Effects of Recreational Physical Activity and Back Exercises on Low Back Pain and Psychological Distress: Findings From the UCLA Low Back Pain Study

Eric L. Hurwitz, DC, PhD, Hal Morgenstern, PhD, and Chi Chiao, MS, PhD

Objectives. We sought to estimate the effects of recreational physical activity and back exercises on low back pain, related disability, and psychological distress among patients randomized to chiropractic or medical care in a managed care setting.

Methods. Low back pain patients (n=681) were randomized and followed for 18 months. Participation in recreational physical activities, use of back exercises, and low back pain, related disability, and psychological distress were measured at baseline, at 6 weeks, and at 6, 12, and 18 months. Multivariate logistic regression modeling was used to estimate adjusted associations of physical activity and back exercises with concurrent and subsequent pain, disability, and psychological distress.

Results. Participation in recreational physical activities was inversely associated—both cross-sectionally and longitudinally—with low back pain, related disability, and psychological distress. By contrast, back exercise was positively associated—both cross-sectionally and longitudinally—with low back pain and related disability.

Conclusions. These results suggest that individuals with low back pain should refrain from specific back exercises and instead focus on nonspecific physical activities to reduce pain and improve psychological health. (*Am J Public Health.* 2005;95:1817–1824. doi:10.2105/AJPH.2004.052993)

Low back pain is one of the leading reasons for physician visits[1] and is the most common reason for use of complementary and alternative medicine in the United States.[2] Back symptoms are frequently accompanied by depression or anxiety and psychological distress,[3,4] which are principal reasons for use of both conventional and complementary health care.[1,2] Despite the well-known cardiovascular and weight control benefits of regular physical exercise, participation has decreased in recent years,[5] with almost 70% of US adults reporting that they do not engage in regular leisure-time physical activity.[6] Findings from several studies conducted in the United States and elsewhere have shown associations of physical activity with depression and psychological well-being,[7–16] as well as the potential buffering effects of physical fitness or activity on stress.[17–21]

Exercise interventions have been shown in some randomized clinical trials (RCTs) to help prevent low back pain in at-risk populations.[22] However, the bulk of the scientific literature indicates that specific back exercises (e.g., flexion, extension, and strengthening exercises) and instruction in standardized exercises (as advocated by many physical therapists) do not appreciably improve low back pain prognoses.[23,24]

Although the results of observational studies have not been entirely consistent (e.g., Kujala et al.[25]), these investigations have produced evidence pointing to the benefits of leisure-time physical activity in preventing low back pain or improving its prognosis.[26–31] In addition, various published guidelines[32,33] recommend that patients with acute low back pain stay active, and a recent systematic review of RCTs provided corroboration for such a strategy.[34] Nevertheless, no published studies have followed a clinical population over an extended period and collected serial data on reported use of back exercises and leisure time physical activity to estimate separate and unconfounded associations of physical activity and exercise with concurrent and subsequent low back pain, disability, and psychological distress.

We sought to estimate the effects on several outcomes of recreational physical activity and back exercise among low back pain patients participating in a large RCT conducted in a managed care setting. We hypothesized that (1) participation in sport or recreational physical activities would reduce levels of low back pain, disability, and psychological distress and (2) back exercises would not reduce levels of pain, disability, and psychological distress.

METHODS

Study Design and Source Population

Individuals were enrolled from October 30, 1995, through November 9, 1998; follow-up data were collected through June 2000. Baseline for each patient was the date of randomization, which was also the date of their first (baseline) visit and the date that the baseline questionnaire was completed. Individuals presenting for care with low back pain at one of the 3 outpatient care facilities of a multispecialty network of health care providers based in Southern California were randomized, in a balanced design, to 4 treatment groups: chiropractic care with physical modalities, chiropractic care without physical modalities, medical care with physical therapy, and medical care without physical therapy. Follow-up questionnaires were sent to participants at 6 weeks and, after completion of the initial (baseline) questionnaire, at 6, 12, and 18 months. The source population consisted of the approximately 100 000 members of the multispecialty network.

