

Chapter 2

Physical Activity and Adherence

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Adherence to Physical Activity

There is abundant evidence supporting the health benefits of physical activity, including reduced risk for cardiovascular disease, stroke, some cancers, type 2 diabetes, osteoporosis, hypertension, high cholesterol, obesity, osteoarthritis, and all-cause mortality [1]. Physical activity is also associated with improved psychological health and functional status, as well as reduced health-care expenditures [2]. It has been estimated that the direct costs of physical inactivity account for approximately \$24 billion, or 2.4% of US health-care expenditures [1, 2]. Furthermore, about 12% of all deaths in the USA can be attributed to physical inactivity [3].

This chapter provides a synopsis of research related to physical activity adherence, with a primary focus on adults. We discuss recommendations for physical activity, the problem of non-adherence to physical activity recommendations and factors associated with non-adherence, screening for non-adherence, and interventions to increase

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physical activity. Finally, we will discuss clinical and policy implications of physical activity adherence research.

Physical Activity Guidelines and Recommendations

There has been substantial debate and study regarding the amount of physical activity required for achieving health and fitness benefits. Guidelines from Healthy People 2010 (HP2010), the American College of Sports Medicine (ACSM), the American Heart Association (AHA), and the US Department of Health and Human Services (DHHS) advise the following [4–6] (Boxes 2.1 and 2.2):

Box 2.1 Physical Activity Recommendations for Adults Under Age 65

* Do at least 30 or up to 60 (for greater benefit) min per day of moderate intensity aerobic activity, in bouts of at least 10 min each, to total 150–300 min per week

OR

* Do at least 20–30 min per day or more of vigorous intensity aerobic activity to total 75–150 min per week

OR

* Do an equivalent combination of moderate and vigorous activity

AND

* Do 8–10 strength training exercises, 8–12 repetitions of each, twice a week

Box 2.2 Physical Activity Recommendations for Adults Age 65 and Older

- * Follow the same guidelines for aerobic activity as those for adults under age 65

AND

- * 8–10 strength training exercises, 10–15 repetitions each, 2–3 times per week

AND

- * Do balance exercises, if at risk for falling
- * When older adults cannot do these recommended amounts of physical activity because of chronic conditions they should be as physically active as their abilities and conditions allow.

The guidelines emphasize that all adults should avoid inactivity. Some activity is better than none. The guidelines also emphasize that additional health benefits can be gained by performing physical activity in amounts greater than the minimum recommendations. It should also be noted that physical activity performed in the context of regular occupational, household, and leisure activities can produce benefits similar to those of structured exercise, as long as the frequency, intensity, and duration are sufficient [7].

The Problem of Non-adherence to Physical Activity Recommendations

Estimates of the proportion of adults who do not meet physical activity recommendations vary slightly according to the specific set

of guidelines being considered (HP2010, ACSM/AHA, and DHHS). The Centers for Disease Control and Prevention (CDC) analyzed physical activity data from the 2007 Behavioral Risk Factor Surveillance System, which is a nationally representative sample of adults ≥ 18 years. These data showed that when considering the HP2010 guidelines, 48.8% of adults met physical activity recommendations compared with 64.5% who met recommendations according to the 2008 DHHS guidelines. Nevertheless, these and other data show that a large proportion of adults do not meet physical activity recommendations, and this is a significant public health problem [8]. These data also likely underestimate the problem of non-adherence, as adults tend to overreport physical activity levels in comparison to objective measures [9, 10].

Long-term adherence to physical activity is essential for the maintenance of health benefits. For example, Morey et al. reported that among older adults enrolled in a physical activity program for over 10 years, participants classified as adherent had a long-term survival benefit by time compared to a non-adherent group [11]. Other research showed that individuals who are more adherent to regular exercise programs, compared to those who are less adherent, experience greater improvements in fitness, physical function, quality of life, and disease-specific outcomes [12]. However, studies suggest that about 50% of adults who start a physical activity program will drop out within a few months [13].

Risk Factors for Non-adherence to Physical Activity Recommendations

There have been several comprehensive reviews of the correlates and predictors of physical activity, covering over 380 studies [14–17]. This section describes prior research on key correlates of physical activity, focusing on seven categories of factors: demographic, health-related and biological, cognitive and psychological, behavioral, social, program-related, and environmental. Table 2.1 also provides a comprehensive summary of factors associated with physical inactivity.

