question whether deductibles should apply on a per-family or a per-individual basis. The results are also relevant to the choice of accounting period, since the pooling of family members is formally equivalent to aggregating time periods--where, for example, "per year" is analogous to the family deductible and "per quarter" to the individual deductible.

SUMMARY

Most American medical insurance has the form of reimbursement for medical expenses--the insured person pays all of his medical expenses up to a certain amount (the deductible) and pays a proportion (the coinsurance) of the remaining expenses. This report studies how individual deductibles should be combined to make a family deductible with the same expected expense for the insurer, and how the choice of deductible type affects the variance of insurance payouts and alters the individuals' incentives to economize on medical care. The variance of policies is interesting because a major point of medical insurance is the reduction of risk. Altered incentives are a problem even to the policyholder, because he must pay a higher premium for them.

We present some theoretical results on the variance of plans for any family. We prove that if the coinsurance rate is zero, the variance of payments by the *insured* is higher with individual deductibles than with equivalent family deductibles. This is a plus for the family deductible because the purpose of insurance is to shift the risk from the insured to the insurance company, which, by its size and the law of averages, can better afford it.

Other theoretical results are less clear cut. The payouts by the *insurer* under a family plan will usually have higher variance than under individual plans, but this is not necessarily true. Similarly, even with a positive coinsurance rate, the *insured* out-of-pocket payments will usually have higher variance with individual plans than with family plans, but examples show that this is not necessarily true.

A real family, however, is more than just a statistical artifact. Its medical expenses are affected by an unhealthful environment, diet, and constitution; by its attitudes toward health and doctors; and by its insurance policy--all of which are shared to some degree by family members. Because the interrelation of family medical expenses is so complex, the best way to get at real tradeoffs is by empirical study of family and individual plans.

We conducted such a study using data from the CHAS-NORC 1970 Medical Expenditures Survey (described in [1]), which consists of a

national sample of approximately 3700 families. When upper limits for out-of-pocket payments consistent with various NHI proposals are imposed, the variance of payouts by families under individual deductible plans is higher than the variance under equivalent family deductible plans for all deductibles and coinsurance rates we tried. However, raising the upper limit to $10,000 or more per family per year substantially changes our estimates of variance, and exceptions do emerge. Our empirical conclusions for large upper limits on out-of-pocket payments are sensitive to the effect of outliers--very large expenditures--and we conclude that our sample of 3700 households is too small to let us draw definite conclusions. However, we would emphasize that virtually all proposed legislation places an upper limit on expenditures of less than $10,000 per family per year.

It might be noted that our discussion also applies to a choice between 3-month and 1-year deductible periods. In this case, the four members of a one-person "family" (called, for example, Joe) are Joe in the spring, Joe in summer, Joe in fall, and Joe in winter. The same theoretical results apply, as do arguments on family similarity and altered incentives, once the deductible is exceeded.

ACKNOWLEDGMENTS

We wish to thank Carl Morris and Joel Spencer for helpful discussions of the theoretical results in Section 2. James Hosek, Joseph Newhouse, and Mark Pauly read and commented on earlier drafts of the report. Its shortcomings would have been much more numerous if we had not taken most of their many suggestions.

CONTENTS

THE CHOICE BETWEEN FAMILY AND INDIVIDUAL DEDUCTIBLES IN HEALTH INSURANCE POLICIES

1. INTRODUCTION

In the last few decades, major medical policies have become much more significant in the market for health insurance. The so-called comprehensive major medical policy now requires the insured person to pay all of his medical expenses up to a fixed amount (the deductible) and a proportion (the coinsurance rate) of the remainder.* In this report, we study the distribution of medical expenses, and how these expenses are divided between insurer and insured under various medical plans. In particular, we compute the size of a family deductible that gives the same expected out-of-pocket expense as a set of individual deductibles. We call such a family deductible *equivalent*. Since a principal point of insurance is risk reduction, we are also interested in how the type of deductible (family or individual) affects the variance of family out-of-pocket payments. For many utility functions, if expected payments are the same, the policies with the lowest variance of payments are least risky and hence preferred.

In Section 2, we present our theoretical results: some inequalities on the variances of equivalent plans. These results depend on the assumption that expenditures of medical services are independent of their price, and in some cases that the coinsurance rate is zero, and thus they correspond to an idealized situation that, in fact, does not obtain. But they do give guidance as to what one might expect from more realistic assumptions that are impossible to analyze from a purely theoretical standpoint.

In Section 3, we describe some empirical work undertaken to examine whether the inequalities hold in practice. We use data from the

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*The deductible is useful because it greatly reduces administrative cost by eliminating reimbursements and processing for small claims. Were it not for the tax advantages of medical insurance (see [5] and [6]), it is likely that much larger deductibles would be popular. (See also [1], [2], and [3] for related work.)

CHAS-NORC 1970 Medical Expenditures Survey,* generate tables of equivalent family and individual deductibles, and compare family and individual variances under a number of plans. Finally, in Section 4, we conclude by discussing whether family deductible plans are preferable in realistic situations, particularly when the assumption that price doesn't affect purchases of medical care services is dropped.

2. THE VARIANCE OF FAMILY AND INDIVIDUAL DEDUCTIBLE POLICIES

Throughout this section we assume that medical expenditures do not depend on the price of care and, in particular, that they do not depend on the deductible. In this case, the same family deductibles are equivalent to a set of individual deductibles for both insurer and insured. Since a purpose of health insurance is to reduce risk, we will compare various insurance policies with an equal expected payout by the insured to see which has the lowest variance.† Our empirical results show that the insured's out-of-pocket payments under individual deductible plans usually have higher variance than under equivalent family deductible plans. This fact seems intuitively plausible, since the family plans permit greater risk-pooling by the insured. However, only when the coinsurance rate is zero is it necessarily the case that the family plan must have lower variance. We now prove this assertion.

2.1. Zero Coinsurance

Let Z_i be random (nonnegative) medical expenses of individual i ($i = 1, \ldots, n$) in a particular n person family, and let c_i be the deductible for his expenses in an individual deductible policy. Let $Z = \Sigma_{i=1}^{n} Z_i$ be the family's total medical expenses, and let c be a family deductible. The out-of-pocket payment for person i is

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*This survey is described in detail in [1].

†Of course, the policy with lowest variance for the consumer is the one in which he prepays a lump sum equal to his expected expenditures plus a loading fee and then gets all medical care free. Such a policy is typical for participants in a health maintenance organization.

$Y_i = \min(Z_i, c_i)$, while the family out-of-pocket payment under individual deductible policies is $Y' = \sum_{i=1}^{n} Y_i$. Under a family deductible policy, the family's out-of-pocket payment is $Y = \min(Z, c)$.

Theorem 1. *$Var(Y) \leq Var(Y')$. In other words, if the coinsurance rate is zero, the variance of the total family out-of-pocket payments under individual deductible policies is greater than or equal to the variance of family out-of-pocket payments under the equivalent family deductible.*

Proof. $Var(Y') - Var(Y) = E(Y'^2) - E(Y^2) = E(Y'^2 - Y^2) - E(Y' - Y)E(Y' + Y) \geq E(Y'^2 - Y^2) - 2cE(Y' - Y)$, since $E(Y) = E(Y') \leq c$ by the definition of equivalent plans. The following lemma implies that the last term is nonnegative and this completes the proof of the theorem.

Lemma. *$E(Y'^2 - Y^2) \geq 2cE(Y' - Y)$.*

Proof. $E(Y'^2 - Y^2) = E[(Y' + Y)(Y' - Y)]$. Now if $Y' \leq Y$, $Y' + Y \leq 2c$ because $Y \leq c$. Similarly if $Y' > Y$, $Y' < Z$ implies $Y < Z$, so that $Y = c$ and $Y' + Y > 2c$. Combining we have

$$E[(Y' + Y)(Y' - Y)] \geq \int_{Y' \leq Y} (Y' - Y)2c + \int_{Y' > Y} (Y' - Y)2c = 2cE(Y' - Y)$$

proving the lemma.

Remark. Since the lemma needs no assumptions about $E(Y)$, $E(Y')$, and c, with minor modification the proof of the theorem actually shows that $Var(Y) \leq Var(Y')$ for family plans whose deductibles are equivalent to or more generous than the individual deductibles plan (see last inequality).

A simple example shows how c might vary as a function of the c_i. Suppose that the family has two individuals with independent, identical medical expense distributions:

$$\begin{aligned} Z_i &= 0 \text{ with probability } p \\ &= 100 \text{ with probability } 1 - p. \end{aligned}$$

Then the joint distribution $Z = Z_1 + Z_2$ is

$$Z = 0 \text{ with probability } p^2$$
$$= 100 \text{ with probability } 2p(1 - p)$$
$$= 200 \text{ with probability } (1 - p)^2.$$

If both deductibles c_1 and c_2 are less than 100,

$$Y_i = 0 \text{ with probability } p$$
$$= c_i \text{ with probability } 1 - p,$$

so that $E(Y) = E(Y_1 + Y_2) = (1 - p)(c_1 + c_2)$. We must find a c so that

$$E(Y) = 2p(1 - p) \min (100, c) + (1 - p)^2 \min (200, c)$$
$$= (1 - p)(c_1 + c_2).$$

The solution is that

$$c = \frac{c_1 + c_2}{1 + p} \quad \text{if this is} < 100,$$

$$c = \frac{c_1 + c_2 - 200p}{1 - p} \quad \text{otherwise.}$$

Figure 1 gives the histogram of expenditures for the example. Since the positive expenditures by the family Y lies between the positive expenditures for individuals Y', the variance is clearly lower.

2.2. Positive Coinsurance

The coinsurance rate is the proportion of expenses over the deductible paid by the insured person. We now consider the case of a coinsurance ratio α, $0 \leq \alpha \leq 1$. We assume that the individual and the equivalent family plans have the same rate α. Since $E(Y) = E(Y')$ implies that $E(Z - Y) = E(Z - Y')$, and the family payouts for the two plans are $X' = Y' + \alpha(Z - Y')$ and $X = Y + \alpha(Z - Y)$, the equivalent family deductible is the same no matter what the coinsurance rate α.