Eligibility Criteria

Patients were eligible for the study if they were health maintenance organization (HMO) members of any HMO; had sought care at one of the 3 sites between October 30, 1995, and November 9, 1998; had presented with a complaint of low back pain; had not received low back pain treatment within the past month; and were at least 18 years old. Potential participants were excluded if their low back pain involved third-party liability or workers' compensation claims or if they (1) had low back pain from a fracture, tumor, infection, or other nonmechanical cause; (2) had severe medical comorbidity; (3) were being treated with electrical devices, such as pacemakers; (4) had a blood coagulation disorder or were using corticosteroids or anticoagulant medications; (5) had progressive lower-limb muscle weakness; (6) had current symptoms or signs of cauda equina syndrome (bilateral radicular symptoms and signs in the lower extremities owing to nerve root compression from large herniated lumbar nucleus pulposus); (7) had plans to move out of the area; (8) were not easily accessible by telephone; or (9) were not fluent in English.

Data Collection

At baseline, participants underwent physical examinations and completed questionnaires, yielding data on sociodemographic, clinical, and psychosocial characteristics; participation in recreational physical activities; and use of back exercises. Follow-up questionnaires addressed participants' health and functional status, low back pain intensity and related disability, physical activity levels, and use of back exercises. Details about patient screening and enrollment and the treatment and follow-up protocols have been provided elsewhere.[35]

Low Back Pain and Disability Measures

Participants used numerical rating scales (0=no pain, 10=unbearable pain) to assess their most severe and average pain intensity during the past week. Such scales have been shown to have excellent reliability and validity for measuring back pain.[36] Participants who assigned to their low back pain ratings of 2 or higher were considered to have clinically meaningful levels of pain.

Low back disability was assessed via the 24-item Roland–Morris Low Back Disability Questionnaire.[37,38] Patients responded by answering yes or no to indicate whether each statement represented a true description of their current disability owing to low back pain. Scores can range from 0 (indicating no disability) to 24 (indicating severe disability). This instrument has been shown to be reliable and valid[37–39] and responsive to change over time.[40–43] Participants with scores of 3 or higher were considered to have clinically meaningful low back disability.[41,44]

Psychological Distress Measure

Psychological distress was measured with an alternate form of the 5-item mental health index (MHI-5)[45] from the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36).[46,47] The MHI-5, which assesses general mental health, including depression, anxiety, behavioral–emotional control, and general positive affect, has been shown to be a reliable indicator of depressive symptoms.[48] The measure is scored on a scale of 0 to 100, with lower scores indicating more psychological distress. Participants scoring below the median (76) were considered to have psychological distress.

Recreational Physical Activity and Back Exercise Measures

At baseline and at each follow-up point, participants were asked how many hours per week, on average, they engaged in walking and 1 or more light, moderate, and strenuous sport or recreational physical activities. Metabolic equivalent task (MET) values were assigned to each activity, and MET scores were calculated for each participant.[49] The MET score measures metabolic energy cost expressed as a multiple of the resting metabolic rate (the higher the score, the greater the energy expenditure from physical activity). Quartiles were then formed for activity-specific and total METs.

At baseline and at each follow-up point, participants were also queried about the frequency with which they had engaged in back exercises specifically intended to prevent or to deal with low back pain during the past week. Response options were never, seldom (less than 1 day), sometimes (1–3 days), and often (4–7 days).

Other Variables

Other variables measured at baseline for descriptive or analytic purposes included age, gender, race/ethnicity, education level, marital status, employment status, self-perceived general health status, scores on 4 additional SF-36 subscales,[46] duration of current low back pain episode, number of previous episodes, score on the Internal Health Locus of Control scale from the Multidimensional Health Locus of Control Scales,[50] and items focusing on patients' social support networks and strategies for coping with pain. At baseline and at each follow-up assessment, participants were also asked to report the number of hours per week they engaged in muscle strengthening and flexibility exercises.

