THE TREATMENT OF ACUTE LOW BACK PAIN — BED REST, EXERCISES, OR ORDINARY ACTIVITY?

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Abstract *Background.* Bed rest and back-extension exercises are often prescribed for patients with acute low back pain, but the effectiveness of these two competing treatments remains controversial.

Methods. We conducted a controlled trial among employees of the city of Helsinki, Finland, who presented to an occupational health care center with acute, nonspecific low back pain. The patients were randomly assigned to one of three treatments: bed rest for two days (67 patients), back-mobilizing exercises (52 patients), or the continuation of ordinary activities as tolerated (the control group; 67 patients). Outcomes and costs were assessed after 3 and 12 weeks.

Results. After 3 and 12 weeks, the patients in the control group had better recovery than those prescribed either bed rest or exercises. There were statistically significant differences favoring the control group in the duration of pain, pain intensity, lumbar flexion, ability to work as measured subjectively, Oswestry back-disability index, and number of days absent from work. Recovery was slowest among the patients assigned to bed rest. The overall costs of care did not differ significantly among the three groups.

Conclusions. Among patients with acute low back pain, continuing ordinary activities within the limits permitted by the pain leads to more rapid recovery than either bed rest or back-mobilizing exercises. (N Engl J Med 1995;332:351-5.)

ACUTE low back pain is one of the most common reasons for consulting a primary care physician in the industrialized countries. The direct cost of medical care and the indirect costs to society of absenteeism from work due to backache are huge.[1] Physicians commonly prescribe bed rest for acute low back pain, although only a few controlled trials have assessed its effectiveness.[2] Among military recruits with acute low back pain, bed rest led to more rapid recovery than remaining on foot.[3] In a family practice, patients presenting with acute low back pain did not benefit from either bed rest or isometric flexion exercises.[4] Two days of bed rest produced as good clinical recovery as did seven days of rest and, moreover, was associated with fewer days lost from work.[5] In patients with acute low back pain, back-extension exercises were superior to education about back care,[6] but a study comparing exercise therapy with placebo found no difference.[7]

The controversy persists over the relative merits of bed rest and exercise in the treatment of acute back pain. Many leading experts suggest two days or less of bed rest,[8-10] whereas others advocate back-extension exercises.[6,11] The present study was designed to compare bed rest with rapid mobilization in the management of acute backache. We conducted a randomized, controlled trial of the effectiveness and costs of two days of bed rest as compared with those of light back-mobilizing exercises in patients with acute low back pain. A third group of control patients was advised to avoid bed rest, not to engage in mobilizing exercises, and to continue normal activity to the extent that they were able to tolerate it.

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METHODS

Selection and Evaluation of Subjects

The population available for inclusion in the study comprised all employees of the city of Helsinki, Finland, except those working in public transport or the electricity-supply services. The study subjects were patients who presented with low back pain as their main symptom at the city's occupational health care centers. They included patients with acute low back pain or exacerbations of chronic pain lasting less than three weeks. Patients with pain radiating below the knee were included, but not patients with a sciatic syndrome (defined by the presence of at least one neurologic deficit or a positive Lasègue's sign of 60 degrees or less). Also excluded were pregnant patients and those with a history of cancer, a fracture of the lumbar spine, or urinary tract disease.

Patients meeting the criteria for inclusion in the study were given written information by occupational health nurses on the aims and content of the study before they were asked to decide about participation. They were told that according to current knowledge, the three treatment protocols were considered to be equally effective. After the patients gave informed consent, they completed a base-line questionnaire. The researchers dealing with the base-line and outcome data were unaware of the patients' treatment assignments. Base-line data were gathered on potential confounding variables, effect-modifying factors, and factors related to the back disorder (Table 1). Functional status was assessed by the Oswestry low-back-pain disability questionnaire[12] and a health-related measure of quality of life,[13] on which 9 of 15 items were relevant to low back pain and were included in the questionnaire for that reason. A score on the health-related quality-of-life index was calculated from the weighted scores assigned to the responses to the nine items; for the six items excluded from the questionnaire, means and respective weighted scores for the Finnish adult population under 65 years of age were used. The duration of absence from work due to low back pain was assessed from the medical records, but only after all the data that would have revealed the treatment assignment had been removed. All the workers were insured for absence due to illness, and the exact duration and diagnosis of illness were required to be stated in the medical records. Straight-leg raising and lumbar flexion were measured by a study physiotherapist. All base-line and follow-up measurements were made without the physiotherapist's knowledge of the treatment.