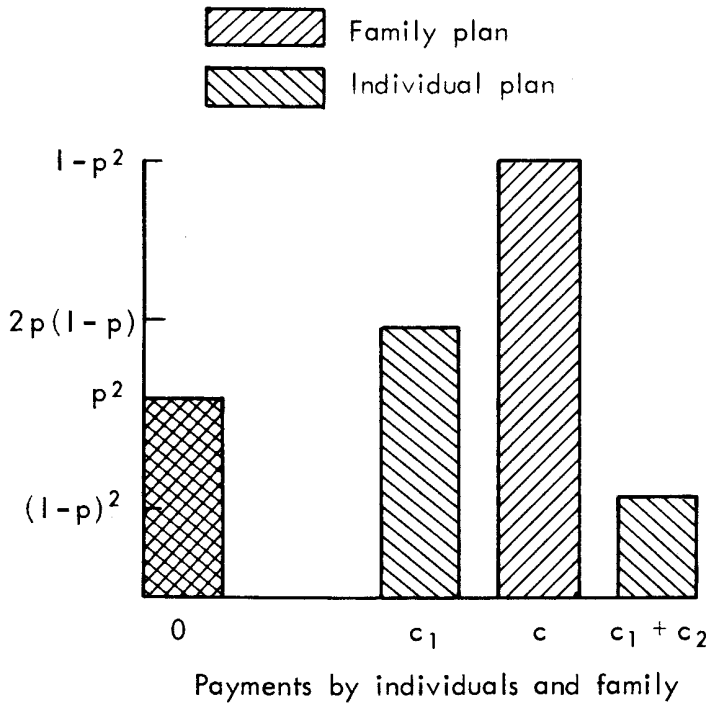
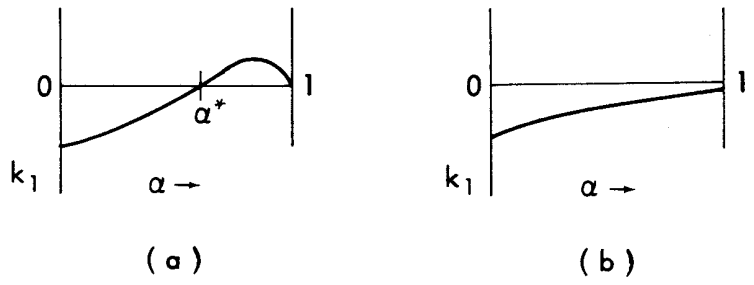


Fig. 1 — Histogram of payments for the case $c_1 = c_2$

We now prove a theorem relating the variances of the family's payouts under individual deductible and equivalent family deductible plans. The relation is illustrated below, where Var(X) - Var(X') is the quantity being graphed:



These graphs are summarized as

Theorem 2. *Let* $D(\alpha) = Var[Y + \alpha(Z - Y)] - Var[Y' + \alpha(Z - Y')]$. *Then there exists an* α^*, $0 < \alpha^* \leq 1$, *so that* $D(\alpha) < 0$ *for* $0 \leq \alpha < \alpha^*$ *and* $D(\alpha) \geq 0$ *for* $\alpha^* \leq \alpha \leq 1$. *In other words, for any joint distribution of expenses, the zero-one interval may be partitioned into two*

segments: a lower one, in which the variance of family out-of-pocket payments for the equivalent family deductible plan is less than or equal to its variance for the individual deductible plan; and an upper (possibly empty) one, in which the variance is strictly greater.

Proof.

$$\begin{aligned} D(\alpha) &= \mathrm{Var}[Y + \alpha(Z - Y)] - \mathrm{Var}[Y' + \alpha(Z - Y')] \\ &= E\{[\alpha Z + (1 - \alpha)Y]^2 - [\alpha Z + (1 - \alpha)Y']^2\} \\ &= E[(1 - \alpha)^2(Y^2 - Y'^2) + 2\alpha(1 - \alpha)Z(Y - Y')] \\ &= (1 - \alpha)\{(1 - \alpha)E(Y^2 - Y'^2) + 2\alpha E[Z(Y - Y')]\} \\ &= (1 - \alpha)[(1 - \alpha)k_1 + 2\alpha k_2], \end{aligned}$$

where $k_1 = E(Y^2 - Y'^2)$ and $k_2 = E[Z(Y - Y')]$. From the lemma, $k_1 \leq 0$. Now $D(0) = k_1$ and $D(1) = 0$. If $k_2 > 0$, then $D(\alpha)/(1 - \alpha)(1 - \alpha)k_1 + 2\alpha k_2$ is strictly increasing with α, so that $D(\alpha) \leq 0$ for $0 \leq \alpha \leq \alpha^*$ and $D(\alpha) > 0$ for $\alpha^* < \alpha < 1$, where $\alpha^* = -k_1/(2k_2 - k_1) < 1$. If $k_2 \leq 0$, $D(\alpha)/(1 - \alpha) < 0$ and hence $D(\alpha) < 0$ for $0 \leq \alpha < 1$. Q.E.D.

Theorem 3. *For any $\alpha > 0$, there is a distribution of independent individual expenses for which the variance of payments for the equivalent family deductible plan is strictly higher than the variance of payments for the individual deductible plan, i.e., $D(\alpha) < 0$.*

Proof. Consider a two-person family with independent identical distributions of expenses $p(0) = .1$, $p(1) = .8$, $p(x) = .1$. If the individual deductible is 1 and $x > 2$, the equivalent family deductible is about 1.97. A messy but straightforward computation shows that the variance of out-of-pocket payments under a family deductible is higher than under an individual deductible for $x \geq 3/\alpha$. Q.E.D.

Such examples also show that the variance of insurance company expenditures $(1 - \alpha)(Z - Y)$, might be greater with individual deductible policies, since $\mathrm{Var}(Z - Y) - \mathrm{Var}(Z - Y') = E(Y^2 - Y'^2) - 2E[Z(Z - Y')] = k_1 - 2k_2$. This is not of great interest, since it is the function of insurance companies to assume risks through pooling that individuals do not want to bear. Furthermore, because of averaging, the difference in risk to the insurance companies should be negligible.

Remark. The α^* in Theorem 2 has an interpretation, since

$$\alpha^* = \frac{-k_1}{2k_2 - k_1} = \frac{\text{Var } Y' - \text{Var } Y}{\text{Var}(Z - Y') - \text{Var}(Z - Y)} .$$

Thus, the individual deductible plan has lower variance only when the coinsurance rate α is greater than the ratio of the difference in variances of out-of-pocket payments below the deductible and the difference in variances of the insurance company payouts.

3. AN EMPIRICAL INVESTIGATION

While the theory of Section 2 provides an inequality on the risk of family versus individual deductibles, it leaves unanswered a number of important questions. First, how much lower is the variance of family deductibles? Second, Theorem 1 assumes zero coinsurance, but it is of interest to determine whether the inequality holds when various policies with positive coinsurance at typical levels are considered. Finally, since it is unreasonable to assume that the demand for medical services is perfectly inelastic, the question naturally arises whether the inequality still holds when insurance is assumed to create additional demand. The purpose of this section is to provide at least partial answers to some of these questions.

The following is a brief description of our approach. We obtained a body of data--the CHAS-NORC 1970 Medical Expenditures Survey--which gives information on the expenses of approximately 3700 families. The data include each person's demographic characteristics and an indicator of whether or not the person was insured. It is a national sample, but the data available were not specific about the type of insurance policies held.

We investigate the relationship in these data between the variance of medical expenditures for equivalent individual and family deductible plans and for a variety of coinsurance rates. We cannot unequivocally answer the question of whether the variance inequalities described in Section 2 still hold when insurance is assumed to create additional

demand. But we do attempt to adjust for what ought to obtain by adjusting medical expenditures in the data to the situation in which everyone is insured, as well as to the situation in which everyone is uninsured; the adjustment method is described in Section 3.1. The adjustment procedure is designed to control both for the "selection effect" of people who tend to have higher medical expenditures (all other things being equal) and are thus more likely to purchase insurance, and, to some degree, for the additional demand created by the insurance policy itself. We do *not* attempt (nor would our data allow us to do so) to explicitly model the effect of insurance on expenditures.

We are therefore limited to comparing variances separately for three different "populations" of medical expenditures where the varying insurance plans (deductibles and coinsurance rates) do not change the actual medical expenses. Nonetheless, if it turns out that the variance of medical expenditures for family deductibles is lower than (or higher than) the variance of medical expenditures for individual deductibles for each of these two adjusted populations, as well as for the unadjusted population, then we will be reasonably sure that the inequality will hold when insurance is assumed to create additional demand. For each of two coinsurance rates--0 percent and 25 percent--and for each of three sets of data--two adjusted and one unadjusted--"equivalent" individual and family deductibles from 0 to $500 per person per year were obtained and their variances compared. The results are described in Section 3.2.

Approximately 3700 households or 11,287 individuals were included in the CHAS-NORC 1970 Medical Expenditures Survey sample. In each household the demographic characteristics of every individual (e.g., race, sex, age, educational level, income) were recorded, along with a qualitative measure of health status, an indicator of whether or not the person was insured, and the medical expenses incurred. A listing of each relevant variable, together with the label used in data processing and its weighted mean and standard deviation, is given in Table 1.

As mentioned earlier, because our data were not specific about the type of insurance held, we could not reliably estimate the amount

Table 1

VARIABLES ENTERING INTO THE ANALYSES OF MEDICAL EXPENDITURES

Variable	Label	Weighted Mean	Weighted Standard Deviation
Family income	INC	10,964	11,534
Nonwhite (head)	NONW	0.118	0.323
Age	AGE	31.26	22.15
Female	FEM	0.508	0.500
Health status poor	HSP	0.038[a]	0.192
Health status fair	HSF	0.121[a]	0.327
Health status good	HSG	0.432[a]	0.495
Employed	EMP	0.365	0.481
Insured	INS	0.740	0.439
Expenditures	EXP	245	86
Family size	SIZE	4.20	2.18

[a]The means do not sum to 1.000 because "health status excellent" is the default value having a weighted mean of 0.409.

of additional demand created by various types of insurance plans. But we felt that three different, estimated, national medical-expenditure populations could be used to obtain insight. The first is simply the national population estimated directly from the data itself. The second is derived by adjusting (according to the method described in Section 3.1) the expenses of uninsured families to what they might have been had the families been insured. The third is derived by using the same method to adjust the insureds' expenses to what they might have been had the families not been insured. When looking at the expenses of insured (or uninsured) families, a natural question is: Why do these different populations need be considered at all? The main reason is bias. The insureds tend to have much higher incomes, consist predominantly of whites, and are much more often employed (see Table 2). Since it is reasonable to assume that these quantities influence medical expenses (a fact borne out in Section 3.2), a simple inference based on the insured subpopulation would not readily extend to the

Table 2

DIFFERENCES IN CHARACTERISTICS BETWEEN INSURED AND UNINSURED GROUPS

Label	Weighted Insured Mean	Weighted Uninsured Mean
INC	12,509	6,571
NONW	0.069	0.257
AGE	30.900	32.400
FEM	0.506	0.517
HSP	0.021	0.087
HSF	0.107	0.162
HSG	0.443	0.402
EMP	0.408	0.243
EXP	241.000	259.000
SIZE	4.150	4.330

national population. A second reason is sample size. Clearly it is reasonable to assume that the expenses of the uninsureds bear some relation to what their expenses would be if they were insured; to have thrown out the uninsureds would have left only 651, 361, 331, 221, and 110 two-through-six-person families, respectively, which we judge would not have been sufficient to estimate the difference between family and individual deductible. For similar reasons, we have adjusted the expenses of insured families to what they would have been had the families been uninsured, in order to derive an estimated national uninsured population. It seems reasonable to suppose that the range of variances between family deductibles and individual deductibles for the more generous plans will be covered by the differences occurring among our two estimated populations and the actual population. This adjustment model is given in Section 3.1 below.