Table 2.1 Factors associated with physical inactivity

Demographic factors
Older age
Female gender
Non-white race/ethnicity
Low socioeconomic status
Health-related and clinical factors
Chronic illnesses
Poor general health and physical function
Overweight/obesity
Cognitive and psychological factors
Greater perceived barriers to physical activity
Lack of enjoyment of physical activity
Low expectations of benefits from physical activity
Poor psychological health
Low self-efficacy for physical activity
Low self-motivation for physical activity
Lack of readiness to change physical activity behaviors
Poor fitness level
Behavioral factors
Prior physical activity
Smoking
Type A behavior ^a
Social factors
Lack of cohesion in exercise group
Lack of physician influence/advice for physical activity
Lack of social support for physical activity
Program-related factors
High physical activity intensity
Long physical activity duration
Environmental factors
Lack of access to facilities/parks/trails
Lack of neighborhood safety

^aType A behavior associated with poorer adherence in supervised exercise programs but greater overall physical activity levels

Demographic Factors

The demographic factors most strongly associated with physical activity levels in prior research include the following:

Age

While the benefits and safety of physical activity for older adults have been well established, increasing age is still one of the most consistent predictors of decreased physical activity [8, 9, 14, 18, 19]. About 60% of older adults in the USA do not meet physical activity recommendations [18, 20]. Some data suggest that physical activity levels increase slightly around the typical age of retirement (60–65), but then decline shortly afterward [21]. Studies have also shown that there is a greater age-related decline in physical activity among older women in comparison to older men [22].

Not surprisingly, poor health status is one of the most important and consistent correlates of physical inactivity among older adults [23]. Some specific health-related variables associated with reduced activity among older adults include poor perceptions of overall health, presence of chronic diseases, depressive symptoms, injuries, activity and mobility limitations, pain, and fear of pain [16, 24]. There are several other factors that seem to be particularly salient with respect to older adults' physical activity levels. First, some research suggests that social support for physical activity decreases substantially with age [25], and this may negatively affect activity among older adults. Second, older adults may be more likely than younger individuals to report lack of skill as a barrier to physical activity [26]. Third, misconceptions about physically activity are problematic among older adults. Specifically, older adults may be deterred from physical activity because of beliefs that activity must be vigorous or uncomfortable to produce benefits [27]. Fourth, physicians are less likely to ask older adults about physical activity and less likely to counsel their patients to become more physically active [28]. The US Preventive Task Force's conclusion that there was insufficient evidence that physical activity counseling by primary care providers was effective may have hindered incorporation of physical activity counseling into primary care [29]. However, more recent studies in primary care settings have reported significant improvements in physical activity among

elders, and physician advice appears to play a key role in older adults' physical activity [30, 31].

Gender

Gender has also been a consistent predictor of physical activity, with men showing greater levels of activity than women [9, 14, 15, 18, 19]. While many barriers to physical activity are similarly influential among both women and men, there are some factors that are particularly relevant to women. First, previous physical activity guidelines emphasized fairly vigorous activity, which may have discouraged participation among women. Research has shown that only about 5% of women adopt vigorous activities (such as running) annually, but about 34% adopt moderate activities (such as walking) [32]. Newer physical activity guidelines focus more on moderate level activities, and this change may have a positive influence on women's activity levels as these recommendations continue to be conveyed. Second, women may experience a social environment that is not as supportive or conducive to activity as men. Women's frequent multiple roles, involving both work and family responsibilities, may be a particularly significant barrier to regular physical activity. For example, data show that women with young children at home are less active than women without young children [33].

Race and Ethnicity

Racial and ethnic minorities suffer disproportionately from chronic illnesses that are associated with physical inactivity, and elimination of these health disparities is a national health priority [34]. Yet there are still considerable racial and ethnic differences in physical activity levels [35]. Blacks, Hispanics, Asian and Pacific Islanders, and American Indians/Alaska Natives all report lower levels of physical activity compared to non-Hispanic Whites [19, 34]. Data from the CDC's Behavioral Risk Factor Surveillance System show that when considering the 2008 DHHS guidelines, 68% of non-Hispanic Whites meet physical activity recommendations compared with only 57% of non-Hispanic Black and Hispanic participants [18].