Randomization and Treatments

A simple randomization was performed before recruitment with random-number tables, and written instructions for the three treatments were sealed in envelopes. The patients were examined by occupational health physicians at the centers, at which time the cri-

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Table 1. Demographic and Clinical Characteristics of the Study Subjects at Randomization.*

CHARACTERISTIC	BED REST (N=67)	EXERCISE (N=52)	CONTROL (N=67)
Age (yr)	40.8	41.1	39.1
Female sex (%)	60	71	70
Education (yr completed)	11.4	11.3	11.2
Married (%)	39	48	46
Body-mass index†	25.0	25.2	25.0
Physical exercise ≥3 times/wk (%)	54	54	58
Monthly income ($)	1858	1947	1852
Heavy physical work ≥5 hr/day (%)	10	13	22
Very satisfied with own work (%)	18	23	25
Pain and disability at work			
Duration of pain (days)	4.7	5.1	4.5
Intensity of pain‡	5.9	6.1	5.7
Pain radiating below the knee (%)	21	10	9
No. of sick days	1.4	1.1	1.4
Ability to work§	4.9	5.3	4.8
Straight-leg raising on more limited side (degrees)	73	74	72
Lumbar flexion (cm)¶	5.1	4.9	5.1
Oswestry back-disability index‖	34.6	33.8	32.0
Health-related quality-of-life index**	0.86	0.86	0.85
Back symptoms in previous 12 mo			
Pain for >30 days (%)	16	27	15
>7 Sick days (%)	14	13	11
No. of medical visits	0.82	0.64	0.55
Previous back surgery (no. of patients)	0	2	0

*Values shown are means unless otherwise stated.

†Calculated as the weight in kilograms divided by the square of the height in meters.

‡Scored on an 11-point scale from 0 (no pain at all) to 10 (unbearable pain).

§Measured subjectively and scored on an 11-point scale from 0 (total inability to work) to 10 (maximal working ability).

¶Measured by the modified Schober method, in which a 15-cm gap is marked on the patient's back with the patient in a standing position and the increase in the width of the gap is measured with the patient in full flexion.

‖Scored from 0 to 100, with higher scores indicating worse function in common activities of daily living because of backache.

**Scored from 0 to 1, with higher scores indicating better function in the most essential dimensions of general health.

teria for inclusion in the study were checked. The physicians opened the envelopes and gave the treatment instructions to each patient at the end of the initial visit. Physicians were asked to decide whether the patient's condition necessitated sick leave or follow-up visits before randomization and at later visits independently of the treatment protocol.

The patients in the bed-rest group were instructed to take two days of complete bed rest, with only essential walking allowed. They were advised about suitable resting positions and were given an illustration of a patient lying supine with the knees supported in a flexed position (the semi-Fowler position). Those in the exercise group received individual instruction from a physiotherapist in one session, as well as written recommendations for back-extension and lateral bending movements to be done at home every other hour during the day until the pain subsided. The recommendations called for these movements to be done 10 times in each direction, but slowly, to avoid aggravating the pain. The patients in the control group were told to avoid bed rest and advised to continue their routines as actively as possible within the limits permitted by their back pain. These instructions were also given to the patients in the exercise group. Those in the bed-rest group were advised to resume routine activities as tolerated only after two days of complete rest. All the treatments were approved by the ethics committee of the Finnish Institute of Occupational Health. Patients were enrolled beginning in January 1992, and enrollment ended in April 1993.

Compliance and Other Interventions

The follow-up questionnaires asked all the patients on how many days they had taken some bed rest during the day, and for how many hours on average. The patients were also asked on how many days they had done back exercises and how often they did them per day, on average. If they received any health care services apart from those prescribed in the protocols, these were recorded.

Follow-up and Outcome Assessment

The patients visited the physiotherapists after 3 and 12 weeks, at which time they completed follow-up questionnaires. Those who did not return for follow-up were contacted by phone and asked to participate. The outcome assessments were based on questionnaire data, measurements by physiotherapists, and sick-leave data from the medical records.

