OVERVIEW: The importance of promoting physical activity in adults with chronic illness cannot be overstated. Although numerous studies have evaluated interventions developed to increase physical activity in this population, it can be difficult to interpret the results without the benefit of a statistical analysis across studies. A 2008 meta-analysis synthesized the findings of 163 reports on such studies. This article discusses the implications of those findings, describing the strategies and practices commonly used to promote physical activity in chronic illness and identifying those that are most effective.
The health benefits of physical activity in chronic illness are well documented. Physical activity has been shown to retard the atherosclerotic process, thereby reducing the risk of subsequent cardiac events in cardiovascular disease; increase physical function in arthritis; improve glycemic control in type 2 diabetes; and enhance the quality of life in patients with chronic illness. Because nurses perform the vast majority of patient education and health promotion interventions, they need to know which strategies and practices are most effective in increasing physical activity in chronic illness. Many research studies have evaluated attempts to increase physical activity in chronically ill adults, but without the benefit of a statistical analysis across studies it can be difficult to detect patterns and interpret results.

**Meta-analysis** is an established means of quantitatively synthesizing findings across many research studies. The inclusion of moderator analysis in such meta-analyses, when possible, provides statistical evidence of the effectiveness of specific intervention characteristics. (A moderator is a variable that alters the relationship between other variables.) A 2008 meta-analysis, conducted by one of us (VSC) with colleagues, summarized the findings of 163 reports on
213 independent tests of interventions used to promote physical activity among a total of 22,557 adults with a varied assortment of chronic illnesses. It took into account variables such as the number of behaviors targeted by the interventions (physical activity only or multiple health behaviors); whether the interventions used behavioral strategies (designed to produce a direct change in behavior), cognitive strategies (that seek to change knowledge, beliefs, or attitudes), or both; as well as numerous specific practices, including self-monitoring, supervised exercise, tailoring, contracting, and several others (see Table 1).

Findings showed that several interventions are effective in promoting physical activity among diverse patient populations. Sex, age, socioeconomic status, and ethnicity appeared not to influence effectiveness. On average, intervention increased physical activity the equivalent of 945 steps per day, or 48 minutes of physical activity per week, per patient—an amount that’s likely to be clinically important for sedentary, chronically ill adults. Among the numerous intervention attributes and practices, however, the effect on physical activity varied considerably. This article addresses the implications of these meta-analysis findings in order to provide nurses with reliable evidence supporting or negating the purported benefits of common strategies and practices used to promote physical activity among chronically ill adults. We report below which strategies and practices were found to be clearly supported by the data, which were modestly supported, and which were not supported.

**CLEARLY SUPPORTED**
The 2008 meta-analysis showed interventions to be most effective in promoting physical activity among chronically ill adults when they
- targeted physical activity exclusively,
- used behavioral (as opposed to cognitive) strategies,
- encouraged self-monitoring.

**A single target: physical activity.** Health promotion interventions often target multiple health behaviors. For example, clinicians caring for people with diabetes frequently attempt to modify behaviors related to diet and medication adherence as well as physical activity. Although multiple behavior changes may be required to manage some chronic illnesses, modifying physical activity alone may have dramatic effects. The meta-analysis found that interventions that were solely focused on improving physical activity levels were more effective in achieving that goal than those that aimed to improve multiple health behaviors simultaneously.

Whereas a study of patients with type 1 diabetes demonstrated the effectiveness of a consultation intervention that exclusively targeted exercise behavior, interventions seeking to modify multiple behaviors, including physical activity, were less successful. For example, a program developed to promote adherence to diabetes self-management among college students with type 1 diabetes—which addressed behaviors surrounding stress, nutrition, medications, and alcohol, as well as exercise—had no significant effect on exercise behavior.

**Table 1.** Intervention Attributes or Practices that Promote Physical Activity

<table>
<thead>
<tr>
<th>Strength of Evidence</th>
<th>Attribute or Practice</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td><strong>Strong</strong></td>
<td>Single target: physical activity only</td>
<td>Interventions designed to modify only behavior related to physical activity, rather than multiple health behaviors.</td>
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<td></td>
<td>Behavioral approaches</td>
<td>Interventions containing at least one behavioral strategy, designed to produce a direct change in behavior related to physical activity.</td>
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<td></td>
<td>Self-monitoring</td>
<td>Interventions including practices such as keeping an activity diary, tracking activity in a calendar, or recording activity on a Web site.</td>
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<tr>
<td><strong>Moderate</strong></td>
<td>Supervised exercise</td>
<td>Exercise overseen by a member of the research team or a health care provider.</td>
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<tr>
<td></td>
<td>Tailoring</td>
<td>Adapting the intervention to meet the needs or situation of the patient.</td>
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<tr>
<td></td>
<td>Contracting</td>
<td>An agreement between patient and provider defining the level and duration of physical activity the patient will perform.</td>
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<tr>
<td></td>
<td>Exercise prescription</td>
<td>Participants receive written instruction for the mode, duration, frequency, intensity, and progression of their physical activity.</td>
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<tr>
<td></td>
<td>Fitness testing</td>
<td>Patient’s level of physical fitness is evaluated before any physical activity program is initiated.</td>
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<tr>
<td></td>
<td>Stimuli and cues</td>
<td>Interventions employ prompts that remind participants to exercise.</td>
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<tr>
<td></td>
<td>Moderate- or high-intensity recommendations</td>
<td>Recommendations are for moderate- or high-intensity (as opposed to low-intensity) physical activity.</td>
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community-based diabetes education program that addressed multiple self-care behaviors (including exercise behavior) found no significant differences in self-care between participants who attended at least half of the weekly sessions, those who attended fewer than half of the weekly sessions, and a control group.11

