ABSTRACT—In a study testing whether the relationship between exercise and health is moderated by one’s mind-set, 84 female room attendants working in seven different hotels were measured on physiological health variables affected by exercise. Those in the informed condition were told that the work they do (cleaning hotel rooms) is good exercise and satisfies the Surgeon General’s recommendations for an active lifestyle. Examples of how their work was exercise were provided. Subjects in the control group were not given this information. Although actual behavior did not change, 4 weeks after the intervention, the informed group perceived themselves to be getting significantly more exercise than before. As a result, compared with the control group, they showed a decrease in weight, blood pressure, body fat, waist-to-hip ratio, and body mass index. These results support the hypothesis that exercise affects health in part or in whole via the placebo effect.

The placebo effect is any effect that is not attributed to an actual pharmaceutical drug or remedy, but rather is attributed to the individual’s mind-set (mindless beliefs and expectations). The therapeutic benefit of the placebo effect is so widely accepted that accounting for it has become a standard in clinical drug trials to distinguish pharmaceutical effects from the placebo effect and the placebo effect from other possible confounding factors, including spontaneous remission and the natural history of the condition (Benson & McCallie, 1979; Brody, 1980; Nesbitt Shanor, 1999; Spiro, 1986). Kirsh and Sapirstein (1998), in a meta-analysis of 2,318 clinical drug trials for antidepressant medication, found that a quarter (25.16%) of the patients’ responses were due to the actual drug effect, another quarter (23.87%) were due to the natural history of depression, and half (50.97%) were due to the placebo effect.

EXERCISE AND THE PLACEBO EFFECT

As the most common health threats are now infectious rather than chronic, remedies have also changed. Doctors now prescribe behavioral changes such as exercise for chronic diseases like diabetes, heart disease, and even cancer. We wondered whether the well-known benefits of exercise are in whole or in part the result of the placebo effect. A positive finding would speak to the potentially powerful psychological control people have over their health.

There is evidence supporting the idea that the placebo effect plays a role in occasioning the psychological benefits associated with exercise (Desharnais, John, Cote, Levesque, & Godin, 2004).
Exercise and the Placebo Effect

Method

Logic
The Surgeon General has stated that all adults should accumulate at least 30 min of physical exercise per day for a healthy lifestyle (Centers for Disease Control and Prevention, CDC, 1996). Everyday moderate physical activity can be achieved by taking a brisk walk, climbing the stairs, or performing active housework (CDC, 1996). Although many people today have sedentary jobs, there are some jobs that are intrinsically physical. Hotel room attendants, for example, clean on average 15 rooms a day (each room taking between 20 and 30 min to complete), and engage in exerting activities that require walking, bending, pushing, lifting, and carrying, clearly meeting and exceeding the Surgeon General’s requirements. Room attendants may not perceive their work as exercise. If they do not, and if the relationship between exercise and health is moderated by mind-set as we hypothesize, then these workers may not be receiving the full health benefits of their exercise. Similarly, if their mind-sets are shifted so that they become aware of the exercise they are getting, then health improvements would be expected to follow.

Design
Each of seven hotels was randomly assigned to one of two conditions: informed or control.

Subjects in the informed condition received a write-up discussing the benefits of exercise and were informed that their daily housekeeping work satisfied the CDC’s recommendations for an active lifestyle. Specifically, they were told that exercise does not need to be hard or painful to be good for one’s health, but that it is simply a matter of moving one’s muscles and burning calories (accumulating approximately 200 calories per day to meet the recommendations). They were given specific details of the average calorie expenditure for various activities (changing linens for 15 min burns 40 calories, vacuuming for 15 min burns 50 calories, and cleaning bathrooms for 15 min burns 60 calories), and they were told that although these figures were based on results for a 140-pound woman and each of them would burn calories at a different rate, it was clear that they were easily meeting and even exceeding the Surgeon General’s recommendations. This sheet, written in both English and Spanish, was read and explained to the subjects and then posted on the bulletin board in their lounge.

The subjects were told we were interested in getting information on their health so that we could study ways to improve it, and in return for helping, they would receive information about research on health and happiness.