To assess any possible bias on the part of the physicians, nurses, and physiotherapists toward the treatments, we asked them to rate the value of the treatments before the results were known. They either rated the treatments from best to worst (i.e., 1,2,3) or rated two or all three treatments as equally effective (i.e., 1,1,2; 1,2,2; or 1,1,1).

Economic Analysis

The economic analysis was based on the responses to the 12-week follow-up questionnaire, which concerned the use and costs of health care services and help at home. The costs of medicines were estimated from the data entered on the questionnaires and from the medical records. The costs of public health services (visits to a physician, a nurse, or a physiotherapist) were calculated from the unit costs of these services in the City of Helsinki Occupational Health Care Centers. The costs of similar services provided privately were recorded on the basis of the patients' own expenditures.

Home help was defined to include help from the patients' spouses and children or their families, relatives, and friends. The monetary value of these voluntary contributions is hard to assess.[14] Two alternative calculations were applied. First, half the current wage of a municipal home helper was used, unless the helper had taken time from work, in which case the total wage was used. In the second calculation, the total wage was used for all the help.

Subjects with missing data were excluded from the economic analyses, making the three groups smaller than in the outcome analyses. The single subject who underwent surgery was also excluded from the economic analysis, since such a high-cost event might have affected the cost analysis disproportionately.[15]

Sample Size and Statistical Analysis

The calculations of power showed a need for 64 subjects in each treatment group in order to achieve a statistical power of 0.80 with an alpha of 0.05.

An analysis of covariance was performed to compare treatments (bed rest vs. control and exercise vs. control).[16] In calculating the prevalence of pain radiating below the knee (expressed as a percentage of the group), binomial regression models were used.[17] The covariates entered into the model included the base-line data and the patient's age, the patient's sex, and confounding variables at base line: the patient's degree of satisfaction with his or her work (very satisfied vs. not very satisfied), the performance of physically heavy work for over five hours daily (yes vs. no), the presence of pain radiating below the knee (yes vs. no), pain for over 30 days in the previous 12 months (yes vs. no), and the number of medical visits due to backache during the previous 12 months. The estimated differences in outcomes between the treatment groups and their standard errors from the models were used to determine 95 percent confidence intervals and statistical significance.

RESULTS

Study Population

A total of 186 subjects were randomly assigned to the three treatment groups. Two days of bed rest was recommended for 67 patients, exercise for 52 patients, and normal activity as tolerated for 67 patients (the control group). Follow-up information was obtained three weeks later for 165 of these subjects (89 percent); 5 subjects were absent from the bed-rest group, 10 from the exercise group, and 6 from the control group. After 12 weeks, information was obtained on 162 subjects (87 percent); this time, 8 subjects were missing

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from the bed-rest group, 11 from the exercise group, and 5 from the control group. The base-line characteristics of the patients who did not return for follow-up did not differ markedly from the characteristics of those who returned.

Sixteen subjects were not included in the final study population of 186 patients because their base-line questionnaires were not obtained or were filled in too late or because the physicians' initial determination that they fulfilled the criteria for inclusion in the study proved to be incorrect. The decision to withdraw these patients from the study was made without knowledge of their treatment assignments. Nine of the 16 would have been in the exercise group, 4 in the bed-rest group, and 3 in the control group.

Characteristics of the Subjects

The demographic and clinical characteristics of the study subjects are shown in Table 1. The three groups were similar with regard to most of the base-line characteristics. The control group contained a few more people engaged in heavy physical work, the bed-rest group had more patients with pain radiating below the knee, and the exercise group had more patients with prolonged pain during the previous 12 months. Two patients in the exercise group had undergone previous back surgery. The patients in all three groups worked in a wide variety of municipal occupations.

Compliance and Other Interventions

At the three-week follow-up, the patients in the bed-rest group had spent an average of 22 hours at rest, as compared with only 2 hours for the patients in the control group. The patients in the exercise group had performed an average of 61 sets of exercises as compared with 3 sets in the control group (Table 2).