We can only speculate about the reasons for these findings, but it may be that focused interventions lead participants to place a greater importance on physical activity and interventions aimed at multiple behaviors dilute the intervention effect. Additionally, by attempting only to increase physical activity, interventionists may be able to employ more strategies specific to that aim. It may also be easier for patients to change one behavior at a time, rather than to divide their attention among multiple behavior changes, and physical activity may be easier to change than some other behaviors.

Interventions incorporating any behavioral strategy were more effective than those that included none.

A 2007 meta-analysis of health behavior change interventions tested in adults with type 2 diabetes found that interventions focused exclusively on physical activity not only improved metabolic control but achieved an effect that was twice as large as interventions that attempted to change multiple behaviors.6 Such findings suggest that interventions sequentially targeting different health behaviors may be more effective than those that simultaneously target several health behaviors.

**Behavioral approaches.** The 2008 meta-analysis of interventions used to promote physical activity in chronic illness investigated both behavioral and cognitive approaches. Behavioral practices included incorporating consequences (rewards for performing more physical activity), patient contracts, feedback (information from a clinician about the amount of physical activity performed), goal setting, self-monitoring, and stimuli and cues. Cognitive approaches included barriers management (teaching patients how to manage obstacles or deterrents to increasing physical activity), decisional balance (working with patients to chart the benefits and costs of increasing physical activity), motivational counseling, problem solving, and social cognitive interventions.8 Interventions incorporating any behavioral strategy were found to be more effective than those that included none, and interventions employing only behavioral strategies were more effective than those with both behavioral and cognitive components—findings that

- have important implications for health care providers, who typically attempt to encourage physical activity in chronically ill patients through education.9

It’s possible that people already know why they should exercise (the typical emphasis of cognitive strategies) but require behavioral strategies to achieve and maintain higher levels of physical activity. Such findings provide evidence for replacing attempts to provide a scientific rationale for the benefits of physical activity with behavioral strategies to encourage physical activity.

**Effective interventions using behavioral strategies** to promote physical activity among women after cardiac surgery were found to include self-reinforcement through keeping logs, specific goal setting, and nurse feedback.12 Specific goal setting and nurse feedback were also found to be effective in promoting physical activity in patients with chronic obstructive pulmonary disease.10 Another approach to self-monitoring is a behavioral strategy that requires the participant to record her or his daily or weekly physical activity over time, perhaps in an exercise diary, on a tracking calendar, or on a Web site. For example, in a study of patients with diabetes, subjects used log books to record behavioral goals and physical activity.10 Another approach to self-monitoring would be to provide patients with pedometers to record their daily steps, a strategy that has been shown to motivate patients with type 2 diabetes to increase their physical activity.17

The 2008 meta-analysis found that strategies involving self-monitoring significantly improved the effectiveness of interventions aimed at promoting physical activity, regardless of other strategies employed.9 Self-monitoring increases participants’ awareness of their physical activity level and provides them with
an activity history they can improve. These findings are consistent with a 2002 meta-analysis of interventions used to increase physical activity among aging adults, which found self-monitoring to be a particularly important strategy with significant effects.11

MODESTLY SUPPORTED
The 2008 meta-analysis of physical activity interventions modestly supported several specific practices, including supervised exercise, tailoring, contracting, exercise prescription, fitness testing, stimuli and cues, and intensity recommendations.8

Supervised exercise. In some studies, interventions included exercise sessions supervised by a member of the research team or a health care provider (in the case of cardiac rehabilitation) and follow-up to determine whether patients continued with the physical activity after the supervised sessions. In one study, adults with osteoporosis who had participated in supervised group exercise sessions had significantly higher physical activity scores compared with control subjects, even after six months.19 Similarly, patients with multiple sclerosis demonstrated a 17% increase in sport-related activity following a supervised exercise intervention, whereas control subjects with multiple sclerosis remained sedentary.20

Supervised exercise may provide patients an opportunity to receive guidance on exercise techniques, which may improve their exercise experience and thus their exercise behavior. Adults with chronic illnesses frequently have safety concerns about exercise, which supervision may alleviate. Supervised exercise also provides a successful exercise experience, which may have a reinforcing effect.