3.1. Adjustment Model

In this section we develop a model that addresses the question: How different would expenses have been for uninsured (or insured) families if they had been insured (or uninsured)?

Our adjustment model assumes that an individual's propensity toward medical expenditures can be split into predictable and unpredictable

components. The predictable component depends on such measurable characteristics as age, sex, insurance status, income, race, etc. The unpredictable component depends on such unobservables as the number of illnesses the patient has had, whether he is a heavy user of medical services, the fraction of his income available for medical services, whether he gets hit by a car, etc. Clearly, both are relevant to the prediction of what adjustments must be made to an individual's expenses if his insurance status changes. Ideally, we would like a method that uses both the predictable and unpredictable components.

There are a number of ways to adjust for insurance status. We chose a way that makes the expenses of the uninsureds (insureds) look "exactly" like those of the insureds (uninsureds), in the sense that if the insureds (uninsureds) regression model were fitted to the uninsured (insured) group, the regression coefficients and the mean squared error would be identical. To do this, we proceeded in several steps. First, we developed regression models to measure the predictable components of expense, separately for both the insured and uninsured persons. For each person, the unpredictable component was estimated as his residual expense. Then, to adjust an uninsured person's expense, we modified the predictable component by substituting the person's demographic characteristics into the equation for insured persons, rescaled the unpredictable component by the ratio of insured to uninsured standard deviations, and added the two. A similar procedure was followed to adjust an insured person's expenses to those of an uninsured person.

One difficulty in using a regression model is that expenses are not normally distributed. We tried to overcome this by transforming expenses, and among the class log (expenses + c), we picked c = 1 as the parameter that made the dependent variable most nearly normal. In particular, taking logarithms prevents a few large expenditures from having too much effect on the fitted model. A bulge at zero remains, but that is true for any dependent variable transformation. An alternative is to model explicitly both the probability of zero expenditures and the amount of nonzero expenditures conditional on nonzero expenditures as functions of the independent variables. We rejected this

approach on the grounds that our conceptual understanding of the relationship between the insurance effect and the independent variables is slight and our data are not detailed enough to warrant constructing such a complicated model.

As independent variables, we included both actual income and family size to measure effective income. As a compromise between assuming that effective income is independent of family size or is equal to per capita income, we included log income and log family size as independent variables. This is equivalent to assuming effective income = income$^{\alpha}$/family size$^{\beta}$, with α and β to be determined from the data. We also included five age-class dummy variables, an employment dummy variable, and a dummy variable for poor health status. In model development, it appeared that sex and race were interacting with insurance and medical expenses, so we split the sample into eight possible race-sex-insurance classes. The regression results are given in Table 3.

Higher expenses are associated with poor health, with higher effective income (more income and smaller families), with unemployment, and with age. Employment makes a bigger difference for men than for women. Younger people generally have lower expenses, except women of child-bearing age.

One fact that stands out clearly is the low R^2 (squared multiple correlation coefficient) achieved in each of these equations. This suggests that medical expenses are highly unpredictable even after including a dummy variable for poor health. It is likely that individuals simply cannot predict their future expenses very well. In fact, if individuals knew their future expenses, they wouldn't need to insure against risk "over time," and adverse selection would cripple any "insurance" plan.

The way that the adjustment model works is best illustrated by a simple example. Consider the problem of adjusting the expenses of an uninsured nonwhite female. The predictable component of log (expenditures + 1) is

$$\sum_{j=1}^{k} b_j(u)x_j,$$

Table 3

REGRESSIONS OF INDIVIDUAL EXPENDITURES

Category	Sample Size	R^2	Regression Coefficients										
			Constant Term	Log Income	Age Dummies					Poor Health	Employed	Log Family Size	Standard Deviation
					0-2	3-17	18-40	41-60	60+				
Uninsured:													
White males	1128	.15	1.96	.26	.34	-.72	-.07	.33	0	1.16	-.72	-.43	1.99
			(3.4)[a]	(3.7)	(1.2)	(3.3)	(.4)	(1.5)		(7.7)	(4.4)	(3.5)	
White females	1230	.16	2.90	.17	.09	-.09	.59	.37	0	1.16	-.15	-.80	1.87
			(5.5)	(2.5)	(.3)	(.5)	(3.2)	(2.0)		(9.0)	(.9)	(6.9)	
Nonwhite males	983	.21	2.73	.17	-.62	-1.2	-.62	-.15	0	1.75	-.64	-.46	1.96
			(3.4)	(1.6)	(1.9)	(4.5)	(2.2)	(.5)		(9.4)	(2.9)	(3.5)	
Nonwhite females	1233	.21	3.66	.02	-.17	-.65	.46	.21	0	1.35	-.42	-.49	1.90
			(5.2)	(.2)	(.6)	(2.9)	(2.1)	(.9)		(10)	(2.4)	(4.3)	
Insured:													
White males	2509	.10	2.08	.30	-.06	-.56	-.14	-.07	0	1.12	-.35	-.48	1.72
			(4.6)	(5.7)	(.3)	(3.8)	(1.0)	(.5)		(10)	(2.9)	(5.7)	
White females	2675	.16	2.70	.25	-.36	-.50	.37	.18	0	1.08	-.26	-.64	1.66
			(6.6)	(5.0)	(1.8)	(3.7)	(3.0)	(1.5)		(12)	(3.1)	(.8)	
Nonwhite males	660	.15	3.64	.18	-.52	-1.56	-1.09	-.85	0	1.08	-.28	-.61	1.82
			(3.0)	(1.3)	(1.1)	(3.9)	(3.0)	(2.3)		(5)	(1.1)	(4.4)	
Nonwhite females	735	.17	1.12	.40	-.25	-.78	.46	-.05	0	.92	-.17	-.64	1.85
			(1.1)	(3.2)	(.6)	(2.2)	(1.4)	(.2)		(5)	(.9)	(4.5)	

[a]The t-statistics are shown in parentheses.

where $x_1, x_2, \ldots, x_k$ are the characteristics (log income, age, health status, employment, log family size) of the particular uninsured nonwhite female being adjusted and $b_1(i), b_2(i), \ldots, b_k(i)$ are the coefficients for insured nonwhite females. The residual of Y = log (expenditures + 1) is

$$r(u) = Y - \sum_{j=1}^{k} b_j(u)x_j,$$

where $b_1(u), \ldots, b_k(u)$ are the coefficients from the nonwhite uninsured female regression. Then Y_A, the adjusted value of Y, is

$$Y_A = \sum_{j=1}^{k} b_j(i)x_j + \frac{\hat{\sigma}(i)}{\hat{\sigma}(u)} r(u),$$

where $\hat{\sigma}(i) = 1.85$ and $\hat{\sigma}(u) = 1.90$ are the estimated error standard deviations given in the last column of Table 3 for insured and uninsured nonwhite females, respectively. A similar procedure is used for other categories and for adjusting insured to uninsured.

Table 4 indicates how the adjustment procedure affected the expenditures of insured and uninsured people. Thus, in the above example, an uninsured nonwhite female's expenses are, on the average, adjusted upwards from $164 to $190. As the table shows, the adjustment procedure makes a substantial difference in the expense distributions. An examination of the individual expenses revealed a few very large annual totals. For example, one family of four had annual expenses of $28,887--with $25,605 of this sum spent on one dependent. To gauge the effect of these inordinately large expenditures, we redid the calculations after eliminating all families with annual expenditures of at least $10,000--a total of 10 families. There was an enormous effect on the resulting means and standard deviation; some standard deviations decreased by 65 percent. But the regression coefficients in the adjustment model are essentially unaffected by these large expenditures because the dependent variable is the logarithm of the expenditures. Thus, our adjustment model is robust against very large values.

Table 4

EFFECTS OF ADJUSTMENT ON MEANS AND STANDARD DEVIATION OF INDIVIDUAL EXPENSES

Category	Actual Data		Adjusted Data[a]	
	Mean	Standard Deviation	Mean	Standard Deviation
Uninsured:				
Nonwhite females	164	394	190	417
Nonwhite males	175	596	225	697
White females	272	699	323	788
White males	327	1,546	357	1,550
Insured:				
Nonwhite females	223	905	147	357
Nonwhite males	182	642	153	1,147
White females	272	1,154	223	600
White males	226	493	193	899

[a]Adjustment for uninsured status is to insured (upward); adjustment for insured status is to uninsured (downward).

3.2 Comparing Individual and Family Deductibles

We turn now to the main purpose of Section 3--an empirical comparison of expenses under equivalent individual and family deductible plans. We consider our CHAS-NORC 1970 sample as reflecting the entire 1970 national population once the sampling weights are used to "blow it up." This is done as follows: Let $Y_{i1}, \ldots, Y_{in_i}$ be the expenditures of the n_i members of the i-th family, where $i = 1, \ldots, k$. If $w_1, \ldots, w_k$ ($\Sigma_{i=1}^{k} w_i = 1$) are the normalized weights associated with each family, then $\Sigma_{i=1}^{k} w_i \Sigma_{j=1}^{n_i} Y_{ij}$ is an estimate of the average national medical expenditure. Thus, our estimated national population is assumed to have proportion w_i of families with expenditures $Y_{i1}, \ldots, Y_{i,n_i}$. Although using this estimated national population in our variance calculations assumes many more homogeneous "lumps" of families than actually exist, this lumping should not appreciably affect the difference in medical expenditure variances between family and individual

deductible plans. Our procedure in comparing variances has the advantage of not assuming any distribution form for medical expenditures.

As indicated earlier, the distributional characteristics (means and standard deviations) of our data are sensitive to the upper tail of the distribution--the larger expenditures. It is in this region that typical insurance policies reach expenditure limits. On the other hand, public programs, free care, bankruptcy, or refusal to pay bills become possible remedies. Given this varied pattern of financing, it is hard to know how to "standardize" or truncate expenditure distributions.

Most National Health Insurance (NHI) bills do not envision copayments up to very high expenditure levels. Among NHI bills that do retain patient payment, the two that roughly span the gambit of proposals are the Kennedy-Mills bill, which limits per-family expenses to $1000 per year, and the Long-Ribicoff-Wagner bill, which limits per-person expenditures to $1000 per year [7]. In the computations that follow, we have taken an upper limit that is a compromise between these two proposals and have truncated the excess of all expenditures above this upper limit. For an n person family, this upper limit on yearly family medical expenditures is 1000 + 500 (n - 1) dollars. Our decision to base the upper limit on possible NHI legislation reflects our hope that our work might shed some light on the choice between individual and family deductible plans for NHI. Other standardizing rules were also used; the results are discussed at the end of this section.