Data Analysis

Linear and logistic regression models were used to estimate cross-sectional and longitudinal associations of back exercise and recreational physical activity with low back pain, low back disability, and psychological distress. Generalized estimating equations with robust standard error estimates were used to take into account within-subject correlations during the 18-month follow-up period.[51–53] Because findings from the linear and logistic analyses were similar, we present only the logistic model results. Estimated associations are described in the form of adjusted odds ratios (ORs) and 95% confidence intervals (CIs). SAS was used to manage and analyze data; the GENMOD procedure was for generalized estimating equations (GEE) estimation.[54,55]

Low back pain, low back disability, and psychological distress were dichotomized at various cutpoints in preliminary models. Because findings did not vary appreciably according to the cutpoint used, results are presented here for the models for the "clinically meaningful" cutpoints. We found little evidence of different effects according to intensity of sport or recreational activity (e.g., walking or light, moderate, and strenuous activities), and thus we limited our presentation to total MET values derived from all reported sport and recreational activities.

Separate models were fit to estimate cross-sectional and longitudinal associations of back exercise and recreational physical activity with each low back pain, disability, and psychological distress outcome. Data from the 6-week and the 6-, 12-, and 18-month follow-up assessments were assessed simultaneously in all analyses. Covariates included in the cross-sectional models were age, gender, baseline duration of low back pain, number of previous episodes of pain, assigned treatment group, social support, strategy for coping with pain, internal locus of control, baseline MHI-5 score, baseline outcome variable value, muscle strengthening and flexibility exercising, and follow-up week. Back exercise estimates were also adjusted for physical activity level, and physical activity estimates were adjusted for back exercise.

In addition to this set of covariates, all longitudinal (transition) models (first-order Markov chain regression models[53]) also included previous values of the pain or disability variable and previous MHI-5 scores. These models were used to examine associations between activity and exercise and subsequent levels of pain, disability, and psychological distress. Back exercise estimates were adjusted for previous physical activity level, and physical activity estimates were adjusted for previous back exercise. Product terms representing interactions (deviations from multiplicativity) of physical activities and back exercises with gender, age, treatment group, baseline duration of low back pain episode, and follow-up week were included in preliminary models; however, because these estimated interactions were negligible, they were excluded from the final models.

RESULTS

Screening, Enrollment, and Follow-Up

A total of 2355 patients were screened. Eight hundred eighty-six (37.6%) were excluded because they had undergone low back pain treatment in the past month (n=270), their back pain was not primarily in the lumbosacral area (n=144), they had fee-for-service or no health insurance coverage (n=119), they had Medi-Cal or Medicare coverage only (n=80), they were involved in a third-party liability or workers' compensation case (n=55), they were not fluent in English (n=46), they were less than 18 years of age (n=43), they planned to move out of the area (n=18), or they were not easily accessible by telephone (n=4). Prospective participants were excluded for medical reasons such as low back pain owing to fracture, tumor, or infection (n=40); severe coexisting disease (n=37); use of anticoagulant medications (n=13); ankylosing spondylitis or other rheumatic disease (n=7); treatment with an electrical device (n=5); progressive or severe unilateral lower-limb muscle weakness (n=2); abdominal aortic aneurysm (n=1); symptoms or signs of cauda equina syndrome (n=1); and blood coagulation disorder (n=1).

Of the 1469 eligible patients, 788 (53.6%) declined to participate because of lack of interest (n=345), preference for one or more of the randomized treatments (n=266), inconvenience (n=137), or inability to make multiple copayments (n=31). Nine otherwise eligible and willing potential participants were not enrolled because they did not understand the informed consent form. Thus, of the 1469 eligible patients, 681 were enrolled in the study. Six hundred seventy-five participants (99.1%) returned 6-week follow-up questionnaires with complete outcome data; 652 (95.7%) and 610 (89.6%) participants completed 6- and 18-month follow-up questionnaires, respectively.