Subjects in the control group were given all the same information as those in the informed group except they did not receive information about how their work is good exercise until after the second set of measures was taken (see Procedure).

Subjects
Subjects were recruited through hotels. To prevent information contamination, we assigned all room attendants within a hotel to the same condition. Four hotels were assigned to the informed
condition, and three were assigned to the control condition. The 
hotels were matched for similarity: The two same-franchise 
hotels, the two condominium-type hotels, and the two unique, 
luxury hotels were in different conditions. The hotels did not 
differ with respect to managerial structure, and all followed the 
Equal Employment Opportunity (EEO) codes and did not dis- 

criminate on the basis of age, gender, ethnic background, reli-
gious background, or sexual orientation, although all subjects 
in this study were female. No information regarding subjects’ 
characteristics (age or ethnicity) was known when the hotels 
were assigned to the conditions.

In total, 84 subjects completed both sets of measures (44 in 
the informed group, 40 in the control group). The subjects’ ages 
ranged from 18 to 55 years, and most were Hispanic, although 
some were Caucasian, African American, and Asian. All worked 
32 to 40 hr per week and cleaned approximately 15 rooms per 
day. Statistical analysis revealed that at the onset of the inves-
tigation, the groups did not differ significantly except in age.1

This unexpected difference was controlled for in all analyses.

Procedure
All subjects were told that the purpose of the study was to find 
ways to improve the health and happiness of women in a hotel 
workplace. Each subject was given a questionnaire, and while 
the subjects were filling it out, they were taken one at a time to 
complete their physiological measures. The informed group was 
then given the information about how their work is good exer-
cise; this information was conveyed in the form of a verbal 
presentation, through individual handouts, and on larger posters 
tacked to the bulletin boards in their lounge in the hope that they 
would be reminded of how much exercise they were getting each 
day. The control group was not given this information.

Four weeks later, we returned to take the same measures, and 
all subjects were debriefed both orally and in writing. Each 
session took approximately 1 hr.

Measures
Self-Reported Exercise
The study was designed to instigate an increase in perceived 
exercise independent of actual exercise. Self-reported exercise 
was assessed through a series of questions. First, subjects were 
asked to check “yes” or “no” to indicate whether or not they 
exercised regularly (perceived regular exercise). Second, they 
used a scale from 0 to 10 to rate how much exercise they got 
(perceived amount of exercise). Following these questions, they 
were asked to describe how they got their exercise. These de-
scriptions were used for the measures of perceived work as ex-
ercise (i.e., whether or not subjects referenced their work) and 

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1Subjects in the informed group (mean age = 34.12, SD = 9.23) were sig-
nificantly younger than subjects in the control group (mean age = 42.40, SD = 
12.54), F(1, 81) = 11.86, p_{rep} = .986.

exercise outside of work (i.e., whether or not subjects named 
activities such as swimming, running, doing sit ups, or other 
non-work-related activities). Additional questions asked how 
often subjects attended a gym and whether or not they walked to 
work each day.

It was assumed, and later confirmed by the hotel house-
keeping managers, that the workload of the room attendants 
remained constant in the 30 days prior to and the 30 days during 
the study. Therefore, if there was no increase in reported exer-
cise outside of work, any increase in perceived regular exercise, 
perceived amount of exercise, or perceived work as exercise 
would be assumed to reflect a change in mind-set initiated by the 
intervention and not due to an increase in actual exercise.

Dependent Variables: Physiological Measures
Weight and percentage of body fat were measured using the 
Tanita Body Fat Monitor/Scale (Model UM-026, Tanita Manu-
ufacturing Co., Tokyo, Japan). In addition to giving a normal 
weight reading (to the closest 1/10 pound), this model measures 
body fat using a simplified version of bioelectrical impedance 
analysis that uses leg-to-leg bioimpedance analysis. After 
weight and impedance are measured, computer software (a 
microprocessor) embedded in the product uses the measured 
impedance, the subject’s weight, and the subject’s gender, 
height, and age (which are entered in) to determine the per-
centage of body fat and body water, according to equation for-
ulas. Tanita’s standard formulas have been derived by multiple 
regression analysis, using the institutional standard, dual-en-
ergy x-ray absorptiometry (DEXA), as a reference.5

Body mass index (BMI) was calculated after the fact using the 
following equation: [(weight in pounds)/(height in inches × 
height in inches)] × 703. BMI expresses weight as adjusted for 
height.