We present our results on comparing the variance of medical expenditures for family and individual deductible plans conditional on the size of the family, i.e., two-, three-, four-, five-, or six-member families. For each family size, we calculate the distribution of out-of-pocket medical expenditures for the individual deductible (0 to $500 in increments of $50) and for the equivalent family deductible. For each of these distributions (standardized as above), we calculate both the mean and standard deviation.

Figures 2 through 6 present the comparison of standard deviations for each of these insurance plans for two different coinsurance rates: 0 percent and 25 percent. The three graphs in each figure refer to the

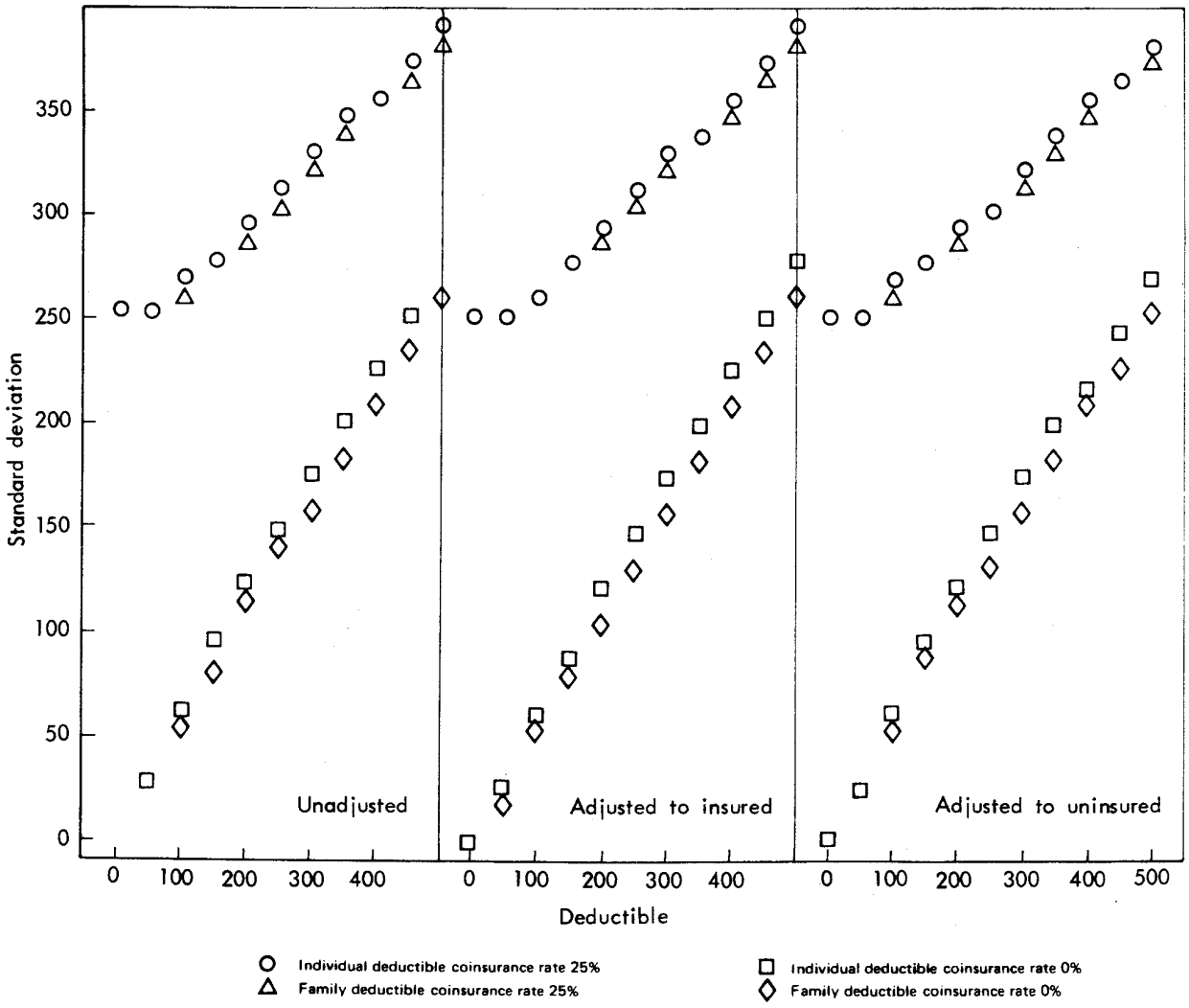


Fig. 2—Standard deviations of two-person family medical expenditures under equivalent individual and family deductible insurance plans

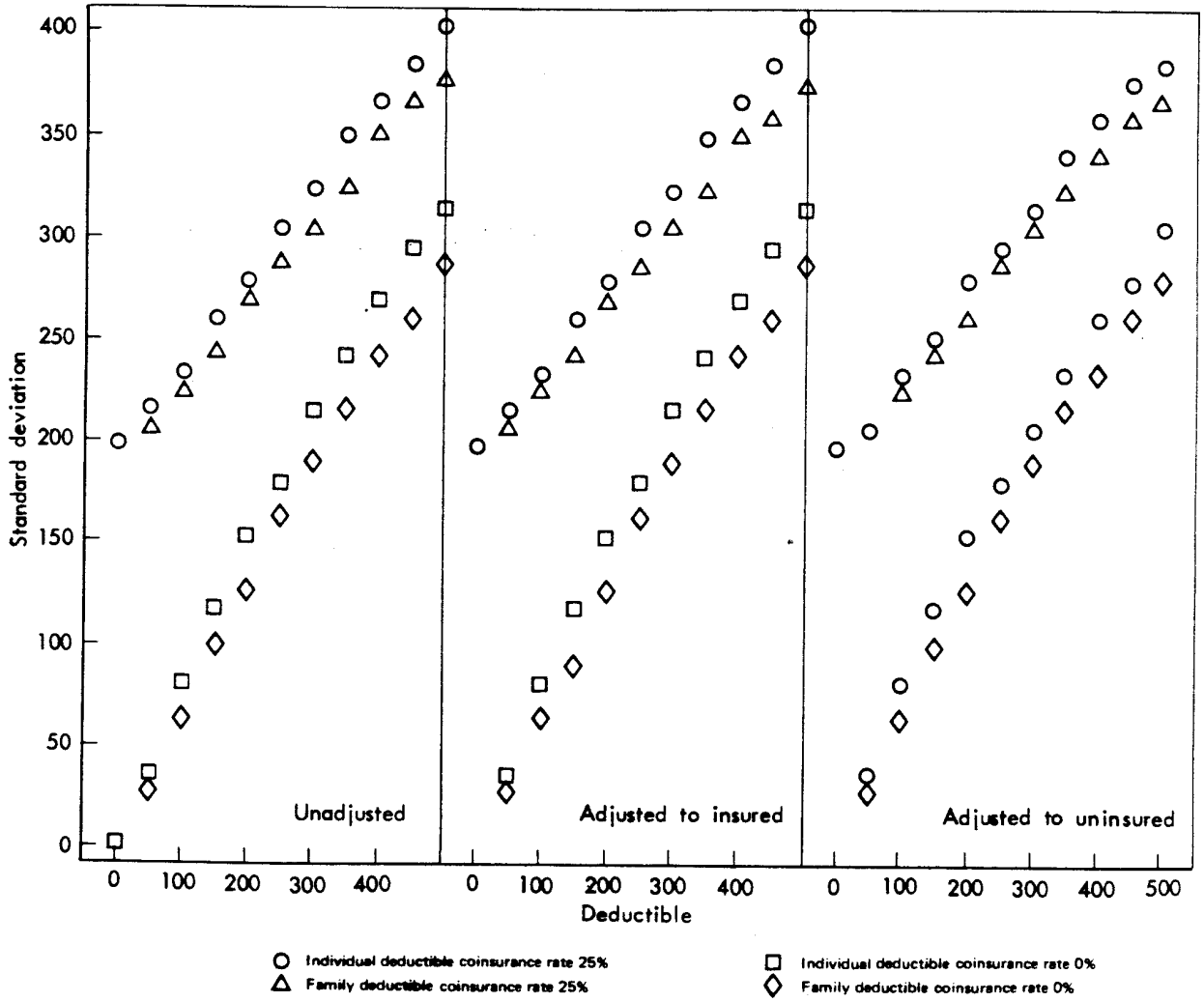


Fig. 3—Standard deviations of three-person family medical expenditures under equivalent individual and family deductible insurance plans