While racial/ethnic differences in physical activity may partly be mediated by socioeconomic status (SES) [15], some studies have controlled for income, work status, or education in statistical models and still observed racial differences in physical activity level [36, 37]. Barriers and facilitators of physical activity have not been as well examined among racial and ethnic minority groups as among non-Hispanic Whites. However, these data are emerging, and in particular, there is a growing literature on physical activity among racial and ethnic minority women [38–43]. These studies indicate that among racial and ethnic minority women, family disapproval, family needs, and child care are particularly important barriers to physical activity [42, 43]. Research also shows that among racial and ethnic minorities in general, two key strategies for increasing physical activity may be enhancing social support for physical activity and augmenting access to places for physical activities [44].

Socioeconomic Status

Overall, SES has been a fairly consistent correlate of physical activity [14, 19]. “Blue collar” occupational status (typically manual and industrial labor), low income, and lower education level have all been associated with less physical activity (especially leisure time physical activity) in some studies [14]. Women with low SES and low-skilled occupations are at particular risk for being physically inactive [45].

There are several likely reasons that physical activity levels are lower among individuals with low SES. First, these individuals are more likely to live in communities that have fewer parks or recreational facilities, are more likely to lack financial resources to purchase home exercise equipment, may lack social support or encouragement to lead a physically active lifestyle, and may also lack understanding about the health benefits of activity [46]. Second, some research suggests that individuals with lower income levels receive less advice from their physicians about preventive health behaviors such as physical activity [47]. Third, low SES is associated with poor adherence during and following clinical exercise programs such as cardiac rehabilitation [48], and this may be related to financial constraints, health-care coverage, and lack of work flexibility.

Health-Related and Clinical Factors

Individuals with chronic diseases and overall poorer levels of health and physical function are less likely to be physically active [49]. For individuals with some chronic health conditions, involvement in a formal, structured exercise program can facilitate physical activity adherence. Alternatively, the use of group-mediated cognitive-behavioral therapy has been successful at integrating physical activity into daily life rather than delivered as an independent center-based activity among adults with chronic conditions [50].

Overweight/obesity is also strongly associated with lower activity levels [14, 18]. For example, Brownson et al. found that among a national sample of women in the USA, those who were overweight were significantly less likely to report being regularly active and more likely to report having no leisure time physical activity compared to women who were not overweight [51].

Cognitive and Psychological Factors

A wide array of cognitive and psychological variables have been examined as potential correlates of physical activity adherence (see Table 2.1) [14, 15, 17]. Among these variables, studies have shown that the following are most consistently associated with greater physical activity levels: fewer perceived barriers, greater enjoyment of physical activity, greater expected benefits, better psychological health, greater self-efficacy for physical activity, greater self-motivation for physical activity, greater readiness to change, and better perceived health or fitness [14, 17].

Self-efficacy for physical activity, defined as an individual's confidence in his or her ability to be physically active on a regular basis, has been one of the strongest and most consistent cognitive correlates of activity level [14, 15, 17]. Self-efficacy is related to both adoption and maintenance of physical activity [32]. It has been correlated with physical activity in a variety of settings, including large population-based community samples, exercise groups for healthy individuals, and clinical exercise programs [14]. Self-efficacy has also been shown to predict future physical activity levels in longitudinal studies [17]. Furthermore, self-efficacy may be enhanced through training and

feedback [52] and therefore could be a particularly important target for interventions.

Perceived barriers also correlate strongly with physical activity [14, 15, 17]. The most commonly reported barrier to physical activity among US samples is lack of time [15]. Some other common barriers include lack of facilities, bad weather, safety, lack of exercise partner, fatigue or lack of energy, poor health, and self-consciousness about appearance [14]. Perceived barriers may incorporate both subjective and objective components. Objective barriers, such as lack of exercise facilities, may be modified by policy interventions, and subjective barriers may be modified through cognitive interventions that refute beliefs that hinder activity.

Behavioral Factors

Behavioral factors that have been associated with current physical activity level include prior physical activity history, smoking, and Type A behavior. Of these, prior activity history has shown the most consistent association with current activity level [14, 17]. While not all studies have shown a significant association between smoking and physical activity, most have found an inverse relationship [14]. Type A behavior has been defined as a behavioral syndrome or style of living characterized by competitiveness, feelings of being under the pressures of time, striving for achievement, and aggressiveness [53]. Studies have indicated that Type A behavior is associated with greater overall levels of physical activity but lower adherence within supervised exercise programs [15, 17]. These results have implications for interventions, suggesting that individuals with greater Type A behavior may be better suited to individual or home-based physical activity programs.