Antiinflammatory drugs or analgesics were prescribed for 93, 91, and 93 percent of the patients in the bed-rest, exercise, and control groups, respectively. In the bed-rest group, one patient underwent back surgery because of a disk prolapse.

Assessments by Health Care Personnel

Before learning the results of the study, 10 of the 36 doctors, nurses, and physiotherapists rated exercise as the best of the three treatments, 3 favored the control treatment, and 3 considered bed rest the best treatment. In all, 10 physicians, 6 nurses, and 6 physiotherapists were able to prioritize the treatments, whereas the remaining 14 could not rank the treatments at all.

Three-Week Outcomes

After adjustment for base-line measurements, the control group had statistically significant advantages over the bed-rest group in terms of the duration of absence from work due to sickness and the ability to work (assessed subjectively) (Table 2). As compared with the patients in the exercise group, the control patients recovered significantly better in terms of the number of sick days, the duration of pain, and scores on the Oswestry back-disability index. The median number of sick days was five in both the bed-rest group and the exercise group, and four in the control group. After one week the percentage of patients still out from work was 41, 36, and 20 percent in the bed-rest, exercise, and control groups, respectively; at two weeks it was 19, 11, and 2 percent; and at three weeks it was 5, 6, and 2 percent. There were statistically significant differences between the bed-rest group and the control group at one and two weeks ($P=0.01$ and $P=0.002$ by Fisher's exact test), respectively.

12-Week Outcomes

After adjustment for base-line values, the patients assigned to bed rest recovered significantly more slowly than the controls in terms of the number of sick days,

Table 2. Outcomes in the Bed-Rest, Exercise, and Control Groups at the Three-Week Follow-up.*

Outcome Measure at 3 wk	Bed Rest (N = 62)	Exercise (N = 42)	Control (N = 61)	Difference in Adjusted Group Means (95% CI)	
				bed rest minus control	exercise minus control
Pain and disability at work					
No. of sick days	7.5	5.7	4.1	3.2 (1.3 to 5.0)	1.8 (0.1 to 3.5)
Duration of pain (no. of days)	15	20	14	0.3 (−3.1 to 3.8)	4.3 (0.8 to 7.8)
Intensity of pain†	2.4	3.1	1.9	0.3 (−0.4 to 0.9)	0.9 (−0.001 to 1.7)
Pain radiating below the knee (%)	13	10	8	−1.5 (−29.6 to 26.6)	−2.0 (−33.2 to 29.1)
Ability to work‡	6.8	7.2	7.9	−0.9 (−1.8 to 0.02)	−0.3 (−1.2 to 0.5)
Straight-leg raising on more limited side (degrees)	86	86	87	0.3 (−4.2 to 4.7)	−0.03 (−5.1 to 5.0)
Lumbar flexion (cm)§	6.2	6.0	6.4	−0.3 (−0.7 to 0.2)	−0.3 (−0.7 to 0.1)
Oswestry back-disability index¶	16.0	18.6	10.0	3.9 (−0.2 to 8.0)	6.6 (2.0 to 11.1)
Health-related quality-of-life index‖	0.92	0.91	0.94	−0.02 (−0.04 to 0.002)	−0.02 (−0.04 to 0.001)
Satisfaction with treatment**	7.0	7.7	7.6	−0.7 (−1.8 to 0.4)	0.5 (−0.6 to 1.6)
Compliance with treatment for 3 wk					
Daytime bed rest (hr)	22	5	2	—	—
No. of exercise sessions	8	61	3	—	—

*Values shown are means unless otherwise stated. CI denotes confidence interval.

†Scored on an 11-point scale from 0 (no pain at all) to 10 (unbearable pain).

‡Measured subjectively and scored on an 11-point scale from 0 (total inability to work) to 10 (maximal working ability).

§Measured by the modified Schober method, in which a 15-cm gap is marked on the patient's back with the patient in a standing position and the increase in the width of the gap is measured with the patient in full flexion.

¶Scored from 0 to 100, with higher scores indicating worse function in common activities of daily living because of backache.

‖Scored from 0 to 1, with higher scores indicating better function in the most essential dimensions of general health.