Characteristics of Study Population

Table 1 shows baseline distributions of selected sociodemographic variables. Fifty-two percent of the participants were female, 50% were younger than 50 years, 40% were non-White, and 67% were employed. Almost 3 in 10 participants reported engaging in no recreational sport or physical activities at baseline. Table 2 shows baseline distributions of low back pain and health status variables. Almost half of the participants had been in pain for more than 1 year. Approximately 80% reported previous episodes of low back pain and at least 1 disability day in the past month. The median low back disability score of 11 reflected moderate disability, whereas pain intensity scores indicated appreciable levels of pain perception. SF-36 scores were lower than US general population norms[46] but were consistent with scores observed in other populations of back-pain patients.[56–58]

Cross-Sectional Associations

Table 3 presents logistic regression results for adjusted cross-sectional associations (ORs) of back exercise and recreational physical activity with average and most severe low back pain, low back disability, and psychological

TABLE 1—Frequency Distributions of Selected Sociodemographic Characteristics: UCLA Low Back Pain Study, 1995–2000

Variable	Sample (n = 681), %
Age, y	
<30	9.4
30–49	40.2
50–69	32.2
≥70	18.2
Gender	
Male	48.0
Female	52.0
Race/ethnicity	
White/non-Hispanic	60.4
Latino/Hispanic	29.8
Asian/Pacific Islander	4.5
African American/Black	2.8
Other	2.5
Education level	
High school or less	29.6
Some college	39.5
College	30.8
Marital status	
Married/involved in relationship	71.6
Widowed/divorced/separated	18.3
Never married	10.1
Employment status	
Employed full time	58.7
Employed part time	8.1
On leave/unemployed	7.5
Retired	25.7
General health status	
Excellent	8.1
Very good	37.0
Good	42.0
Fair/poor	12.9
Weekly metabolic equivalent task score,[b] %	
0	27.6
0.1–10.49	21.9
10.5–25.9	25.5
≥26	25.0

[a]The mean age was 51.0 years (SD = 16.7); the median was 50 years.
[b]The metabolic equivalent task score measures metabolic energy cost expressed as a multiple of the resting metabolic rate (the higher the score, the greater the energy expenditure from physical activity).

TABLE 2—Low Back Pain and Health Status Variables at Baseline: UCLA Low Back Pain Study, 1995–2000

	Sample (n = 681)
Duration of back pain episode, %	
<3 wk	26.1
3 wk–3 mo	15.6
3 mo–1 y	11.6
>1 y	46.7
Roland–Morris disability score (0–24 scale)	
≤5, %	17.5
6–10, %	31.6
11–15, %	27.9
>15, %	23.1
Mean (SD)	10.9 (5.4)
Median	11
Most severe low back pain in past week (0–10 scale)	
Mean (SD)	6.7 (2.1)
Median	7
Average low back pain in past week (0–10 scale)	
Mean (SD)	4.6 (1.9)
Median	5
Days with restricted activity owing to low back pain in past month	
Mean (SD)	6.9 (8.0)
Median	4
At least 1, %	76.9
History of low back pain episodes, %	
Yes	82.2
No	17.8
SF-36 physical functioning score	
Mean (SD)	62.2 (24.6)
Median	65
SF-36 role limitations score: physical problems	
Mean (SD)	41.3 (40.1)
Median	25
SF-36 role limitations score: emotional problems	
Mean (SD)	70.0 (39.2)
Median	100
SF-36 mental health index score	
Mean (SD)	71.2 (16.6)
Median	76
SF-36 general health perceptions score	
Mean (SD)	67.8 (18.0)
Median	70

Note. Roland–Morris = Roland–Morris Low Back Disability Questionnaire; SF-36 = Medical Outcomes Study 36-Item Short-Form Health Survey.