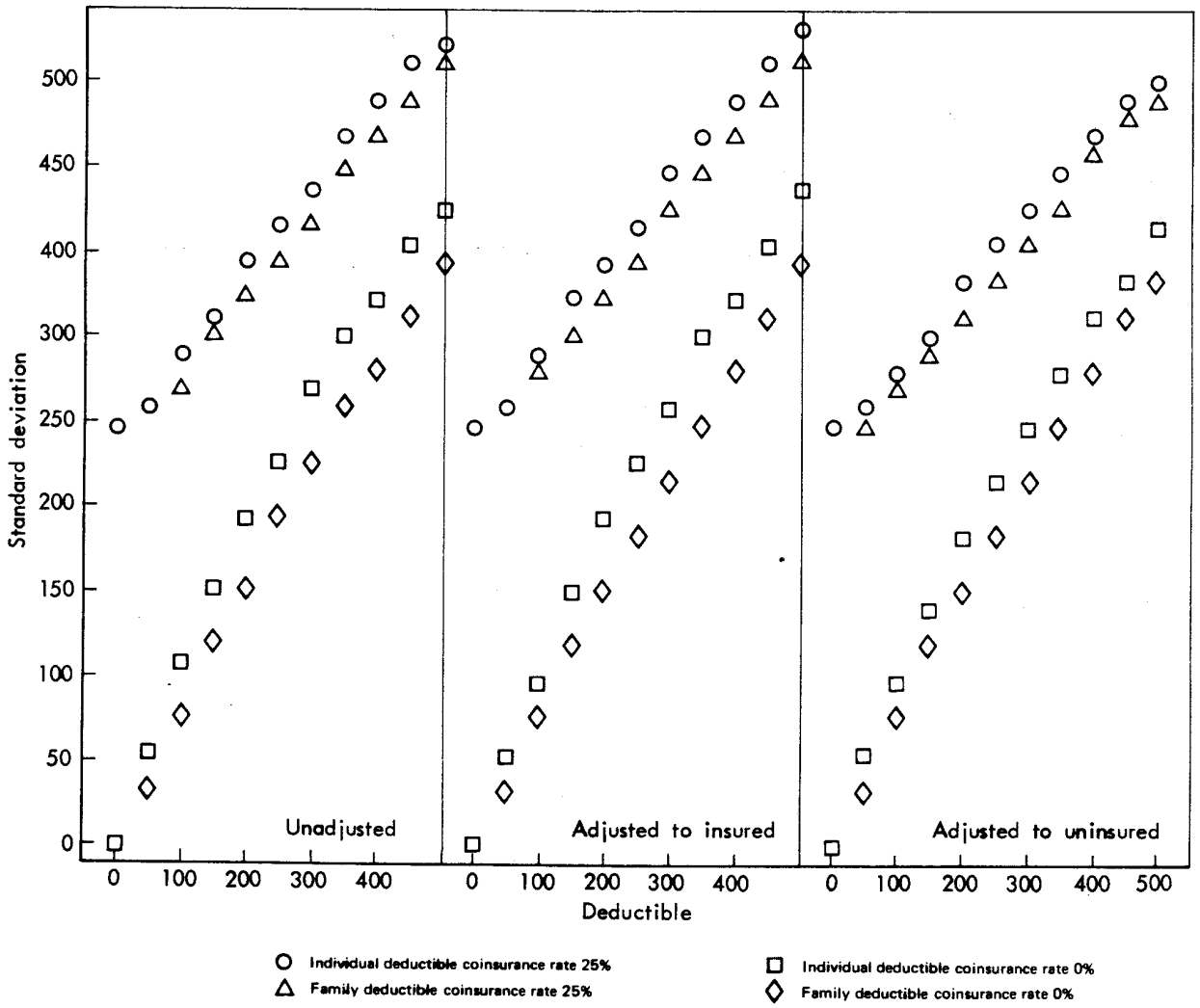


Fig. 4—Standard deviations of four-person family medical expenditures under equivalent individual and family deductible insurance plans

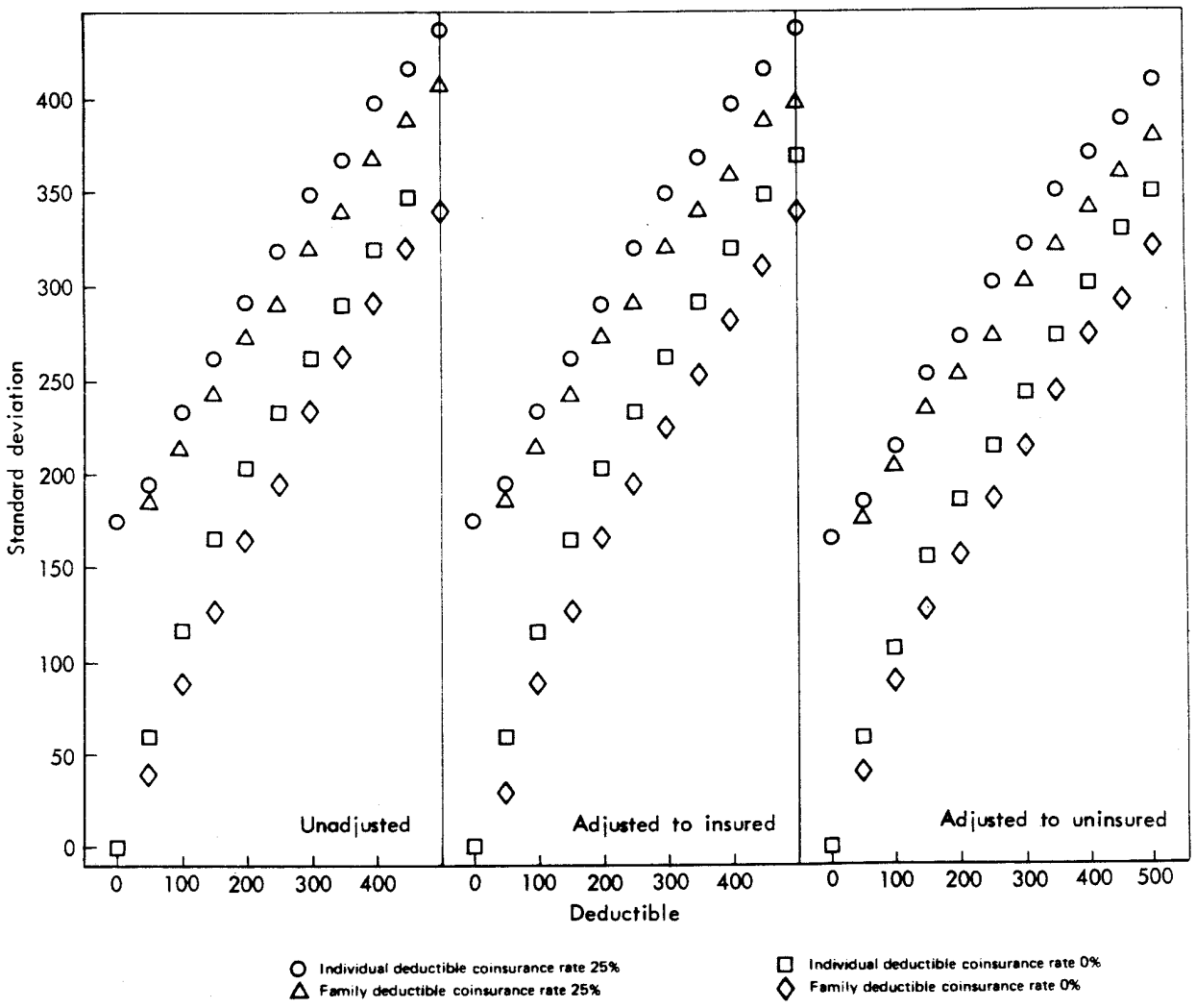


Fig. 5 — Standard deviations of five-person family medical expenditures under equivalent individual and family deductible insurance plans

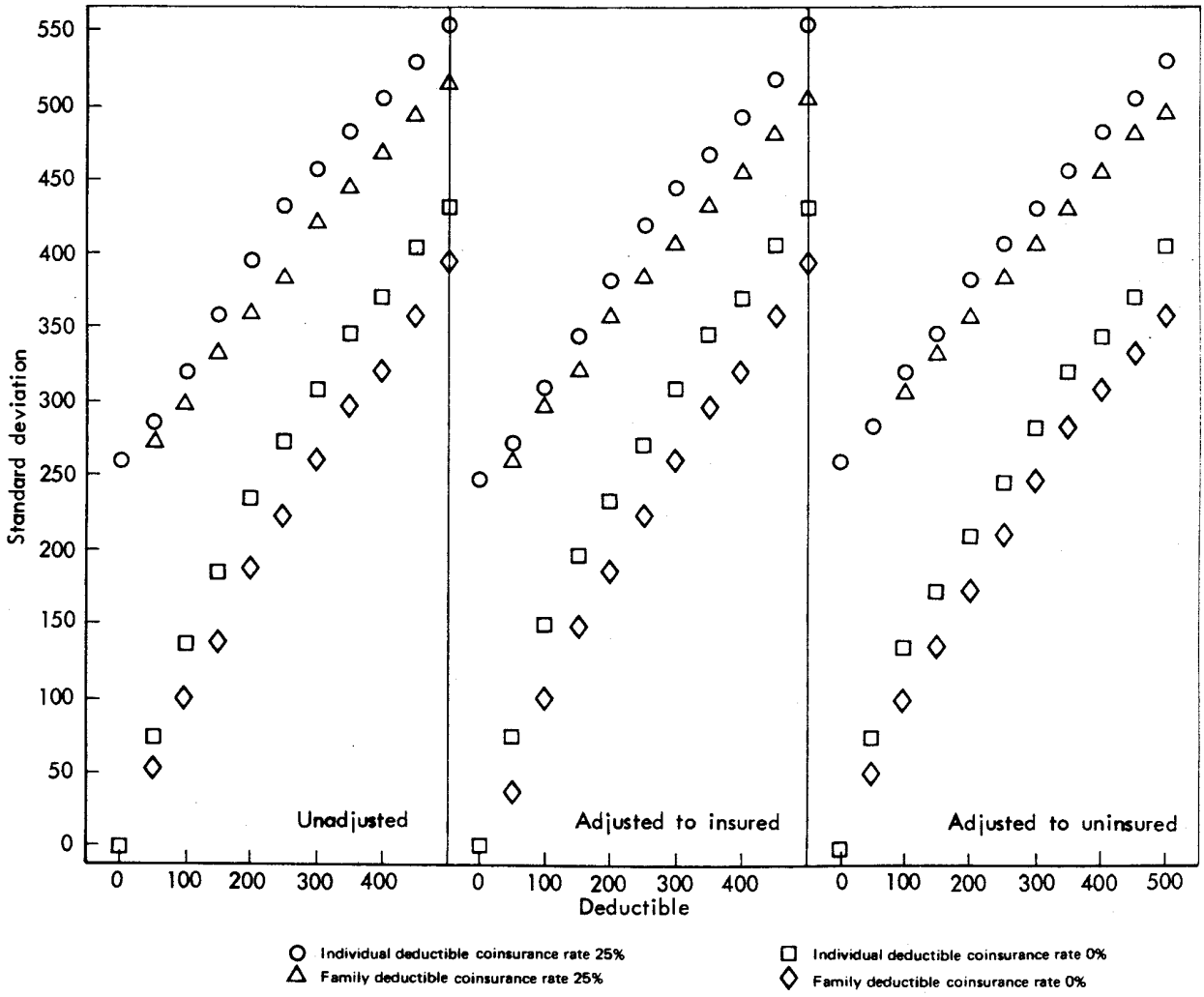


Fig. 6 — Standard deviations of six-person family medical expenditures under equivalent individual and family deductible plans

unadjusted, adjusted to insured, and adjusted to uninsured populations. The adjustment method is that described in Section 3.1. The Appendix gives the tables of values on which Figs. 2 through 6 are based.

The six figures all show that the standard deviation of a family's expenses, for all three populations, is less under the family deductible plan than under the individual deductible plan, even with a 25 percent coinsurance rate. Tables 5 through 14 show that under the family deductible plan, the standard deviation can be as much as 30 percent lower than under an individual deductible plan, but more typically it is between 2 and 10 percent lower. The differences are greatest for zero coinsurance and for larger family sizes.

A number of different expenditure distributions were run, corresponding to different upper expenditure limits. These runs included no upper limit, a $10,000 per family upper limit, an n × $1000 per n-person family upper limit, and a $1000 per family upper limit. Only in two cases--the 25 percent coinsurance and no upper limit and the $10,000 per family upper limit--does the equivalent family deductible plan yield a larger standard derivation (and hence a higher variance) than the individual deductible plan. With a $10,000 per family upper limit, the *only case* in which the standard deviation of the family deductible plan exceeds that of the individual deductible plan is for families of four in the uninsured population with an individual deductible of $450. For this case, the equivalent family deductible is $840 and the standard deviations of the individual and family deductible plans are $460 and $463, respectively. With no upper limit and 25 percent coinsurance, there are several individual deductibles for four- and six-person families when the standard deviation of the equivalent family deductible plan is larger than that of the individual deductible plan for all three populations.