**Scored on an 11-point scale from 0 (totally dissatisfied) to 10 (totally satisfied).

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Table 3. Outcomes in the Bed-Rest, Exercise, and Control Groups at the 12-Week Follow-up.*

Outcome Measure at 12 wk	Bed Rest (N = 59)	Exercise (N = 41)	Control (N = 62)	Difference in Adjusted Group Means (95% CI)	
				bed rest minus control	exercise minus control
Pain and disability at work					
No. of sick days	9.2	7.2	4.7	3.4 (0.2 to 6.5)	2.5 (0.2 to 4.9)
Intensity of pain†	2.1	1.8	1.3	0.7 (0.03 to 1.4)	0.2 (−0.5 to 1.0)
Pain radiating below the knee (%)	14	10	11	4.1 (−13.4 to 21.6)	−0.01 (−28.2 to 26.2)
Ability to work‡	7.7	7.8	8.5	−0.8 (−1.5 to −0.1)	−0.7 (−1.6 to 0.2)
Straight-leg raising on more limited side (degrees)	88	89	90	0.4 (−4.8 to 5.5)	−0.7 (−5.8 to 4.4)
Lumbar flexion (cm)§	6.3	6.0	6.6	−0.6 (−1.1 to −0.1)	−0.6 (−1.1 to −0.1)
Oswestry back-disability index¶	11.8	10.8	7.4	3.8 (0.1 to 7.5)	2.6 (−1.6 to 6.7)
Health-related quality-of-life index‖	0.93	0.95	0.95	−0.02 (−0.04 to 0.002)	−0.005 (−0.03 to 0.02)
Satisfaction with treatment**	7.3	8.1	7.7	−0.6 (−1.6 to 0.4)	0.4 (−0.6 to 1.4)

*Values shown are means unless otherwise stated. CI denotes confidence interval.

†Scored on an 11-point scale from 0 (no pain at all) to 10 (unbearable pain).

‡Measured subjectively and scored on an 11-point scale from 0 (total inability to work) to 10 (maximal working ability).

§Measured by the modified Schober method, in which a 15-cm gap is marked on the patient's back with the patient in a standing position and the increase in the width of the gap is measured with the patient in full flexion.

¶Scored from 0 to 100, with higher scores indicating worse function in common activities of daily living because of backache.

‖Scored from 0 to 1, with higher scores indicating better function in the most essential dimensions of general health.

**Scored on an 11-point scale from 0 (totally dissatisfied) to 10 (totally satisfied).

the intensity of pain, the ability to work (assessed subjectively), lumbar flexion, and the Oswestry back-disability index (Table 3). The recovery was slower in the exercise group than in the control group in terms of the number of sick days and capacity for lumbar flexion. The median duration of absence from work was six days in the bed-rest group, five days in the exercise group, and four days in the control group. No one was still out from work at 12 weeks of follow-up.

Costs and Use of Services

After adjustment for base-line values, visits to doctors were significantly more frequent in the exercise group than in the control group (Table 4). There were other appreciable differences, but they were not statistically significant. The cost of health care services was lowest in the control group. The patients in the exercise group needed home help the most often of the three groups, and those in the control group least often.

Table 4. Costs and Use of Services Associated with Back Disorders in the Three Study Groups at the 12-Week Follow-up.*

Variable	Bed Rest (N = 52)	Exercise (N = 40)	Control (N = 53)	Difference in Adjusted Group Means (95% CI)	
				bed rest minus control	exercise minus control
Visits to a doctor					
Cost ($)	73	89	74	2 (−19 to 23)	19 (−6 to 44)
No. of visits	1.8	2.2	1.7	0.2 (−0.2 to 0.5)	0.5 (0.1 to 0.9)
Visits to a nurse					
Cost ($)	10	10	9	0 (−7 to 6)	1 (−7 to 9)
No. of visits	0.4	0.4	0.3	0.0 (−0.2 to 0.2)	0.0 (−0.3 to 0.3)
Visits to a physiotherapist					
Cost ($)	34	24	22	13 (−17 to 43)	2 (−25 to 29)
No. of visits	1.4	1.4	0.9	0.5 (−0.7 to 1.6)	0.0 (−1.1 to 1.0)
Cost of medicine ($)	13	13	11	2 (−3 to 6)	1 (−3 to 5)
Cost of other services ($)†	14	29	7	5 (−8 to 19)	19 (−5 to 43)
Total cost of health care ($)	144	165	123	22 (−31 to 74)	34 (−28 to 96)
Home help‡					
Cost ($)					
Half wage§	43	114	23	17 (−37 to 71)	67 (−17 to 150)
Full wage¶	86	228	42	39 (−68 to 146)	138 (−28 to 304)
No. of hours	4.8	12.8	2.4	2.2 (−3.8 to 8.1)	7.8 (−1.6 to 17.0)
Total cost of health care and home help ($)‡					
Half wage§	191	282	150	44 (−37 to 125)	102 (−27 to 232)
Total wage¶	234	397	168	67 (−58 to 191)	174 (−33 to 381)