TABLE 3—Adjusted Cross-Sectional Associations of Back Exercise and Recreational Physical Activity With Pain Ratings, Disability, and Psychological Distress

	Most Severe Pain,[a] OR (95% CI)	Average Pain,[a] OR (95% CI)	Back Disability,[a] OR (95% CI)	Psychological Distress,[b] OR (95% CI)
Back exercise				
Never	1.00	1.00	1.00	1.00
Seldom (<1 d/wk)	1.48 (1.09, 2.00)	1.49 (1.14, 1.94)	1.59 (1.19, 2.12)	1.05 (0.78, 1.42)
Sometimes (1–3 d/wk)	2.13 (1.63, 2.79)	1.56 (1.20, 2.01)	1.85 (1.44, 2.38)	0.98 (0.77, 1.25)
Often (4–7 d/wk)	2.12 (1.57, 2.85)	1.56 (1.18, 2.06)	1.61 (1.22, 2.13)	0.95 (0.73, 1.23)
Physical activity (weekly metabolic equivalent task score)				
0	1.00	1.00	1.00	1.00
0.1–10.49	0.78 (0.55, 1.09)	0.83 (0.60, 1.13)	0.72 (0.52, 1.01)	0.77 (0.56, 1.06)
10.5–25.9	0.68 (0.49, 0.95)	0.63 (0.46, 0.85)	0.60 (0.44, 0.82)	0.68 (0.50, 0.91)
≥26	0.62 (0.44, 0.87)	0.72 (0.52, 0.99)	0.48 (0.35, 0.66)	0.60 (0.44, 0.83)

Note. OR = odds ratio; CI = confidence interval. Average back pain and most severe low back pain were defined as ratings of 2 or higher on a 0–10 numerical scale; low back disability was defined as a score of 3 or above on the 0–24 Roland–Morris Low Back Disability Questionnaire; psychological distress was defined as a mental health index score of less than 76.

[a]Adjusted for age, gender, baseline duration of low back pain episode, number of previous low back pain episodes, assigned treatment group, social support, strategy for coping with pain, internal health locus of control, baseline mental health index score, baseline value of outcome variable, muscle strengthening and flexibility exercising, and follow-up week. Back exercise effect estimates were also adjusted for physical activity level, and physical activity effect estimates were adjusted for back exercise.

[b]Adjusted for age, gender, baseline duration of low back pain episode, number of previous low back pain episodes, assigned treatment group, social support, strategy for coping with pain, internal locus of control, baseline mental health index score, baseline low back pain and disability levels, muscle strengthening and flexibility exercising, and follow-up week. Back exercise effect estimates were also adjusted for physical activity level, and physical activity effect estimates were adjusted for back exercise.

distress during the follow-up period. For example, relative to participants reporting no physical activity, the odds of meaningful low back disability were more than halved among participants in the top quartile (≥26 METs/week) of recreational physical activity (OR=0.48; 95% CI=0.35, 0.66). No association was detected between back exercise status and concurrent psychological distress.

By contrast, after adjustment for the effects of back exercise and other covariates, odds of clinically significant low back pain and disability decreased as reported physical activity level increased ($P<.05$ for trend). For example, participants in the top quartile of recreational physical activity (26 METs per week) were less than half as likely as participants reporting no physical activity to have experienced meaningful low back disability (OR=0.48; 95% CI=0.35, 0.66). Similarly, odds of psychological distress decreased as reported physical activity increased ($P<.05$ for trend). Relative to physically inactive participants, the odds of being psychologically distressed were 40% lower among participants in the top quartile of physical activity (OR=0.60; 95% CI=0.44, 0.83).