Social Factors

Social factors that have been studied as correlates of physical activity include exercise group cohesion, physician influence, and social support. Group cohesion has shown a modest positive correlation with adherence in some studies [17]. However, physician influence and social support have been stronger and more consistent correlates of physical activity level and adherence [14, 17]. Physician advice to

exercise has been reported as a correlate of physical activity among the general adult population [54]. Social support has been significantly associated with physical activity in cross-sectional and prospective studies, both in community samples and within organized exercise groups [14, 55]. While both family and friend support for physical activity appear to be influential [14, 17], the role of the spouse seems to be particularly important [55].

Program-Related Factors

In addition to person-level characteristics, specific aspects of the physical activity regimen or program can influence adherence. Adherence may be poorer for high-intensity physical activity versus lower intensity levels [56]. With respect to exercise duration, some evidence indicates that completing several shorter bouts of activity may result in greater adherence than one longer bout, while retaining some health benefits [57]. Shorter, intermittent exercise periods may be particularly beneficial for reducing rates of attrition at the beginning of an exercise program [58].

Studies have also compared group- or center-based programs versus home-based programs. Some studies have found that home-based exercise is associated with greater adherence and higher levels of activity [59, 60]. However, some research has shown an advantage of center-based programs [61], and this may vary according to individual needs and preferences. Within the context of group- or center-based programs, there are several factors that have been shown to enhance adherence, including convenient time and location, reasonable cost, variety of exercise modalities, flexibility in exercise goals, and quality of the exercise leader [62].

Environmental Factors

There is growing recognition that environmental factors have a tremendous influence on individuals' physical activity behavior [14]. Perhaps the most prominent theme to emerge in recent research involving environmental factors is that of convenient access. Studies show that simply having convenient access to parks, walking or biking trails, or other physical activity facilities is strongly associated with greater activity levels [63, 64]. Neighborhood safety is also another key factor,

particularly among older adults, women, and individuals with lower education levels [64].

Screening for Non-adherence to Physical Activity Recommendations

There are numerous options for assessing physical activity. Most commonly, physical activity is measured via subjective self-report, using one of many available validated questionnaires [65]. While there is no single best questionnaire for assessing physical activity, some have been developed for specific patient groups (i.e., older adults), and this should be considered when selecting a measure. There are also objective measures of physical activity, including pedometers and accelerometers. While these objective measures may provide a more accurate assessment of activity level, use of this equipment may not be feasible in clinical settings and in some large-scale studies.

In clinical settings, a brief screening assessment for physical activity level is typically most appropriate. Many validated physical activity questionnaires, though useful in research settings, may be too time consuming to administer as part of a clinical screening process. However, brief assessments can be used to identify patients who are physically inactive [66, 67]. For example, Smith et al. found that the two-item assessment shown in Box 2.3 was feasible to use in a clinical setting and enabled physicians to ascertain the overall activity levels of patients [66]. These questions can be used to assess whether patients are meeting the guidelines for aerobic activity described in Boxes 2.1 and 2.2.

Box 2.3 Physical Activity Screening Assessment

1. How many times a week do you usually do 20 min or more of vigorous intensity activity that makes you sweat or puff and pant (e.g., heavy lifting, digging, jogging, aerobics, or fast bicycling)?

☐ 3 or more times a week ☐ 1–2 times a week ☐ None

2. How many times a week do you usually do 30 min or more of moderate intensity physical activity or walking that increases your heart rate or makes you breathe harder than normal (e.g., carrying light loads, bicycling, at a regular pace, or doubles tennis)?

☐ 5 or more times per week ☐ 3–4 times a week ☐ 1–2 times a week ☐ None

Source: Ref. [66]

Physical Activity Adherence Intervention Studies

There have been numerous studies designed to identify successful physical activity interventions. These studies have varied widely with respect to participant samples, settings, theoretical models, and intervention strategies. Physical activity interventions can be grouped into two main categories: public health/environmental/policy interventions and individual-based interventions (which also encompass small group classes). While this chapter focuses primarily on individual interventions that can be implemented in clinical settings, we first provide a brief overview of broad public health interventions.