We conclude that our estimates of the relative size of the standard deviations of the two plans are quite sensitive to the extreme upper tail of the expense distributions--the probability of occasional very large expenditures. For this reason, our sample of 3500 households is too small to let us draw definite conclusions about how the standard deviations of expenses under different insurance plans with

no upper limit compare for a national population. As argued earlier, the no upper limit plan is unrealistic for many situations.

4. CONCLUSIONS

We have shown that under certain assumptions, a family deductible plan, or alternatively a longer-time-period deductible plan, is less risky for the insured than individual or shorter deductible plans. Specifically, if demand for medical services does not depend on price, and the coinsurance rate is zero, individual deductible plans have higher variance than equivalent family plans. (Intuitively, the latter plans permit greater risk-pooling by the insured.) We have observed that this result remains true with 25 percent coinsurance at all levels of deductibles up to $500 per person for family expenditures when an upper limit typical of a NHI plan is imposed in the CHAS-NORC 1970 Medical Expenditures Survey. However, some exceptions appear when no upper limit is imposed.

Tables 5 through 14 in the Appendix show that under an individual deductible plan, the probability of a claim is greater than under the equivalent family deductible plan. This *may* lead to family deductible plans having lower administrative costs to the insurance company, thus further increasing their attractiveness. Insurance companies might be willing to offer a family plan with a deductible even lower than the "equivalent value" in order to save on administrative costs. Such a plan would tend to give families an even lower standard deviation of expenditures, in addition to decreasing the family's expected payout.

The assumptions and criteria for choice may not be realistic, and when they are dropped, people may not necessarily prefer the family plans. For example, except for certain classes of utility functions, means and standard deviations of probability distributions are not sufficient to determine preferences. For most people, the exact shape of probability distributions must be known before a choice can be made. Since the standard deviation is not that much bigger with individual deductibles, reasonable examples of utility functions can be constructed in which the individual deductible plans might be preferred.

More important is the influence that insurance coverage has on medical expenditures. We believe that the demand for medical services does depend on price. Not only is there less reason to economize once the deductible is exceeded, but, as the deductible is approached there is an incentive to seek care for marginal problems, since today's expenditures have a bonus effect of reducing the deductible remaining for the next illness. (This phenomenon is discussed at length in [4].) Evidence presented in [8] bears out these predicted effects. While the probability that anyone will file a claim is only slightly larger for individual deductibles under equivalent plans (because ordinarily only one person in a family has large expenditures in a year), the probability of any particular individual's filing is lower than that of the family's filing under a family plan. In other words, under a family plan, after one member of a family has had large medical expenses, all the family gets care cheaply; but under a set of individual plans, only the large-expenditure member gets medical care cheaply.* The anticipation of future illnesses exacerbates the problems of family deductibles, since a family with a small deductible can be fairly confident that it will exceed its deductible in the future, but only rarely will an individual know that he is due for heavy future medical expenses.

Thus, the family deductible plans have both advantages and disadvantages that must be balanced against one another. The solution may lie in family deductibles that are larger than equivalent. Apparently, because of the tax advantages of medical insurance, large deductibles have not been very common. If the tax laws change, such policies may become desirable because of their smaller premiums (see [5]). Indeed, they may permit a lower coinsurance rate. With a deductible large enough to induce people to economize on care, such policies would be less expensive.

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*For longer as opposed to shorter plans, only the later periods can get cheaper care as a result of earlier expenditures. This is one place where the analogy with families and individuals is imperfect.

APPENDIX

Here we present the tables of values on which Figs. 2 through 6 are based. Tables 5 through 14 show company and family expenditure data for two- through six-person families for both 0 percent and 25 percent coinsurance rates. Each table covers three population groups: unadjusted, adjusted to insured, adjusted to uninsured. The first two columns give the individual deductible in increments of $50 and the equivalent family deductible. The next two columns give the average cost to the family (insured) and to the insurance company (insurer) for either of the two equivalent plans. The next two columns, headed "Family Standard Deviation," give the standard deviations of the insured's payout under the individual deductible and family deductible plans, respectively. These are the numbers graphed in Figs. 2 through 6. The two columns headed "Company Standard Deviation" give the standard deviations of the insurer's payout for the individual and family deductible plans, respectively. The final two columns give the probability of a claim under each of the two plans. It turns out that the probability of filing a claim is larger for the individual deductible plan than for the family deductible plan for all cases.

Table 5

COMPANY AND FAMILY EXPENDITURES FOR 0 PERCENT COINSURANCE PLANS
FOR TWO PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	682.	0.	0.	1030.	1030.	0.99	0.99
50.	88.	78.	604.	28.	22.	1023.	1024.	0.84	0.79
100.	167.	134.	548.	61.	53.	1009.	1011.	0.69	0.65
150.	238.	177.	505.	92.	82.	992.	996.	0.59	0.55
200.	304.	211.	471.	121.	109.	975.	981.	0.50	0.48
250.	370.	240.	442.	148.	135.	957.	963.	0.44	0.41
300.	433.	265.	417.	174.	160.	939.	946.	0.40	0.38
350.	497.	288.	394.	200.	186.	921.	929.	0.37	0.35
400.	560.	309.	372.	226.	209.	903.	911.	0.35	0.32
450.	623.	329.	353.	251.	233.	886.	893.	0.32	0.30
500.	687.	347.	335.	276.	258.	869.	876.	0.30	0.28

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	705.	0.	0.	1021.	1021.	0.99	0.99
50.	89.	80.	625.	27.	22.	1015.	1016.	0.86	0.81
100.	169.	139.	566.	60.	50.	1001.	1003.	0.71	0.68
150.	240.	185.	520.	91.	79.	985.	989.	0.62	0.58
200.	308.	222.	483.	120.	107.	968.	974.	0.53	0.50
250.	375.	256.	452.	147.	134.	949.	957.	0.46	0.43
300.	438.	279.	426.	173.	159.	931.	940.	0.42	0.40
350.	500.	303.	402.	199.	184.	913.	922.	0.39	0.36
400.	565.	325.	380.	225.	209.	895.	904.	0.36	0.33
450.	630.	346.	359.	250.	233.	877.	886.	0.34	0.31
500.	693.	365.	341.	275.	256.	860.	868.	0.31	0.29

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	628.	0.	0.	1153.	1153.	0.99	0.99
50.	86.	72.	556.	30.	25.	1145.	1146.	0.76	0.72
100.	158.	120.	508.	63.	54.	1132.	1134.	0.63	0.58
150.	226.	156.	472.	92.	83.	1117.	1121.	0.51	0.50
200.	290.	185.	444.	119.	109.	1101.	1106.	0.43	0.42
250.	350.	209.	419.	145.	134.	1086.	1092.	0.40	0.38
300.	413.	232.	396.	172.	158.	1070.	1077.	0.38	0.34
350.	480.	253.	376.	197.	184.	1054.	1061.	0.33	0.30
400.	540.	271.	357.	221.	206.	1038.	1046.	0.31	0.29
450.	600.	288.	340.	244.	229.	1023.	1031.	0.29	0.27
500.	663.	304.	324.	267.	252.	1008.	1016.	0.27	0.25

Table 6

COMPANY AND FAMILY EXPENDITURES FOR 25 PERCENT COINSURANCE PLANS FOR TWO PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	1.	170.	512.	251.	251.	779.	779.	0.99	0.99
50.	88.	227.	455.	255.	254.	778.	778.	0.84	0.78
100.	168.	269.	413.	265.	263.	771.	773.	0.69	0.65
150.	238.	300.	382.	280.	275.	763.	766.	0.59	0.55
200.	303.	325.	357.	295.	289.	755.	759.	0.50	0.48
250.	370.	346.	336.	311.	304.	747.	750.	0.44	0.41
300.	433.	364.	318.	327.	320.	739.	742.	0.40	0.38
350.	495.	380.	302.	343.	335.	731.	734.	0.37	0.35
400.	560.	395.	287.	359.	352.	723.	725.	0.35	0.32
450.	620.	408.	274.	375.	367.	717.	718.	0.32	0.30
500.	685.	421.	261.	390.	383.	711.	712.	0.30	0.29

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	1.	176.	529.	250.	250.	771.	771.	0.99	0.99
50.	88.	235.	470.	254.	253.	770.	770.	0.86	0.81
100.	168.	279.	426.	264.	262.	764.	764.	0.71	0.68
150.	243.	313.	392.	278.	275.	756.	757.	0.62	0.57
200.	310.	340.	366.	294.	289.	747.	749.	0.53	0.50
250.	373.	361.	344.	310.	304.	738.	741.	0.46	0.44
300.	433.	380.	325.	326.	319.	730.	733.	0.42	0.40
350.	497.	397.	308.	342.	334.	721.	724.	0.39	0.36
400.	560.	413.	292.	359.	350.	714.	716.	0.36	0.33
450.	625.	427.	278.	375.	367.	706.	708.	0.34	0.31
500.	685.	440.	265.	390.	381.	700.	702.	0.31	0.29

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	152.	476.	250.	250.	914.	914.	0.99	0.99
50.	85.	205.	423.	254.	253.	913.	914.	0.76	0.72
100.	160.	241.	388.	265.	262.	908.	909.	0.63	0.57
150.	228.	267.	361.	279.	275.	902.	904.	0.51	0.49
200.	287.	287.	341.	293.	287.	896.	898.	0.43	0.42
250.	350.	305.	323.	307.	301.	890.	893.	0.40	0.38
300.	410.	321.	307.	323.	315.	885.	887.	0.38	0.35
350.	475.	335.	293.	337.	331.	879.	882.	0.33	0.30
400.	535.	348.	280.	352.	346.	874.	876.	0.31	0.29
450.	600.	360.	269.	366.	361.	870.	870.	0.29	0.27
500.	655.	370.	258.	380.	374.	865.	866.	0.27	0.26

Table 7

COMPANY AND FAMILY EXPENDITURES FOR 0 PERCENT COINSURANCE PLANS
FOR THREE PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	741.	0.	0.	806.	806.	1.00	1.00
50.	124.	115.	626.	36.	25.	793.	799.	0.90	0.84
100.	227.	195.	546.	79.	61.	772.	782.	0.78	0.70
150.	317.	253.	488.	117.	96.	752.	761.	0.67	0.60
200.	398.	300.	441.	152.	129.	732.	739.	0.61	0.56
250.	468.	338.	403.	184.	159.	712.	721.	0.55	0.53
300.	534.	372.	369.	213.	188.	692.	703.	0.51	0.50
350.	598.	402.	339.	242.	214.	672.	686.	0.48	0.45
400.	658.	429.	312.	268.	240.	653.	670.	0.44	0.44
450.	718.	454.	287.	293.	264.	634.	655.	0.41	0.41
500.	778.	477.	264.	316.	288.	616.	639.	0.38	0.37