Longitudinal Associations

Table 4 presents logistic regression results for adjusted longitudinal associations (ORs) of back exercise and recreational physical activity with subsequent average and most severe low back pain, low back disability, and psychological distress. After control for previous values of the low back pain or disability variables and other covariates, back exercise increased the odds of subsequent appreciable low back pain and disability by 64% and 44%, respectively. However, back exercise reduced the odds of subsequent psychological distress by 22% (OR=0.78; 95% CI=0.59, 1.03).

As reported participation in physical activity increased, the odds of experiencing clinically meaningful low back pain and disability at the subsequent assessment decreased. For example, after control for low back disability

TABLE 4—Adjusted Longitudinal Associations of Back Exercise and Recreational Physical Activity With Subsequent Pain, Disability, and Psychological Distress

	Most Severe Pain,[a] OR (95% CI)	Average Pain,[a] OR (95% CI)	Back Disability,[a] OR (95% CI)	Psychological Distress,[b] OR (95% CI)
Previous back exercise				
Never	1.00	1.00	1.00	1.00
Seldom (< 1 d/wk)	1.78 (1.23, 2.59)	1.48 (1.07, 2.03)	1.32 (0.95, 1.83)	0.87 (0.65, 1.17)
Sometimes (1–3 d/wk)	1.46 (1.10, 1.95)	1.48 (1.14, 1.93)	1.19 (0.91, 1.56)	0.93 (0.72, 1.20)
Often (4–7 d/wk)	1.64 (1.21, 2.23)	1.30 (0.97, 1.73)	1.44 (1.07, 1.94)	0.78 (0.59, 1.03)
Physical activity (weekly metabolic equivalent task score)				
0	1.00	1.00	1.00	1.00
0.1–10.49	0.91 (0.62, 1.34)	0.95 (0.69, 1.32)	0.91 (0.64, 1.29)	1.03 (0.76, 1.39)
10.5–25.9	0.85 (0.60, 1.20)	0.85 (0.63, 1.15)	0.70 (0.50, 0.97)	0.91 (0.69, 1.20)
≥ 26	0.82 (0.57, 1.17)	0.82 (0.60, 1.12)	0.69 (0.50, 0.97)	0.75 (0.55, 1.01)

Note. Average back pain and most severe low back pain were defined as ratings of 2 or higher on 0–10 numerical rating scales; disability was defined as a score of 3 or above on the 0–24 Roland–Morris Low Back Disability Questionnaire; and psychological distress was defined as a mental health index score of less than 76.
[a]Adjusted for age, gender, baseline duration of low back pain episode, number of previous low back pain episodes, assigned treatment group, social support, strategy for coping with pain, internal locus of control, previous muscle strengthening and flexibility exercising, previous mental health index score, previous value of outcome variable, and follow-up week. Back exercise effect estimates were also adjusted for previous physical activity level, and physical activity effect estimates were adjusted for previous back exercise.
[b]Adjusted for age, gender, baseline duration of low back pain episode, number of previous low back pain episodes, assigned treatment group, social support, strategy for coping with pain, internal health locus of control, previous muscle strengthening and flexibility exercising, previous low back pain and disability levels, previous mental health index score, and follow-up week. Back exercise effect estimates were also adjusted for previous physical activity, and physical activity effect estimates were adjusted for previous back exercise.

at previous assessment and other covariates, the odds of clinically meaningful disability were 30% lower among participants in the upper 2 quartiles of the physical activity distribution than among inactive participants, i.e., those in the lowest quartile of the physical activity distribution (OR=0.69; 95% CI=0.50, 0.97). Compared with inactive participants, and after control for psychological distress at the previous assessment and other covariates, the odds of being psychologically distressed at the subsequent assessment were 25% lower among those in the uppermost quartile of the physical activity distribution (OR=0.75; 95% CI=0.55, 1.01).

