



DIGITAL ACCESS TO SCHOLARSHIP AT HARVARD

Mind-set Matters: Exercise and the Placebo Effect

The Harvard community has made this article openly available.
[Please share](#) how this access benefits you. Your story matters.

Citation	Crum, Alia J., and Ellen J. Langer. 2007. Mind-set matters: Exercise and the placebo effect. <i>Psychological Science</i> 18, no. 2: 165-171.
Published Version	doi:10.1111/j.1467-9280.2007.01867.x
Accessed	September 25, 2017 9:25:09 AM EDT
Citable Link	http://nrs.harvard.edu/urn-3:HUL.InstRepos:3196007
Terms of Use	This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA

(Article begins on next page)

Research Article

Mind-Set Matters

Exercise and the Placebo Effect

Alia J. Crum and Ellen J. Langer

Harvard University

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.

Address correspondence to Alia Crum or Ellen Langer, Department of Psychology, Harvard University, 1330 William James Hall, 33 Kirkland St., Cambridge, MA 02138, e-mail: ajc@post.harvard.edu or langer@wjh.harvard.edu.

The placebo effect extends much further than medications or therapy: Subjects exposed to fake poison ivy developed real rashes¹ (Blakeslee, 1998), people imbibing placebo caffeine experienced increased motor performance and heart rate (and other effects congruent with the subjects' beliefs and not with the pharmacological effects of caffeine; Kirsch & Sapirstein, 1998), and patients given anesthesia and a fake knee operation experienced reduced pain and swelling in their "healed" tendons and ligaments (Blakeslee, 1998). More generally, studies suggest that 60 to 90% of drugs and other therapies prescribed by physicians depend on the placebo effect for their effectiveness (Benson & Freedman, 1996; Nesbitt Shanor, 1999).

The placebo effect does not have to involve inert pills or sham procedures. Symbols, beliefs, and expectations can elicit powerful physiological occurrences, both positive and negative (Hahn & Kleinman, 1983; Roberts, Kewman, & Mercie, 1993). For example, the mere presence of a doctor increases patients' blood pressure (the "white coat effect"), reinterpreting pain in nonthreatening ways (e.g., as sensations) prompts patients to take fewer sedatives and leave the hospital sooner; and the health decline of cancer patients often has less to do with the actual course of the illness and more to do with their negative expectations regarding the disease (Langer, 1989).

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, Jobin, Cote, Levesque, & Godin,

¹When negative expectations are met with negative results, the placebo effect is often called the *nocebo effect* (Hahn, 1997).

1993; Plante, Lantis, & Checa, 1998; Plante & Rodin, 1990). Desharnais et al. conducted an experiment on 48 healthy young adults engaged in a supervised 10-week exercise program. Half of the subjects (the experimental condition) were led to believe that the program was specifically designed to improve psychological well-being. The other half were not told anything about these benefits; instead, the emphasis was on the biological aspect of the program. Although the results showed similar increases in fitness in the two conditions, the subjects in the experimental condition showed a significant increase in self-esteem.

Although studies have yet to investigate whether the perception of physical activity and resulting beliefs about one's health have effects on the physiological benefits associated with physical activity, several studies allude to the possibility. Health perceptions have been related to actual health. For example, Kaplan and Camacho (1983), in a cohort study of 6,928 adults, found that perceived health was a better predictor of mortality than actual health. Idler and Kasl (1991) concluded that elderly persons who perceive their health as poor are 6 times more likely to die than those who perceive their health as excellent, regardless of actual health status.

Further support for the possibility of the placebo effect in the benefits of exercise comes from the fact that the numerous studies linking exercise to health have generally relied on self-reported information to measure physical activity (Plante & Rodin, 1990); the results of these studies therefore reflect the relationship between health and perceived levels of physical activity, rather than actual levels. This raises the question of whether some of the positive gains of physical activity are due more to the perception of exercise and its association with health than to the actual performance of exercise.