The 2002 meta-analysis found supervised exercise to be effective in promoting physical activity in aging adults,11 but the 2008 meta-analysis produced inconclusive findings regarding its effectiveness in chronic illness.8 Because supervised exercise requires considerable financial resources, it may be prudent to determine which populations stand to derive the greatest benefit from its use before employing the practice.

Tailoring describes interventions that are systematically adjusted to meet an individual’s needs or situation. For example, interventions might be tailored to age, sex, or a specific health condition, as well as to a previous physical activity behavior. Some tailored interventions provide messages matched to patients’ perceived exercise barriers or to their desired benefits. In one study, computerized algorithms were used successfully to tailor home communication interventions to the needs of patients with heart failure, based on information the patients provided about themselves.21 A lower-tech approach, using self-report assessments conducted at baseline, three months, and one year, has been used to tailor self-management interventions to adults with diabetes.22 The meta-analysis of physical activity interventions found a trend toward tailored
interventions being more effective than nontailored interventions, but few interventions met the criteria for categorization as “tailoring”—that the intervention’s features were systematically modified on the basis of an individual patient’s characteristics, to make the intervention more effective for that patient. Given the meta-analysis findings and the possibilities for complex tailoring with computerized algorithms, tailoring is certain to be an important area for future research.

**Contracting** is a strategy in which the participant makes an agreement with the interventionist to perform physical activity at a specified level and for a particular duration. It’s been used by patients undergoing cardiac rehabilitation and by chronically ill older adults. Contracting defines physical activity expectations for the patient and, in doing so, may provide motivation because patients want to complete their contractual obligations. Contracting also helps patients take a complex behavior and break it into manageable units. Whereas the idea of exercising routinely for many years may be inconceivable to a chronically ill adult, walking at a moderate pace for 30 minutes on Monday, Wednesday, and Friday of the next week may seem feasible. Success in meeting previous contracts may stimulate future efforts.

**Exercise prescription** provides patients with clear (often written) expectations and instructions for performing physical activity that’s appropriate for their level of fitness and health. Exercise prescriptions that detail intensity, duration, and frequency have been shown to be effective in increasing physical activity among women with osteoporosis and adults with multiple sclerosis. Exercise prescriptions may help chronically ill patients realize that physical activity is often as necessary for health maintenance and improvement as medication. Additionally, the fact that instructions are individualized and appropriate for the patient increases the chances that the intervention will be successful.

**Fitness testing** describes a structured evaluation of the patient’s physical fitness performed prior to the initiation of a physical activity program. Fitness testing may work in conjunction with other physical activity interventions, such as tailoring, exercise prescription, contracting, or self-monitoring, as a way of providing a baseline from which the patient strives to improve. Fitness testing can prevent injury and improve an exercise program’s chances of success by helping to ensure that it doesn’t exceed the patient’s ability. In addition, some patients are motivated by receiving objective information about their fitness level. Fitness testing has been used successfully as a component of interventions in adults with multiple sclerosis and older adults with chronic illness.

**Stimuli and cues** were components of many physical activity interventions that produced modest effect sizes in the 2008 meta-analysis involving chronically ill adults. Such stimuli may take the form of calendars, automated phone calls, beepers, or other prompts that fit the patient’s circumstances. For instance, placing walking shoes by the bedroom door may act as a reminder to take an early morning walk. Friends may call each other several times a week to remind each other to exercise. Family involvement has been used as a stimulus in programs aimed at increasing physical activity in adults with diabetes. In one such study, spousal participation in an exercise and diet program effectively prompted adherence in female (but not male) obese adults with type 2 diabetes.

**Moderate- or high-intensity recommendations.** Although physical activity recommendations must consider patients’ underlying chronic illness and health status, interventions that recommended moderate- or high-intensity (as opposed to low-intensity) physical activity trended toward greater effectiveness in the

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**Physical activity is often as necessary for health maintenance and improvement as medication.**

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2008 meta-analysis involving chronically ill adults. This finding echoes those of earlier meta-analyses of physical activity interventions in older adults. It’s possible that patients misinterpret recommendations for low-intensity physical activity, believing that they represent no meaningful change from their current physical activity, or that they experience greater real or perceived benefit from more intense physical activity. A study of older adults with knee osteoarthritis found that adherence was greater (84%) among those participating in a high-intensity, progressive strength training program than among those participating in a nutrition education program (65%). Similarly, an intensive, water-based exercise program increased physical activity among adults with rheumatoid arthritis.