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	756.	0.	0.	797.	797.	1.00	1.00
50.	125.	117.	639.	35.	24.	784.	791.	0.91	0.85
100.	229.	199.	556.	78.	59.	763.	773.	0.79	0.71
150.	320.	259.	496.	116.	94.	742.	752.	0.68	0.61
200.	402.	307.	449.	151.	128.	722.	731.	0.63	0.57
250.	474.	347.	409.	184.	159.	701.	711.	0.57	0.54
300.	542.	382.	374.	214.	188.	681.	693.	0.52	0.50
350.	606.	413.	343.	243.	214.	661.	676.	0.49	0.46
400.	666.	440.	315.	269.	239.	641.	660.	0.45	0.44
450.	725.	465.	290.	294.	264.	622.	644.	0.41	0.41
500.	785.	488.	268.	317.	287.	603.	628.	0.38	0.38

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	649.	0.	0.	788.	788.	1.00	1.00
50.	118.	105.	544.	39.	28.	774.	779.	0.83	0.79
100.	213.	172.	477.	80.	64.	754.	760.	0.71	0.63
150.	295.	221.	428.	116.	98.	735.	741.	0.62	0.57
200.	368.	261.	388.	149.	130.	715.	722.	0.54	0.53
250.	434.	294.	355.	180.	158.	696.	705.	0.49	0.47
300.	500.	324.	325.	209.	186.	677.	687.	0.47	0.44
350.	563.	351.	298.	236.	211.	659.	671.	0.44	0.41
400.	623.	375.	274.	260.	236.	642.	655.	0.40	0.38
450.	680.	396.	253.	282.	259.	625.	640.	0.36	0.36
500.	740.	416.	233.	304.	282.	608.	625.	0.34	0.32

Table 8

COMPANY AND FAMILY EXPENDITURES FOR 25 PERCENT COINSURANCE PLANS
FOR THREE PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	185.	555.	201.	201.	605.	605.	1.00	1.00
50.	123.	271.	469.	212.	207.	596.	600.	0.90	0.84
100.	226.	331.	409.	234.	223.	581.	588.	0.78	0.70
150.	318.	375.	366.	257.	245.	566.	573.	0.67	0.59
200.	400.	410.	331.	280.	268.	552.	556.	0.61	0.56
250.	468.	438.	303.	303.	288.	537.	544.	0.55	0.53
300.	535.	464.	277.	325.	309.	523.	531.	0.51	0.50
350.	597.	486.	255.	346.	327.	509.	519.	0.48	0.45
400.	660.	507.	234.	367.	347.	496.	507.	0.44	0.44
450.	717.	525.	216.	385.	364.	484.	496.	0.41	0.41
500.	773.	541.	199.	403.	381.	473.	485.	0.38	0.37

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	189.	566.	199.	199.	598.	598.	1.00	1.00
50.	126.	277.	479.	211.	206.	588.	592.	0.91	0.85
100.	230.	339.	417.	233.	222.	572.	580.	0.79	0.71
150.	322.	384.	372.	256.	244.	557.	564.	0.68	0.61
200.	402.	419.	337.	280.	267.	542.	549.	0.63	0.57
250.	475.	449.	307.	303.	288.	527.	534.	0.57	0.54
300.	540.	475.	281.	325.	307.	512.	521.	0.52	0.50
350.	605.	498.	257.	347.	328.	498.	508.	0.49	0.46
400.	667.	519.	237.	367.	346.	485.	496.	0.45	0.44
450.	723.	537.	218.	386.	363.	471.	485.	0.41	0.41
500.	783.	554.	201.	404.	381.	459.	474.	0.38	0.38

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	1.	163.	487.	196.	196.	592.	592.	1.00	1.00
50.	118.	241.	408.	209.	205.	581.	585.	0.83	0.79
100.	212.	291.	358.	230.	222.	567.	572.	0.71	0.63
150.	295.	328.	321.	252.	243.	553.	557.	0.62	0.57
200.	368.	358.	291.	275.	263.	539.	544.	0.54	0.53
250.	435.	383.	266.	297.	284.	524.	531.	0.49	0.47
300.	500.	405.	244.	318.	303.	511.	519.	0.47	0.44
350.	563.	425.	224.	338.	322.	498.	506.	0.44	0.41
400.	623.	443.	206.	357.	340.	485.	495.	0.40	0.38
450.	680.	459.	190.	374.	357.	474.	485.	0.36	0.36
500.	735.	473.	176.	390.	373.	464.	475.	0.34	0.32

Table 9

COMPANY AND FAMILY EXPENDITURES FOR 0 PERCENT COINSURANCE PLANS
FOR FOUR PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	815.	0.	0.	976.	976.	1.00	1.00
50.	158.	145.	670.	50.	34.	962.	967.	0.89	0.84
100.	277.	235.	580.	103.	70.	940.	948.	0.76	0.68
150.	378.	299.	516.	149.	115.	916.	927.	0.68	0.59
200.	470.	350.	465.	190.	153.	894.	904.	0.60	0.51
250.	560.	392.	423.	228.	189.	872.	881.	0.53	0.45
300.	645.	428.	388.	264.	222.	852.	859.	0.47	0.40
350.	727.	459.	356.	296.	253.	833.	836.	0.45	0.35
400.	807.	486.	329.	325.	283.	815.	814.	0.41	0.32
450.	890.	511.	304.	352.	312.	798.	791.	0.37	0.28
500.	970.	533.	282.	379.	339.	782.	769.	0.36	0.26

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	839.	0.	0.	996.	996.	1.00	1.00
50.	160.	148.	691.	49.	32.	982.	987.	0.91	0.85
100.	280.	241.	598.	101.	73.	960.	969.	0.77	0.70
150.	385.	308.	531.	147.	114.	936.	947.	0.69	0.59
200.	476.	359.	480.	189.	150.	913.	925.	0.60	0.52
250.	564.	402.	437.	227.	186.	391.	903.	0.55	0.46
300.	648.	438.	400.	262.	219.	870.	881.	0.49	0.40
350.	733.	470.	368.	295.	251.	850.	857.	0.46	0.36
400.	817.	499.	340.	326.	283.	831.	834.	0.42	0.33
450.	900.	524.	314.	354.	312.	813.	811.	0.38	0.28
500.	990.	548.	291.	381.	342.	796.	786.	0.36	0.27

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	701.	0.	0.	1046.	1046.	1.00	1.00
50.	146.	130.	571.	52.	36.	1032.	1036.	0.83	0.75
100.	255.	203.	498.	101.	78.	1011.	1019.	0.70	0.61
150.	346.	255.	445.	143.	115.	991.	1000.	0.58	0.51
200.	433.	297.	404.	181.	150.	972.	981.	0.53	0.44
250.	523.	333.	368.	217.	185.	953.	960.	0.46	0.37
300.	610.	363.	337.	250.	218.	935.	938.	0.42	0.34
350.	693.	390.	311.	282.	249.	918.	918.	0.39	0.31
400.	773.	413.	287.	311.	278.	902.	900.	0.34	0.27
450.	855.	434.	267.	337.	306.	887.	881.	0.32	0.25
500.	930.	452.	249.	361.	331.	872.	864.	0.28	0.22

Table 10

COMPANY AND FAMILY EXPENDITURES FOR 25 PERCENT COINSURANCE PLANS
FOR FOUR PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	204.	611.	244.	244.	732.	732.	1.00	1.00
50.	159.	313.	502.	259.	253.	721.	725.	0.89	0.84
100.	278.	380.	435.	284.	273.	705.	711.	0.76	0.68
150.	378.	428.	387.	313.	296.	687.	695.	0.68	0.59
200.	470.	466.	349.	340.	320.	671.	679.	0.60	0.51
250.	560.	498.	318.	365.	345.	657.	663.	0.53	0.45
300.	643.	524.	291.	390.	368.	644.	647.	0.47	0.40
350.	725.	547.	268.	414.	391.	631.	632.	0.45	0.36
400.	810.	568.	247.	435.	415.	619.	616.	0.41	0.32
450.	890.	586.	229.	456.	437.	608.	601.	0.37	0.28
500.	975.	603.	213.	476.	459.	598.	586.	0.36	0.26

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	210.	629.	249.	249.	747.	747.	1.00	1.00
50.	160.	321.	518.	262.	257.	736.	740.	0.91	0.85
100.	282.	391.	448.	288.	275.	720.	727.	0.77	0.70
150.	383.	440.	398.	316.	299.	702.	711.	0.69	0.60
200.	478.	479.	360.	343.	323.	685.	694.	0.60	0.52
250.	563.	511.	328.	369.	347.	671.	679.	0.55	0.46
300.	647.	538.	301.	394.	370.	657.	664.	0.49	0.40
350.	733.	562.	277.	418.	394.	644.	647.	0.46	0.36
400.	817.	583.	256.	441.	417.	631.	632.	0.42	0.33
450.	900.	602.	237.	462.	440.	619.	616.	0.38	0.28
500.	985.	619.	220.	482.	463.	608.	600.	0.36	0.27

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	-2.	174.	527.	243.	265.	806.	782.	1.00	1.00
50.	148.	271.	430.	254.	250.	800.	802.	0.83	0.74
100.	254.	325.	375.	278.	268.	787.	792.	0.70	0.61
150.	348.	364.	336.	303.	289.	775.	780.	0.58	0.51
200.	433.	395.	305.	327.	311.	763.	769.	0.53	0.44
250.	523.	422.	279.	351.	335.	752.	756.	0.46	0.37
300.	607.	444.	256.	374.	357.	742.	744.	0.42	0.34
350.	690.	464.	236.	397.	380.	732.	732.	0.39	0.31
400.	775.	482.	219.	418.	403.	723.	720.	0.34	0.27
450.	855.	497.	204.	437.	424.	715.	709.	0.32	0.25
500.	930.	510.	190.	455.	443.	708.	699.	0.28	0.22

Table 11

COMPANY AND FAMILY EXPENDITURES FOR 0 PERCENT COINSURANCE PLANS
FOR FIVE PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	750.	0.	0.	693.	693.	1.00	1.00
50.	191.	178.	572.	55.	34.	671.	681.	0.91	0.81
100.	327.	281.	469.	115.	84.	640.	656.	0.79	0.68
150.	435.	349.	401.	162.	126.	612.	630.	0.68	0.59
200.	528.	400.	350.	202.	163.	585.	604.	0.62	0.51
250.	612.	441.	309.	235.	197.	559.	580.	0.51	0.47
300.	690.	475.	275.	266.	228.	533.	557.	0.46	0.41
350.	770.	506.	245.	295.	258.	509.	534.	0.45	0.36
400.	843.	533.	217.	323.	286.	485.	513.	0.39	0.35
450.	923.	558.	192.	351.	315.	462.	491.	0.36	0.30
500.	997.	579.	171.	376.	340.	443.	472.	0.33	0.26