*Values shown are means unless otherwise stated. Dollar costs are derived from Finnish currency at the 1992 exchange rate ($1 = 4.48 Finnish marks). CI denotes confidence interval.

†Denotes the cost of private examinations (radiographs), medical equipment and appliances, and traveling expenses due to back pain.

‡Values shown for this variable are based on a total of 43 patients in the bed-rest group, 38 patients in the exercise group, and 50 patients in the control group.

§Costs shown are based on half the usual wage of a municipal home-help worker.

¶Costs shown are based on the full wage of a municipal home-help worker.

Discussion

Our study was conducted in an occupational health care setting in which the subjects were engaged in various types of work for the municipality. The continuity of care in these health care centers is very good because all the employees have easy access to the services and treatment is free. Thus, the sample represents a working population with acute, nonspecific low back pain that required the services of a physician.

Simple randomization was used to assign patients to one of three treatments, and with this method the base-line characteristics in the three groups were successfully balanced (Table 1). Minor imbalances in base-line characteristics were controlled for in the multivariate analyses.

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Compliance was adequate to show significant differences in the amount of bed rest and exercise between the patients assigned to those two treatments and the control patients assigned to continue their usual activities as tolerated. The actual compliance may have been poorer than that shown by our data, since compliance tends to be overestimated when questionnaires are used.

In our study design it was not possible for the health care personnel to remain completely unaware of the treatment assignments. However, a placebo effect seems an unlikely explanation for the success of the control treatment, because in general the doctors, nurses, and physiotherapists thought exercise was the most effective treatment and considered resting in bed and continuing normal activity to have more or less equal efficacy. Patients may express satisfaction with a treatment because they assume that the treatment they are given is effective. Because the degree of satisfaction with treatment did not differ among the three groups, the higher degree of recovery in the control group cannot be regarded as a placebo effect. The results favoring the control group were remarkably consistent across the measures used to determine the outcome.

Our findings agree with those of two previous reports about the poor results of bed rest[4,5] and suggest that as little as two days of bed rest may lead to a slower recovery than the avoidance of bed rest, as well as to longer sick leaves. A study of young, healthy army recruits found that bed rest led to substantially more improvement after two weeks than a regimen in which the recruits did not participate in any physical exercise but were on their feet the whole day.[3] It may be that excessive walking and standing delayed recovery in this latter group. This would accord with our results, which show that even light exercise resulted in a slower recovery after three weeks.

In a recent, careful review of the effectiveness of physiotherapy in patients with acute, nonspecific low back pain, only one of four randomized, controlled trials was found to show a positive effect of exercise therapy in such patients.[18] That study used back-extension exercises,[6] but the treatment regimen differed from that in our study, as did the recommendations for the control group, since those patients were advised to rest several times each day. In a recent study, an exercise treatment was found not to be effective in patients with acute low back pain.[7]

Our economic analysis showed that the cost associated with continuing normal activity was somewhat lower than that of treatment with either bed rest or back-mobilizing exercises. When a monetary value was applied to the home help needed in the various groups, that value was lowest for the controls and highest for the patients in the exercise group. However, because of the wide variation among patients in the costs and use of services, the differences between groups were not statistically significant. If a cost–benefit analysis based on the value of human capital were used, with a monetary value placed on lost production due to absence from work,[14] the control treatment would definitely emerge as the most economical.

Our controlled study of workers with acute low back pain suggests that avoiding bed rest and maintaining ordinary activity as tolerated lead to the most rapid recovery. Widespread use of this approach in clinical practice would result in substantial monetary savings.

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