**NOT SUPPORTED**

The 2008 meta-analysis indicated that some components of physical activity interventions may have no effect on, possibly, a negative effect on physical activity in chronically ill adults. The meta-analysis found that face-to-face interventions held no advantage over those mediated by telephone, mail, or mass media. This finding has important financial implications because face-to-face interventions tend
to require far greater financial resources than those using mediated delivery.

**An intervention’s social context.** Physical activity interventions that can be conducted either in groups or in more costly individual settings had no less effect when conducted in group settings.

**Walking (as compared with other physical activity).** Whether interventions recommended walking or other forms of physical activity didn’t appear to influence effectiveness.

**Purely cognitive strategies.** Interventions consisting entirely of cognitive strategies were considerably less effective than other interventions. The cognitive strategies of barriers management and problem solving appeared to have no effect on an intervention’s success in promoting physical activity.

**Purported theoretical foundation.** Although many theories have been suggested as the basis for physical activity interventions, most primary studies don’t report a theory. Among those interventions claiming a theoretical foundation, the theories are often inadequately implemented. For example, studies claiming to use the transtheoretical model may not match materials to a patient’s stage of change or appropriately match the processes of change with each stage.31, 32 The 2008 meta-analysis found that physical activity outcomes have. I feel 100% better than when I started. If it weren’t for this study, I’d either be dead—or a very sick person.”

Rena Wing, professor of psychiatry and human behavior at Brown and codirector of Look AHEAD, said that during the first year of the study (which is planned to end in 2012), those in the intensive program lost 8.6% of their starting body weight — about 19 lbs. — compared with 1.5 lbs. among those in the less intensive program. Exercise was the strongest reason for weight loss, followed by program attendance and meal replacements, according to analysis of the first year.

“The people who did the best were those who exercised the most and came to meetings,” said Wing. “The intensive program greatly improved fitness levels, blood pressure, and lipid levels.”

Newman attends meetings at Miriam Hospital in Providence, where Wing is based. “I’m a mother and a grandmother,” Newman said, “and this study is for the next generation, who will be prone to type 2 diabetes because of a lack of activity and proper diet.” For more information on the Looking AHEAD study, go to www.lookaheadtrial.org. —Patrice O’Shaughnessy

**STUDY LIMITATIONS**

The meta-analysis on which this article is based was limited by the number and range of primary intervention trials reported in the literature.4 Moderator analyses couldn’t be conducted on some intervention characteristics because they were reported too infrequently. This article addresses only the effectiveness of the interventions in promoting physical activity; health outcomes in specific chronic illnesses are reported elsewhere.1, 3, 6, 7

**THE TAKEWAY**

The 2008 meta-analysis found that it’s possible to increase physical activity in adults with chronic illnesses.4 Findings document that interventions focused on physical activity alone are most effective. Changing health behaviors in chronically ill patients is a very complex undertaking, and many conditions require patients to change several health behaviors. When

Looking AHEAD for Health

A successful weight loss program in Rhode Island.

Ronnie Newman was diagnosed with type 2 diabetes more than 10 years ago, just as a team of medical professionals at Brown University launched the Look AHEAD (Action for Health in Diabetes) study of 5,145 men and women nationwide to assess the long-term effects of weight loss on people with the chronic illness. Researchers have been monitoring the participants, who were enrolled when they were between the ages of 45 and 74 and were randomly assigned to a program of intensive lifestyle intervention (focusing on weight reduction through “moderately intense activity”) or to a control group of diabetes education and support.

“I was one of the first people to respond to the ad looking for people for the study,” said Newman, 63, of Rhode Island. She’d always had a weight problem, but through the program of intensive lifestyle change, she lost about 20 pounds and has kept most of it off for a decade by reading every food label, giving up soda, controlling the amounts she eats, and exercising regularly. “We all agreed that without this support we’d never have been able to do what we’ve done,” she said. “My diabetes hasn’t progressed as quickly as it could have. I feel 100% better than when I started. If it weren’t for this study, I’d either be dead—or a very sick person.”

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boosting physical activity is a desired goal, however, the evidence indicates that outcomes will be better if behavior changes are targeted sequentially.

Mounting evidence suggests that behavioral strategies are more effective than cognitive approaches in improving physical activity.\textsuperscript{4, 10, 31} Effective interventions include such behavioral components as self-monitoring, consequences, contracting, feedback, goal setting, and stimuli and cues. Self-monitoring was found to be particularly effective and can be recommended as part of any physical activity intervention program for adults with chronic illness.

Meta-analysis is a powerful means of synthesizing research and determining an intervention’s effectiveness. The results of the meta-analysis on which this article is based indicate that certain intervention strategies are effective in improving physical activity in adults with chronic illnesses. Further evaluation is needed to determine the effectiveness of other physical activity interventions and how to best implement effective interventions in the clinical practice setting.

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