Waist-to-hip ratio (WHR) was measured by a tape measure 
and calculated as the waist circumference divided by the hip 
circumference. Waist measurements were taken at the midpoint 
between the upper iliac crest and lower costal margin in the 
midaxillary line (the narrowest point of the waist). Hip cir-
cumference was measured at the largest point around the but-
tocks or gluteofemoral fold.

Blood pressure (BP) was measured using the HEM-711AC 
OMRON Automatic Blood Pressure Monitor with IntelliSense 
(OMron Co., Tokyo, Japan). The OMRON monitor uses the 
oscillometric method of BP measurement, detecting blood’s 
movement through the brachial artery and converting it to a 
digital reading of systolic and diastolic blood pressure.

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5Initial and final measurements were taken at the same time of day (morning). 
(Body-fat readings are normally highest in the morning; therefore, because 
measures were taken in the morning, these readings may be higher than nor-
mal.) In addition, measures were taken 4 weeks apart to eliminate the hydration 
fluctuation involved in a woman’s menstruation cycle. Clothing weight was 
accounted for by virtue of the fact that the women wore the same uniforms at the 
two sessions.
**RESULTS**

**Change in Self-Reported Exercise**

Subjects’ self-reported exercise was examined using 2 (time: Time 1, Time 2; within subjects) × 2 (condition: control, informed; between subjects) repeated measures analyses of variance (ANOVA). These analyses yielded no significant effects for exercise outside of work. Perceived amount of exercise, however, showed main effects of time, for exercise outside of work. Perceived amount of exercise, and condition, $F(1, 65) = 4.79, p_{rep} = .910, \eta^2 = .07$, which were qualified by a significant interaction, $F(1, 65) = 6.34, p_{rep} = .955, \eta^2 = .09$ (see Table 1). Simple effects tests demonstrated that subjects in the informed condition reported higher levels of perceived amount of exercise at Time 2 than did subjects in the control condition, $t(38) = 6.72, p_{rep} > .99$, whereas there were no significant differences between conditions at Time 1, $t(52) = 0.40, p_{rep} = .749$. Similar results were found for perceived regular exercise and perceived work as exercise. Thus, the experimental group increased their perceived exercise over the course of the study, whereas the control group did not, and neither group increased their actual levels of activity. Table 1 shows the means and standard deviations for these changes, which are illustrated graphically in Figure 1.

**Change in Dependent Variables: Physiological Measures**

Repeated measures 2 (time: Time 1, Time 2; within subjects) × 2 (condition: control, informed; between subjects) ANOVAs yielded a significant interaction effect for weight, $F(1, 71) = 10.39, p_{rep} = .984, \eta^2 = .13$; percentage of body fat, $F(1, 49) = 7.31, p_{rep} = .958, \eta^2 = .13$; BMI, $F(1, 67) = 7.344, p_{rep} = .958, \eta^2 = .10$; WHR, $F(1, 67) = 7.46, p_{rep} = .961, \eta^2 = .10$; and systolic BP, $F(1, 67) = 7.34, p_{rep} = .958, \eta^2 = .10$. No significant differences were found in diastolic BP. Table 1 presents the means and standard deviations of these variables, which are illustrated graphically in Figure 2.

**Change in Dependent Variables: Behavioral Measures**

As mentioned, repeated measures ANOVAs yielded no significant effects for subjects’ responses regarding exercise outside of work. Similarly, there were no significant changes in subjects’ substance abuse and diet.