DISCUSSION

To our knowledge, this is the first longitudinal study of primary care low back pain patients to show not only that recreational physical activity and back exercise are associated cross-sectionally and longitudinally with low back pain and disability but also that the associations are in opposite directions and that physical activity may be beneficial in coping with comorbid psychological distress, pain, and disability. We found that (1) participation in recreational physical activities reduces the likelihood of concurrent and subsequent low back pain, related disability, and psychological distress and (2) use of back exercises increases the likelihood of concurrent and subsequent low back pain and related disability. We also found that the associations of back exercise and physical activity with low back pain outcomes were stronger in the cross-sectional analyses than in the longitudinal analyses, indicating that amount of back exercise and physical activity may be affected by degree of back pain or related disability (i.e., reverse causation).

Leisure time physical activity, physical fitness, and exercise have been suggested as possible risk or prognostic factors for low back pain in some community-based, occupational, and clinic-based studies[26–31] but not in other studies.[25,59–63] In a systematic review of 11 controlled clinical trials conducted in industrial settings,[64] the 3 investigations of exercise interventions were found to demonstrate effects on preventing back pain or work-loss days, and the researchers concluded that evidence for the effectiveness of exercise was limited. However, the 3 studies involved several methodological problems that made interpretation of their results difficult. A recent review of 39 studies involving workers showed little association of leisure time physical activity with low back pain, although sedentary leisure activity was found to be associated with an increased prevalence of low back pain and related sick leave.[65]

In a systematic review of exercise therapy that identified 39 RCTs, the researchers concluded that specific back exercises should not be recommended for patients with acute (12 weeks or less) or chronic (more than 12 weeks) pain but that exercise in general may be beneficial as part of an active rehabilitation program for chronic pain sufferers.[23] They found (1) moderate evidence that flexion exercises are not effective in reducing acute pain, (2) strong evidence that extension exercises are not effective in reducing acute pain, (3) no evidence that flexion exercises are effective in reducing chronic pain, (4) no evidence that strengthening exercises are effective in reducing acute pain, and (5) strong evidence that strengthening exercises are not more effective than other types of exercise.[23] In a systematic review of 20 RCTs of physical exercise and training interventions, the International Paris Task Force on Back Pain concluded that active physical exercise should be promoted among patients with acute or chronic pain and that no evidence exists to indicate the effectiveness of specific exercises or the relative benefits of one exercise regimen over another.[24]

Consistent with those studies, our findings suggest that specific back exercises may be counterproductive and that restoration of normal functioning should instead be emphasized.[66] Our results are also consistent with current guidelines for managing acute low back pain that recommend low-stress aerobic exercises such as walking and swimming.[32,33] Recommendations to engage in physical activity appear to be appropriate for people with chronic low back pain as well. Brisk walking for at least 3 hours per week is equivalent to 10.5 METs, a level we found to be associated with reductions in concurrent low back pain, disability, and psychological distress and subsequent back disability. As others have found in regard to back pain[67] and depression,[68] strenuous activities such as running and swimming do not necessarily result in better outcomes than walking or other less strenuous activities. Given the shared neural and biochemical pathways of physical and psychological pain,[69,70] engaging in physical activity may be a safe and effective strategy to ameliorate both pain and depression.

The beneficial effects of physical activity on pain perception and psychological distress may be caused by beta-endorphin levels, which have been shown to be lower in physically active men than in sedentary men.[71,72] Higher resting beta-endorphin levels have been observed to be associated with depression,[73] and physical activity may decrease resting plasma beta-endorphin and improve mood.[74] In contrast, circulating beta-endorphin levels have been shown to be elevated during physical exercise,[75,76] to be relatively higher among pregnant women who exercise regularly than among those who do not,[77] and to increase among angina patients during treadmill testing.[78] Peripheral and experimental pain thresholds have also been shown to rise in response to exercise,[78,79] and perceptions of labor pain may be lower among regular exercisers than among nonexercisers.[77] However, with respect to both physical pain and psychological distress, it is unclear whether beta-endorphin or other mediators and mechanisms are responsible for apparent physical activity–induced effects.[80] Different mechanisms may be involved depending on type or duration of activity, other behavioral or environmental factors, or presence of comorbidities.[76,81]