In the study we report here, we investigated the role of the placebo effect (the moderating role of mind-set) in the relationship between exercise and health. We hypothesized that the placebo effect plays a role in the health benefits of exercise: that one's mind-set mediates the connection between exercise and one's health. If this hypothesis is true, increasing perceived exercise, independent of actual exercise, would be expected to result in subsequent health benefits (a 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.² 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.³

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

²This information is based on extensively researched recommendations for exercise and calorie expenditure made by the CDC, American College of Sports Medicine, and Surgeon General (Pate, Pratt, Blair, et al., 1995, as cited in CDC, 1996).

³All of the written information was translated into Spanish, and each hotel had a designated and qualified supervisor to translate the verbal information and instruction to the subjects.

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 discriminate on the basis of age, gender, ethnic background, religious 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 investigation, the groups did not differ significantly except in age.⁴ 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 exercise; 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 descriptions were used for the measures of *perceived work as exercise* (i.e., whether or not subjects referenced their work) and

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 exercise 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 Manufacturing 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 percentage of body fat and body water, according to equation formulas. Tanita's standard formulas have been derived by multiple regression analysis, using the institutional standard, dual-energy 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 circumference was measured at the largest point around the buttocks 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.

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 normal.) 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.

⁴Subjects in the informed group (mean age = 34.12, *SD* = 9.23) were significantly younger than subjects in the control group (mean age = 42.40, *SD* = 12.54), $F(1, 81) = 11.86$, $p_{\text{rep}} = .986$.

Dependent Variables: Behavioral Measures

In addition to assessing changes in exercise outside of work (including gym attendance, walking to work, or other non-work-related physical activities), we assessed *substance abuse and diet* through questions asking subjects to reflect on their habits over the past 30 days, including how much they ate relative to their normal intake, how many cigarettes they smoked, how many servings of vegetables and sugary foods they ate, and how many glasses of caffeinated beverages, alcoholic beverages, and water they drank.

RESULTS**Change in Self-Reported Exercise**

Subjects' self-reported exercise was examined using 2 (time: Time 1, Time 2; within subjects) \times 2 (condition: control, informed; between subjects) repeated measures analyses of variance (ANOVAs). These analyses yielded no significant effects for exercise outside of work. Perceived amount of exercise, however, showed main effects of time, $F(1, 65) = 6.80$, $p_{\text{rep}} = .955$, $\eta^2 = .10$, and condition, $F(1, 65) = 4.79$, $p_{\text{rep}} = .910$, $\eta^2 = .07$, which were qualified by a significant interaction, $F(1, 65) = 6.34$, $p_{\text{rep}} = .955$, $\eta^2 = .09$ (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, $t(38) = 6.72$, $p_{\text{rep}} > .99$, whereas there were no significant differences between conditions at Time 1, $t(52) = 0.40$, $p_{\text{rep}} = .749$. 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) \times 2 (condition: control, informed; between subjects) ANOVAs yielded a significant interaction effect for weight, $F(1, 71) = 10.89$, $p_{\text{rep}} = .984$, $\eta^2 = .13$; percentage of body fat, $F(1, 49) = 7.31$, $p_{\text{rep}} = .958$, $\eta^2 = .13$; BMI, $F(1, 67) = 7.344$, $p_{\text{rep}} = .958$, $\eta^2 = .10$; WHR, $F(1, 67) = 7.46$, $p_{\text{rep}} = .961$, $\eta^2 = .10$; and systolic BP, $F(1, 67) = 7.34$, $p_{\text{rep}} = .958$, $\eta^2 = .10$. 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.