**DISCUSSION**

**Mind-Set Matters**

This study did not test the placebo effect in the traditional manner, in which expectations are aroused through inert pills or sham procedures. Rather, subjects were actually engaging in a behavior that is clinically proven to have positive effects on the physiological variables measured (e.g., CDC, 1996; Hubert, Feinleib, McNamara, & Castelli, 1983; Lee, Mansor, Hennekens, & Paffenbarger, 1993; Press, Freestone, & George, 2003; Raglan & Morgan, 1987; Schnohr, Scharling, & Jensen, 2003; Tipton, 1984). To determine if the placebo effect plays a role in the benefits of exercise, this study investigated whether subjects’ mind-set (in this case, their perceived levels of exercise) could inhibit or enhance the health benefits of exercise independently of actual exercise.

Although it is clear that the room attendants studied met or exceeded the Surgeon General’s recommendations for physical

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**TABLE 1**

<table>
<thead>
<tr>
<th>Dependent measure and group</th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived amount of exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informed</td>
<td>3.76 (3.44)</td>
<td>5.74 (3.48)**</td>
</tr>
<tr>
<td>Control</td>
<td>3.17 (3.42)</td>
<td>3.21 (2.67)</td>
</tr>
<tr>
<td>Perceived regular exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informed</td>
<td>0.42 (0.55)</td>
<td>0.68 (0.50)**</td>
</tr>
<tr>
<td>Control</td>
<td>0.39 (0.55)</td>
<td>0.36 (0.53)</td>
</tr>
<tr>
<td>Perceived work as exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informed</td>
<td>0.29 (0.47)</td>
<td>0.45 (0.50)**</td>
</tr>
<tr>
<td>Control</td>
<td>0.23 (0.43)</td>
<td>0.15 (0.40)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physiological variables</th>
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<tbody>
<tr>
<td>Weight</td>
<td>Informed</td>
<td>145.5 (22.4)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>146.92 (23.2)</td>
</tr>
<tr>
<td>Body mass index</td>
<td>Informed</td>
<td>26.05 (3.0)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>26.89 (4.8)</td>
</tr>
<tr>
<td>Body-fat percentage</td>
<td>Informed</td>
<td>34.84 (6.3)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>35.71 (4.9)</td>
</tr>
<tr>
<td>Waist-to-hip ratio</td>
<td>Informed</td>
<td>0.834 (0.05)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>0.853 (0.06)</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>Informed</td>
<td>129.55 (24.3)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>128.87 (22.1)</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>Informed</td>
<td>79.55 (17.48)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>77.80 (12.85)</td>
</tr>
</tbody>
</table>

*Note. Standard deviations are given in parentheses. Paired-sample t tests indicated that on each of these variables, the informed group differed significantly between Time 1 and Time 2 (*p < .05, **p < .01, ***p < .001).
activity, initial measures suggest that the subjects were not aware that their work is good exercise. At the onset of the experiment, 66.6% of subjects reported not exercising regularly, and 36.8% reported not getting any exercise. Interestingly, the health of the room attendants reflected their perceived levels of exercise rather than their actual levels: According to their initial physiological measures, the subjects were at risk with respect to BP, BMI, percentage of body fat, and WHR—all important indicators of health. These results suggest the possibility that at the onset of the study, the room attendants were not receiving the

![Fig. 1. Changes in self-reported exercise as a function of time and group. Bars denote standard errors of the means.](image1)

![Fig. 2. Changes in physiological dependent variables as a function of time and group. Bars denote standard errors of the means. BMI = body mass index.](image2)
full benefits of their exercise because they were not aware that they were getting exercise at work. Of course, there may have been many confounding reasons (e.g., genetics or diet) why these women were unhealthy despite their intense activity levels.

Over the course of the study, the percentage of informed subjects who reported exercising regularly (perceived regular exercise) doubled (39.4% to 79.4%), and the average amount of exercise that subjects in the informed group believed themselves to be getting (perceived amount of exercise) increased by more than 20%. It is important to note that although the informed room attendants did report higher levels of exercise at the end of the study, they did not report getting any additional exercise outside of work. In addition, although the subjects in the informed group showed a significant increase in recognizing their work as a form of exercise, their actual workload did not change. Thus, the changes in reported physical activity appear to be attributable not to actual increases in physical activity, but to a shift in mind-set initiated by the information given to them in the intervention.