Public Health, Environmental, and Policy Interventions

Because the problem of physical inactivity is pervasive, large-scale, population-based strategies to this problem are an important counterpart to intensive individualized and small group interventions. Public health, environmental, and policy strategies to enhance physical activity adherence can range from very simple, low-cost interventions to complex policies involving budget allocation and transportation restructuring [68]. In general, broad mass media educational approaches seem to have little influence on physical activity levels within communities [69]. However, other types of environmental and policy interventions have shown promising results [70, 71]. These

interventions have included posting signs in public areas to encourage the use of stairways, adding bicycle trails, organizing activity clubs, and providing additional exercise facilities in the community. While community- and population-based strategies are clearly important for facilitating physical activity, the costs of implementation are often a significant barrier [72].

Individual Interventions

Systematic reviews have concluded that there is good evidence to support the overall efficacy of individual interventions to increase physical activity and improve fitness [73, 74]. The following are brief descriptions of specific intervention components that have been shown to enhance physical activity levels and/or adherence:

1. *Health Education* [52, 75] While health education alone is not sufficient to promote long-term changes in exercise adherence, this can be a foundational component of broader interventions. It is important to provide individuals with information about the benefits of exercise, proper exercise techniques, and normal physiological responses that can be expected during exercise.
2. *Health Risk Appraisal* [76] Health risk appraisals provide participants with information about various aspects of their current health, risk factors, and/or fitness level. Health risk appraisals are also not typically sufficient to engender long-term behavior change, but they can help to enhance motivation and be used to monitor changes over time.
3. *Goal Setting* [52, 75] This strategy has been used widely in behavior change studies and involves asking participants to identify and document personal goals related to their physical activity behavior. Individuals should be encouraged to set goals that are realistic, specific, and relatively short term. Individuals should also be asked to identify specific steps toward meeting their physical activity goals.
4. *Contracts* [77] This strategy involves asking participants to write out specific physical activity behaviors they agree to do. Participants also identify individuals who will be responsible for verifying they have fulfilled their contract.

5. *Self-Monitoring* [78, 79] Self-monitoring is a commonly used strategy that involves asking participants to document their physical activity behavior. Participants can be asked to turn in their self-monitoring records to group leaders or other participants, which helps to facilitate adherence.
6. *Reinforcement and Incentives* [78, 80] These strategies are often combined with self-monitoring and/or goal setting and involve provision of some type of reward when participants attain an activity-related goal.
7. *Problem Solving* [52, 75, 79, 80] Problem-solving interventions teach individuals to identify obstacles or barriers that hinder their physical activity, generate and implement solutions, evaluate the outcome, and choose other solutions if needed.
8. *Relapse Prevention* [52, 75, 76] Similar to problem solving, this intervention involves instructing participants to identify future situations that may lead to lapses in adherence. Participants are then taught to develop specific strategies to deal with these potential situations.
9. *Stimulus Control* [52, 77] This strategy is built on the principle that environmental cues exert an important influence on behavior. Stimulus control interventions involve teaching participants to structure their environment in ways that encourage physical activity.
10. *Cognitive Restructuring* [77] Maladaptive thoughts and beliefs can contribute to non-adherence. For example, individuals may believe that exercise must be vigorous or painful to produce any health benefit. Cognitive restructuring is a process of teaching individuals to recognize these thoughts and replace them with more positive self-statements that can help to promote regular physical activity.
11. *Enhancing Social Support* [52, 75, 77, 80] Social support for physical activity can be enhanced through a group program, friend or family involvement, or interactions with personal trainers or health professionals.
12. *Modeling* [77] Modeling involves providing examples of peers who are successfully engaging in physical activity. This can occur in a group program context or through videos or other media that include examples of peers engaging in physical activity.

13. *Motivational Interviewing* [81] Motivational interviewing is a technique for negotiating behavior changes with people who are reluctant or ambivalent about changing [82]. The goal of this method is to increase individuals' intrinsic motivation for physical activity, as well as self-efficacy for physical activity.