Several limitations of this study should be considered when interpreting our findings. Our participants were primary care patients taking part in an investigation of treatment options for low back pain. Thus, they may not be representative of individuals with low back pain who present for care in other kinds of clinical settings (e.g., specialty clinics or centers focusing on third-party liability or workers' compensation cases) or who do not seek clinical treatment at all. Because all of the participants had low back pain at baseline, we cannot draw inferences about the associations of exercise and physical activity with pain or disability and psychological distress in initially pain-free populations. Also, because the outcomes assessed here are relatively common, the odds ratios observed probably tended to overestimate reductions in relative risks. Furthermore, information on specific types of back exercises was not collected. Although little evidence indicating that some specific exercise regimens are more effective than others exists in the literature, certain exercise regimens may be more effective than others. Also, we relied on participants' self-reports of their exercise and physical activities, and it was not feasible to validate responses with other strategies such as direct observation.

Because recreational physical activity was not randomized, confounding is an additional concern, although we considered the most important potential confounders in our analytic strategy. Residual confounding is possible, however. For example, individuals with more chronic or disabling histories of back pain may be more likely than those with less severe or chronic histories to engage in regular back exercise. Although we controlled statistically for baseline duration of low back pain episode and number of previous episodes of pain, our back exercise estimates could still be subject to residual confounding. However, it is unlikely that such confounding would be so substantial as to mask truly protective back exercise effects.

Although these limitations weaken our ability to offer firm causal inferences, our study involved a number of strengths that support the possibility that the associations observed may in fact be causal. First, the 18-month follow-up rate of almost 90% diminishes the possibility that our findings were due entirely to selection bias. Second, we controlled for several factors likely to confound crude associations of exercise and physical activity with subsequent pain, disability, and psychological distress. Third, previously validated measures were used in assessing all outcomes, and well-established MET values were assigned to physical activity categories. Finally, because our serial assessments involved a large population of low back pain sufferers, we were able to conduct analyses that clearly delineated the temporal relations of exposures and outcomes. The stronger cross-sectional than longitudinal associations observed suggest possible reverse causation, a problem inherent in interpreting estimates derived from cross-sectional studies of physical activity and low back pain.[82]

In summary, in a population of primary care patients presenting with low back pain, participation in recreational physical activities was *inversely* associated, both cross-sectionally and longitudinally, with low back pain, related disability, and psychological distress. In contrast, back exercise was *positively* associated both cross-sectionally and longitudinally with low back pain and related disability. These results suggest that individuals with low back pain, rather than being advised to engage in specific back exercises, should instead be encouraged to focus on nonspecific physical activities to help reduce their pain and improve their psychological health. Because of the perception that physical activity could result in pain persisting for a longer period and fear of pain have been identified as possible factors keeping low back pain patients from being physically active,[83] clinicians may want to reduce such barriers to patients modifying their behavior. ■

About the Authors

Eric L. Hurwitz is with the Department of Epidemiology, School of Public Health, University of California, Los Angeles, and the Southern California University of Health Sciences, Whittier. Hal Morgenstern is with the Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor. Chi Chiao is with the Department of Community Health Sciences, School of Public Health, University of California, Los Angeles.

Requests for reprints should be sent to Eric L. Hurwitz, DC, PhD, School of Public Health, Department of Epidemiology, University of California, Box 951772, Los Angeles, CA 90095-1772 (e-mail: ehurwitz@ucla.edu).

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Contributors

E.L. Hurwitz was responsible for study design, development of study hypotheses, supervision of data collection and analysis, and drafting of the article. H. Morgenstern contributed to study design, data interpretation, and critical revision of the article. C. Chiao contributed to the literature review and data analysis.

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Human Participant Protection

The study protocol was approved by the institutional review boards of the University of California, Los Angeles, and the participating health care network. Participants provided written informed consent.

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