This shift in mind-set in the informed group was accompanied by remarkable improvement in physiological measures associated with exercise. After only 4 weeks of knowing that their work is good exercise, the subjects in the informed group lost an average of 2 pounds, lowered their systolic BP by 10 points, and were significantly healthier as measured by body-fat percentage, BMI, and WHR. These were small but meaningful changes given the state of health the subjects were in, especially considering that the change occurred in just 4 weeks. All of these changes were significantly greater than the changes in the control group. These results support our hypothesis that increasing perceived exercise independently of actual exercise results in subsequent physiological improvements.

But How?
How exactly did the change in mind-set bring about such significant physiological changes? Conventional science assumes that in order for weight to be lost and body fat to be reduced, certain biological and physiological events must also take place. In the case of BP, it is assumed that it is lowered during exercise because the peripheral blood vessels are dilated, and that, over time, the attenuating effect of exercise on the sympathetic nervous system’s activity helps to reduce rennin-angiotensin system activity, reset baroreceptors, and promote arterial vasodilation (which helps to control BP; CDC, 1996). In the case of weight, it is assumed that exercise helps to reduce body fat by increasing energy expenditure: To the extent that energy expenditure exceeds caloric intake, the result is weight loss (theoretically, about 1 pound of fat energy is lost for each additional 3,500 kilocalories burned; CDC, 1996).

Given this knowledge, one interpretation of our results regarding the relationship between increased perceived exercise and improved health would be that they were mediated by a change in behavior. The data collected in this study, however, do not support this conclusion. As mentioned, the room attendants did not report any increase in exercise outside of work, nor did they experience any increase in workload over the course of the study. In addition, the subjects reported their habits had not changed over the past 30 days with respect to how much they ate (including servings of sugary foods and vegetables) and how much they drank (caffeine, alcohol, and water). Thus, neither increased exercise nor decreased caloric intake was reported by the subjects.

Of course, it is possible that the room attendants actually did change their behavior—actually did cut back on calories, improve the quality of the food they ate, or work harder or more energetically—but did not report such changes. However, previous research has found it very difficult to change behavior of this sort (Deutschman, 2005). Thus, even if these behavioral changes did occur as a result of the intervention, that too would make these results interesting.

In summary, the data collected in this study, coupled with previous research indicating the difficulty of changing behavior, make it unlikely that the relationship between mind-set and improvements in health was mediated by a change in behavior. In either case, whether the change in physiological health was brought about directly or indirectly, it is clear that health is significantly affected by mind-set.

**IMPLICATIONS AND FUTURE RESEARCH**

The results of this study provide another example of the power of the placebo effect. The moderating role of mind-set and its ability to enhance health should be identified further, substantiated, and utilized. The present results may have particular relevance for treating diseases associated with a sedentary lifestyle.

There is still no generally accepted, scientifically grounded model substantiating the relationship between mind-set and health, although several models have been proposed (see Loveallo, 2005). The present findings warrant investigation in this area.

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*The fact that these subjects significantly reduced body-fat percentage in addition to significantly losing weight makes the weight loss even more important because it indicates that these women lost body fat rather than water weight.

*In an effort to make BP readings as reliable as possible, we controlled for several variables that are known to cause fluctuation: substance abuse (subjects reported no significant changes in alcohol, caffeine, or tobacco use during the study), diet (subjects reported no significant change in diet), time of day (BP was taken at the same time of day in the two sessions), hormonal regulation (BP was taken 4 weeks apart to control for fluctuation due to menstruation), heart rate (there was no significant difference in heart rate between Time 1 and Time 2), and immediate physical activity (BP was measured both times after subjects had been sitting for at least 10 min, to ensure that resting BP was measured).

*Future research might benefit from using measures (e.g., pedometers, food journals, or other people's assessment of diet and activity levels) to enhance control for these variables.
People have mindlessly overlooked what it means that placebos are inert. Ultimately, each individual is responsible for their effects. Recognizing this suggests that it is time for us all to explore more direct means of controlling our health, such as pursuing mindfulness (see Langer, 1989) as a tool to actively and deliberately change our mind-sets.

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