TABLE 1**Self-Reported Exercise and Significant Dependent Variables by Time and Condition**

Dependent measure and group	Time 1	Time 2
Self-reported exercise		
Perceived amount of exercise		
Informed	3.76 (3.41)	5.74 (3.48)***
Control	3.17 (3.42)	3.21 (2.67)
Perceived regular exercise		
Informed	0.42 (0.5)	0.68 (0.5)**
Control	0.39 (0.5)	0.36 (0.5)
Perceived work as exercise		
Informed	0.29 (0.4)	0.45 (0.5)**
Control	0.23 (0.4)	0.15 (0.4)
Physiological variables		
Weight		
Informed	145.5 (22.4)	143.72 (22.7)***
Control	146.92 (23.2)	146.71 (23.0)
Body mass index		
Informed	26.05 (3.8)	25.70 (3.8)***
Control	26.89 (4.8)	26.86 (4.8)
Body-fat percentage		
Informed	34.84 (6.3)	34.34 (6.3)*
Control	35.71 (4.9)	35.89 (4.79)
Waist-to-hip ratio		
Informed	0.834 (0.05)	0.826 (0.06)**
Control	0.853 (0.06)	0.855 (0.06)
Systolic blood pressure		
Informed	129.55 (24.3)	119.9 (19.8)**
Control	128.87 (22.1)	127.27 (21.73)
Diastolic blood pressure		
Informed	79.55 (17.48)	74.88 (14.47)*
Control	77.80 (12.85)	75.03 (11.60)

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 (* $p < .05$, ** $p < .01$, *** $p < .001$).

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, Manson, 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

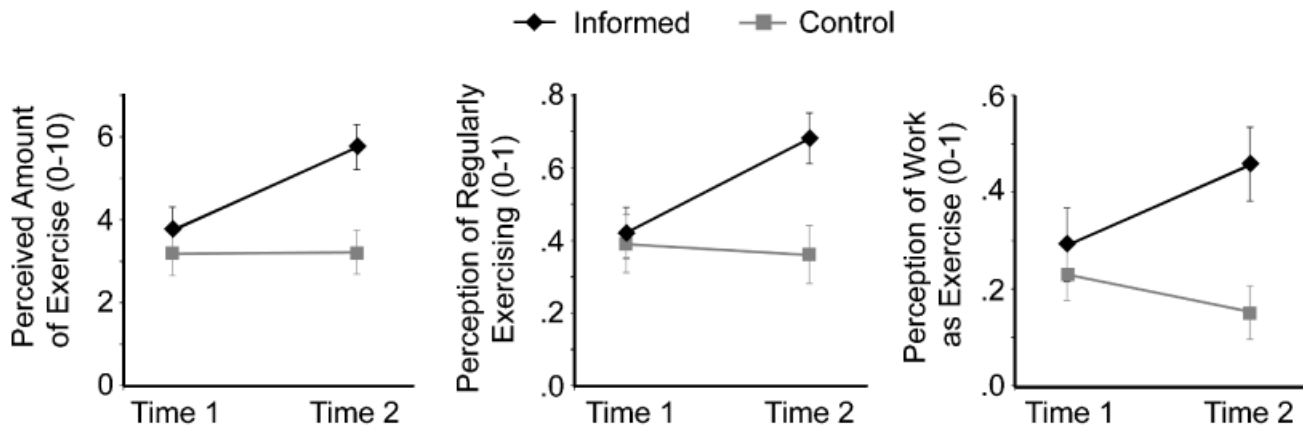


Fig. 1. Changes in self-reported exercise as a function of time and group. Bars denote standard errors of the means.