There is no clear “best” strategy for increasing individuals' physical activity levels. Because many interventions have incorporated more than one of the components described above, it is difficult to disentangle the effectiveness of specific elements. Rather, these intervention components can be considered a “toolbox” of strategies to incorporate into physical activity interventions. In addition, the following general principles are important for effective physical activity interventions:

- *Incorporate Multiple Components* Interventions involving multiple components (of those described above) are generally more successful than those employing a single strategy [52, 77].
- *Include Cognitive-Behavioral Strategies* Studies that include some type of cognitive-behavioral component, such as goal setting or self-monitoring, seem to be the most effective [74, 83, 84].
- *Sufficient Intensity* Brief interventions (such as a one-time advice or health risk appraisals) are generally not a sufficient stimulus to promote behavior change [85]. However, provision of professional guidance about starting an exercise program, supplemented by some type of ongoing support, can be an effective strategy for increasing physical activity [74].
- *Use a Tailored Approach* Tailoring interventions to individual needs and preferences may result in better outcomes and improved adherence [86, 87].
- *Lifestyle Approach* Several studies have now shown that interventions designed to enhance lifestyle physical activity (including all leisure, occupational, or household activities) produce health and fitness benefits similar to those of structured exercise [7, 88, 89]. Furthermore, research suggests that lifestyle physical activity interventions are associated with greater adherence and activity levels than structured programs [90].

Settings for Delivery of Individual Interventions

There are many possible settings for delivering physical activity interventions, including community settings, worksites, and health-care settings. While there have been successful models of physical activity programs in each of these settings, and all are important, we focus here on interventions delivered in the health-care context. This is an attractive and important venue for delivering physical activity interventions for two main reasons. First, the majority of adults have contact with physicians on at least a yearly basis and average over three office visits per year [91]. Therefore, this method has the potential to reach a larger number of individuals than other in-person strategies. Second, clinicians' recommendations regarding health behaviors are generally valued and trusted by patients, and research shows that patients want to receive information about physical activity from their physicians [92]. However, studies show that physicians provide physical activity counseling infrequently and typically do not spend more than 3–5 min providing this type of counseling [93–95]. Lack of time, counseling training, organizational support, materials, and standardized protocols are barriers to provision of physical activity counseling by health-care providers [94].

Despite the challenges of delivering physical activity counseling in a health-care setting, reviews of prior research indicate that supplemental interventions in this context can be effective [29, 83, 85, 96]. Three examples of large trials that have shown the efficacy of health-care provider-based physical activity interventions include the Activity Counseling Trial [97], the Physical Activity for Life program [98], and the Patient-Centered Assessment and Counseling for Exercise (PACE) program [99]. The PACE program was designed to be incorporated into health-care settings with minimal involvement from medical staff. Briefly, PACE involves completion of a short questionnaire to assess readiness to begin a physical activity program, a 3–5 min physician-delivered physical counseling session based on the patient's stage of readiness to engage in physical activity, and a brief booster telephone call by a health educator approximately 2 weeks after the visit. PACE materials, including a Provider Manual, assessment forms, and three counseling protocols (for patients in different stages of readiness), are available for use (Project PACE, Centers for Disease Control and Prevention, Cardiovascular Health

Branch). These materials have also been modified for older adults (<http://www.research.va.gov/resources/pubs/LIFE-modules.cfm>).

Physical activity programs in the health-care settings should incorporate the general principles described above for effective interventions. Also, the US Preventive Services Task Force has adopted the following general approach to clinically based behavior programs (including physical activity) [100]:

- *Assess*: Ask about or assess behavioral health risk(s) and factors affecting a patient's choice of behavior change goals and methods. Physical activity behaviors should be assessed *routinely at each visit*.
- *Advise*: Give clear, specific, and personalized behavior change advice, including information about personal health harms and benefits.
- *Agree*: Collaboratively select appropriate treatment goals and methods based on the patient's interest in and willingness to change the behavior.
- *Assist*: Using behavior change techniques (self-help and/or counseling), aid the patient in achieving agreed-on goals by acquiring the skills, confidence, and social/environmental supports for behavior change, supplemented with adjunctive medical treatments when appropriate.
- *Arrange*: Schedule follow-up contacts (in person or by telephone) to provide ongoing assistance/support and to adjust the treatment plan as needed, including referral to more intensive or specialized treatment.

Historically, physical activity programs have been delivered face to face. However, there has been movement toward developing alternative modes of delivery, particularly telephone and Internet-based programs. Studies have shown that overall these approaches are effective in increasing physical activity levels [69, 101]. Some research has even suggested that adherence rates may even be higher in telephone or Internet-assisted, home-based interventions compared to programs involving face-to-face contact [59, 60]. Telephone or Internet-based follow-up should be considered as an approach to follow-up of brief in-person physical activity counseling in primary care settings, as well as other contexts.