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	766.	0.	0.	697.	697.	1.00	1.00
50.	195.	182.	584.	54.	34.	676.	686.	0.92	0.82
100.	334.	289.	478.	113.	84.	646.	660.	0.79	0.70
150.	442.	358.	408.	160.	125.	617.	635.	0.71	0.60
200.	538.	412.	355.	200.	164.	590.	609.	0.63	0.53
250.	626.	453.	313.	234.	196.	565.	587.	0.53	0.49
300.	693.	488.	278.	264.	227.	539.	566.	0.47	0.43
350.	770.	519.	247.	293.	256.	514.	545.	0.45	0.39
400.	843.	547.	219.	321.	284.	490.	525.	0.39	0.36
450.	917.	571.	195.	348.	310.	467.	505.	0.36	0.31
500.	993.	593.	173.	373.	335.	446.	485.	0.33	0.27

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY STDEV		CO. STDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	618.	0.	0.	647.	647.	1.00	1.00
50.	176.	157.	461.	58.	40.	624.	632.	0.85	0.77
100.	293.	238.	380.	110.	85.	595.	607.	0.72	0.63
150.	390.	293.	326.	152.	125.	569.	583.	0.62	0.55
200.	464.	332.	286.	185.	156.	544.	564.	0.52	0.51
250.	540.	366.	252.	216.	186.	519.	544.	0.45	0.41
300.	615.	396.	222.	246.	215.	495.	524.	0.43	0.37
350.	690.	422.	196.	275.	243.	473.	504.	0.39	0.31
400.	770.	445.	173.	301.	269.	454.	482.	0.34	0.28
450.	850.	465.	154.	326.	295.	436.	461.	0.30	0.22
500.	935.	482.	137.	349.	319.	419.	440.	0.26	0.19

Table 12

COMPANY AND FAMILY EXPENDITURES FOR 25 PERCENT COINSURANCE PLANS
FOR FIVE PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	188.	562.	173.	173.	520.	520.	1.00	1.00
50.	192.	321.	429.	195.	184.	503.	511.	0.91	0.81
100.	327.	398.	352.	231.	211.	480.	492.	0.79	0.68
150.	434.	449.	301.	264.	240.	459.	472.	0.68	0.60
200.	530.	488.	262.	294.	269.	439.	452.	0.62	0.51
250.	610.	518.	232.	321.	293.	419.	435.	0.51	0.47
300.	690.	544.	206.	346.	318.	400.	418.	0.46	0.41
350.	770.	567.	183.	370.	342.	382.	401.	0.45	0.36
400.	843.	587.	163.	393.	364.	364.	385.	0.39	0.35
450.	923.	606.	144.	415.	386.	347.	368.	0.36	0.30
500.	1000.	622.	128.	436.	407.	332.	353.	0.33	0.26

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	192.	574.	174.	174.	523.	523.	1.00	1.00
50.	195.	328.	438.	195.	186.	507.	514.	0.92	0.82
100.	334.	408.	358.	230.	212.	484.	495.	0.79	0.70
150.	442.	460.	306.	264.	241.	463.	476.	0.71	0.60
200.	535.	500.	266.	294.	268.	443.	457.	0.63	0.53
250.	620.	532.	235.	321.	294.	423.	440.	0.53	0.49
300.	693.	558.	208.	346.	316.	404.	424.	0.47	0.43
350.	770.	581.	185.	370.	339.	386.	409.	0.45	0.39
400.	845.	602.	164.	393.	362.	367.	393.	0.39	0.36
450.	920.	620.	146.	415.	383.	350.	378.	0.36	0.31
500.	990.	636.	130.	435.	402.	334.	364.	0.33	0.27

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	155.	463.	162.	162.	485.	485.	1.00	1.00
50.	177.	273.	346.	185.	176.	468.	474.	0.85	0.77
100.	294.	333.	285.	217.	202.	446.	455.	0.72	0.63
150.	388.	374.	244.	248.	228.	427.	438.	0.62	0.55
200.	465.	404.	215.	274.	252.	408.	423.	0.52	0.51
250.	543.	430.	189.	299.	275.	389.	407.	0.45	0.41
300.	617.	452.	167.	323.	297.	371.	393.	0.43	0.37
350.	690.	471.	147.	345.	318.	355.	378.	0.39	0.31
400.	775.	489.	130.	366.	341.	341.	361.	0.34	0.28
450.	850.	503.	115.	386.	360.	327.	346.	0.30	0.22
500.	930.	516.	103.	404.	379.	314.	331.	0.26	0.19

Table 13

COMPANY AND FAMILY EXPENDITURES FOR 0 PERCENT COINSURANCE PLANS
FOR SIX PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	878.	0.	0.	1035.	1035.	1.00	1.00
50.	208.	188.	691.	76.	45.	1017.	1021.	0.89	0.78
100.	347.	283.	595.	141.	97.	984.	994.	0.71	0.58
150.	458.	344.	535.	191.	141.	947.	964.	0.57	0.50
200.	558.	391.	487.	235.	182.	910.	936.	0.50	0.45
250.	658.	433.	446.	276.	222.	876.	907.	0.48	0.39
300.	750.	468.	410.	312.	259.	848.	879.	0.44	0.35
350.	837.	498.	380.	343.	293.	819.	853.	0.40	0.33
400.	920.	525.	353.	373.	325.	791.	828.	0.36	0.31
450.	1007.	551.	327.	403.	358.	763.	803.	0.34	0.30
500.	1090.	576.	302.	435.	390.	736.	780.	0.33	0.28

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	906.	0.	0.	1002.	1002.	1.00	1.00
50.	211.	195.	711.	74.	42.	986.	990.	0.90	0.80
100.	359.	298.	608.	142.	95.	953.	959.	0.73	0.63
150.	474.	364.	543.	194.	143.	917.	930.	0.62	0.54
200.	573.	414.	493.	236.	183.	881.	902.	0.52	0.48
250.	668.	456.	450.	276.	222.	846.	875.	0.50	0.41
300.	760.	494.	413.	312.	259.	816.	847.	0.47	0.40
350.	843.	526.	380.	344.	293.	785.	823.	0.42	0.37
400.	923.	555.	351.	375.	325.	756.	800.	0.39	0.34
450.	1010.	582.	324.	405.	357.	728.	774.	0.38	0.31
500.	1097.	608.	298.	436.	389.	702.	749.	0.34	0.28

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	0.	774.	0.	0.	1048.	1048.	1.00	1.00
50.	189.	161.	613.	77.	50.	1030.	1030.	0.79	0.70
100.	306.	234.	540.	131.	97.	998.	1006.	0.62	0.56
150.	404.	284.	490.	175.	138.	964.	981.	0.51	0.48
200.	498.	325.	449.	214.	175.	933.	955.	0.47	0.40
250.	585.	359.	415.	249.	211.	904.	931.	0.45	0.38
300.	667.	389.	385.	282.	244.	877.	908.	0.42	0.35
350.	753.	418.	356.	315.	278.	852.	884.	0.38	0.31
400.	840.	443.	331.	347.	310.	827.	860.	0.36	0.27
450.	920.	465.	309.	376.	338.	804.	838.	0.28	0.26
500.	990.	483.	291.	403.	362.	781.	819.	0.25	0.25

Table 14

COMPANY AND FAMILY EXPENDITURES FOR 25 PERCENT COINSURANCE PLANS FOR SIX PERSON FAMILIES

UNADJUSTED

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	220.	658.	259.	259.	776.	776.	1.00	1.00
50.	207.	360.	518.	280.	272.	763.	766.	0.89	0.78
100.	348.	432.	446.	318.	300.	738.	745.	0.71	0.58
150.	458.	477.	401.	357.	329.	710.	724.	0.57	0.50
200.	558.	513.	365.	392.	358.	683.	702.	0.50	0.45
250.	657.	544.	334.	426.	388.	657.	680.	0.48	0.39
300.	750.	570.	308.	454.	416.	636.	659.	0.44	0.35
350.	837.	593.	285.	480.	442.	614.	640.	0.40	0.33
400.	925.	614.	265.	505.	469.	595.	620.	0.36	0.31
450.	1007.	633.	245.	530.	493.	572.	603.	0.34	0.30
500.	1095.	652.	227.	555.	519.	552.	584.	0.33	0.28

ADJUSTED TO INSURED (UPWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	0.	227.	679.	251.	251.	752.	752.	1.00	1.00
50.	212.	373.	533.	270.	262.	739.	742.	0.90	0.80
100.	358.	450.	456.	310.	292.	715.	720.	0.73	0.63
150.	475.	500.	407.	349.	324.	688.	697.	0.62	0.54
200.	573.	537.	369.	384.	352.	660.	677.	0.52	0.48
250.	670.	569.	337.	417.	381.	635.	655.	0.50	0.41
300.	760.	597.	310.	447.	409.	612.	635.	0.47	0.40
350.	843.	621.	285.	474.	434.	589.	617.	0.42	0.37
400.	925.	643.	265.	499.	460.	567.	599.	0.39	0.34
450.	1010.	663.	243.	524.	484.	546.	580.	0.38	0.31
500.	1100.	683.	224.	549.	510.	526.	561.	0.34	0.28

ADJUSTED TO UNINSURED (DOWNWARD)

DEDUCTIBLE		FAMILY	CO.	FAMILY SIDEV		CO. SIDEV		PROB(CLAIM)	
INDIV	FAMILY	COST	COST	INDIV	FAMILY	INDIV	FAMILY	INDIV	FAMILY
0.	1.	194.	580.	262.	262.	786.	786.	1.00	1.00
50.	190.	315.	459.	283.	276.	773.	773.	0.79	0.70
100.	306.	369.	405.	317.	304.	749.	754.	0.62	0.56
150.	405.	407.	367.	351.	330.	723.	735.	0.51	0.48
200.	497.	437.	337.	382.	356.	699.	717.	0.47	0.40
250.	587.	463.	311.	410.	382.	678.	698.	0.45	0.38
300.	670.	486.	288.	436.	407.	658.	681.	0.42	0.35
350.	753.	507.	267.	462.	431.	639.	663.	0.38	0.31
400.	840.	526.	248.	487.	456.	620.	645.	0.36	0.27
450.	920.	542.	232.	509.	478.	603.	629.	0.28	0.26
500.	990.	555.	219.	531.	497.	586.	615.	0.25	0.25

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