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

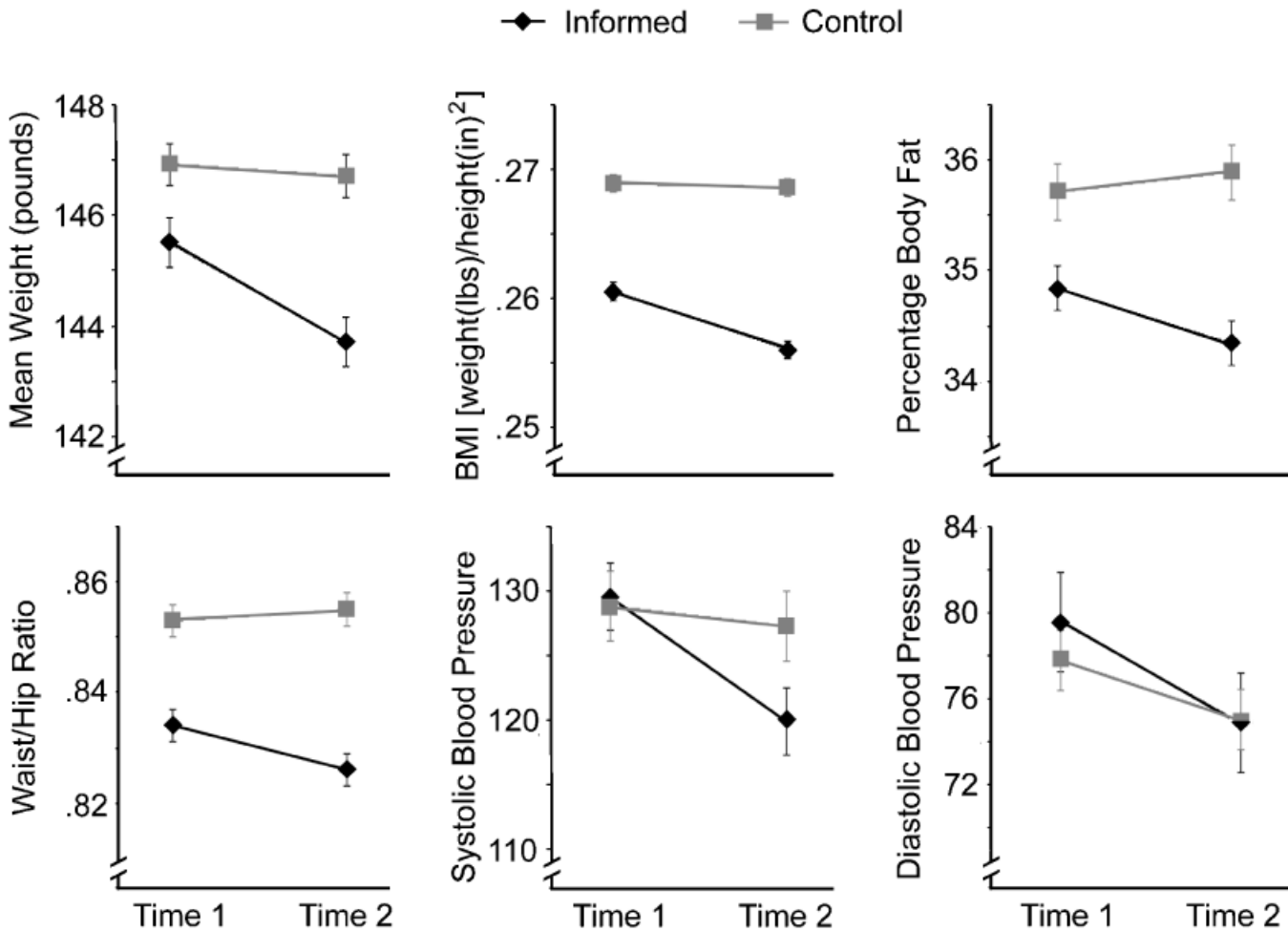


Fig. 2. Changes in physiological dependent variables as a function of time and group. Bars denote standard errors of the means. BMI = body mass index.

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,⁶ lowered their systolic BP by 10 points,⁷ 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.⁸ 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 Lov-allo, 2005). The present findings warrant investigation in this area.

⁸Future 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.

⁶The 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.

⁷In 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).

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.

Acknowledgments—The authors wish to thank Cathy Crum, Maja Dijikic, Adam Grant, and Carey Morwedge for their comments on this manuscript.

REFERENCES

- Benson, H., & Friedman, R. (1996). Harnessing the power of the placebo effect and renaming it “remembered wellness.” *Annual Review of Medicine*, *47*, 193–199.
- Benson, H., & McCallie, D.P. (1979). Angina pectoris and the placebo effect. *The New England Journal of Medicine*, *300*, 1424–1429.
- Blakeslee, S. (1998, October 13). Placebos prove so powerful even experts are surprised. *New York Times Science Times*, F1.
- Brody, H. (1980). *Placebos and the philosophy of medicine*. Chicago: University of Chicago Press.
- Centers for Disease Control and Prevention. (1996). *Physical activity and health: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services.
- Desharnais, R., Jobin, J., Cote, C., Levesque, L., & Godin, G. (1993). Aerobic exercise and the placebo effect: A controlled study. *Psychosomatic Medicine*, *55*, 149–154.
- Deutschman, A. (2005). Change or die. *Fast Company*, *94*, 53.
- Hahn, R.A. (1997). The nocebo phenomenon: Scope and foundations. In A. Harrington (Ed.), *The placebo effect: An interdisciplinary exploration* (pp. 56–76). Cambridge, MA: Harvard University Press.
- Hahn, R.A., & Kleinman, A. (1983). Belief as pathogen, belief as medicine: “Voodoo death” and the “placebo phenomenon” in anthropological perspective. *Medical Anthropology Quarterly*, *14*, 16–19.
- Hubert, H.B., Feinleib, M., McNamara, P.M., & Castelli, W.P. (1983). Obesity as an independent risk factor for cardiovascular disease: A 26 year follow-up of participants in the Framingham Heart Study. *Circulation*, *67*, 968–977.
- Idler, E., & Kasl, S. (1991). Health perceptions and survival: Do global evaluations of health status predict mortality? *Journals of Gerontology*, *46*(2), S55–S65.
- Kaplan, G.A., & Camacho, T. (1983). Perceived health and mortality: A nine-year follow-up of the Human Population Laboratory cohort. *American Journal of Epidemiology*, *117*, 292–304.
- Kirsch, I., & Sapirstein, G. (1998). Listening to Prozac but hearing placebo: A meta-analysis of antidepressant medication. *Prevention & Treatment*, *1*, Article 0002a. Retrieved November 10, 2004, from <http://journals.apa.org/prevention/volume1/pre0010002a.html>
- Langer, E. (1989). *Mindfulness*. Cambridge, MA: Perseus Books Group.
- Lee, I.M., Manson, J.E., Hennekens, C.H., & Paffenbarger, R.S. (1993). Body weight and mortality: A 27 year follow up of middle aged men. *Journal of the American Medical Association*, *270*, 2823–2828.
- Lovallo, W. (2005). *Stress and health: Biological and psychological interactions*. Thousand Oaks, CA: Sage.
- Nesbitt Shanor, K. (1999). *The emerging mind: New research into the meaning of consciousness, based on the Smithsonian Institution lecture series*. Los Angeles: Renaissance Books.
- Plante, T.G., Lantis, A., & Checa, G. (1998). The influence of perceived versus aerobic fitness on psychological health and physiological stress responsivity. *International Journal of Stress Management*, *5*, 141–156.
- Plante, T.G., & Rodin, J. (1990). Physical fitness and enhanced psychological health. *Current Psychology: Research and Reviews*, *9*(1), 3–24.
- Press, V., Freestone, I., & George, C.F. (2003). Physical activity: The evidence of benefit in the prevention of coronary heart disease. *Quarterly Journal of Medicine*, *96*, 245–251.
- Raglan, J.S., & Morgan, W.P. (1987). Influence of exercise and quiet rest on state anxiety and blood pressure. *Medicine and Science in Sports and Exercise*, *19*, 456–463.
- Roberts, A.H., Kewman, D.G., & Mercie, L. (1993). The power of nonspecific effects in healing: Implications for psychosocial and biological treatments. *Clinical Psychology Review*, *13*, 375–391.
- Schnohr, P., Scharling, H., & Jensen, J. (2003). Changes in leisure time physical activity and risk of death: An observational study of 7,000 men and women. *American Journal of Epidemiology*, *158*, 639–644.
- Spiro, H.M. (1986). *Doctors, patients, and placebos*. New Haven, CT: Yale University Press.
- Tipton, C.M. (1984). Exercise, training and hypertension. *Exercise and Sports Science Reviews*, *12*, 245–306.

(RECEIVED 1/3/06; REVISION ACCEPTED 5/1/06;
FINAL MATERIALS RECEIVED 5/23/06)