Physical Activity Adherence Interventions in Special Populations

There are several demographic groups known to have lower levels of physical activity, including older adults, women, ethnic and racial minorities, and individuals with low SES. When considering physical activity interventions for these groups, the same general principles described above should be followed. In addition, the following key points should be considered:

Older Adults

- All older adults should avoid inactivity. Some physical activity is better than none, and older adults who participate in any amount of physical activity gain some health benefits.
- Older adults with chronic conditions should understand whether and how their conditions affect their ability to do regular physical activity safely.
- Older adults should begin with low-intensity exercise and gradually increase to moderate levels [102].
- Cognitive mediators, particularly self-efficacy, seem to be of particular importance in this group [103, 104]. Therefore strategies to enhance self-efficacy for physical activity (i.e., goal setting, modeling) should be included in interventions.
- Individually tailored interventions should be stressed to allow incorporation of strategies that address unique barriers such as intermittent illness and the burden of caregiving [24].

Ethnic and Racial Minorities

- Physical activity programs should be tailored to meet specific cultural concerns, perspectives, and values [105]. For example, interventions may need to address cultural norms, perspectives, and beliefs regarding physical activity.
- Communities should be directly involved in planning and implementation of physical activity programs [106].
- Among some African American communities, church-based programs may be an appropriate setting for delivery of physical activity interventions [107].

Individuals with Low Socioeconomic Status

- Individuals with low SES are underrepresented in physical activity intervention research, therefore optimal strategies to promote exercise adherence in this demographic group are not well understood [106].
- Access to exercise facilities and safe areas for outdoor recreation may be limitations. Interventions that assist with providing these resources may be particularly effective.
- Interventions combining telephone and mailed counseling have been effective in promoting increased physical activity among low-income women [108] and may be suitable in general for this demographic group.

Women

- Research suggests that women may be particularly responsive to intensive behavioral counseling [75].
- Physical activity interventions should consider and incorporate family and caregiving responsibilities [109, 110].
- Interventions should also incorporate social support from peers of family members [33].

Clinical and Policy Implications

Research has confirmed the importance of health-care provider influence on patients' physical activity. Studies have not yet identified an optimal strategy for enhancing physical activity within the health-care settings. However, research does suggest that clinicians can improve patients' adherence simply by assessing and encouraging physical activity on a *regular and repeated* basis. Current rates of physical activity recommendation by physicians are low and must be increased. There are several specific steps that may improve current practice in this area:

- First, more attention should be given to training medical students regarding physical activity (and other health behavior) recommendations and counseling. Since physical activity guidelines change

over time, continuing education for clinicians at all stages of their career would also be valuable.

- Second, physical activity assessment and recommendations could be included as a quality indicator within medical systems. This would provide both a reminder system and accountability for physicians to speak with patients about their physical activity.
- Third, physicians should be informed about local resources related to physical activity, including both clinical and community facilities. This would allow easy referral for patients who are interested in group activities, specific types of facilities, or more intensive exercise counseling.
- Fourth, physicians' time with patients is clearly limited, and there is a need to develop and implement programs that enhance physician recommendations with more detailed behavioral counseling, delivered by a nurse or health educator.

Research has also highlighted the significant influence of the environment on physical activity behavior. Public health initiatives and policies that enhance opportunities for physical activity within communities may have a tremendous impact on nationwide activity levels. There is a need to increase the number, safety, and accessibility of parks and recreational facilities within communities. In addition to community-based efforts, worksites can play an important role in encouraging physical activity. Some practical strategies for worksites include onsite exercise groups, provision of onsite shower facilities for employees, and financial incentives that encourage physical activity (such as reduced costs for health club memberships).

Summary

Physical activity is associated with many physical and psychological health benefits. Yet despite decades of effort to improve physical activity levels, many Americans do not meet physical activity recommendations, and this remains an important public health problem. Health-care visits are an important but underutilized venue for encouraging individuals to adopt and maintain physically active lifestyles. While there are demographic groups who are at greater risk for

physical inactivity (older adults, women, racial and ethnic minorities, individuals with low SES), the problem of inactivity is pervasive, and this health behavior should be addressed for all adults as part of routine health care.

While time limitations and competing demands during health-care visits are barriers to physical activity counseling, it should be considered that outcomes for many chronic health conditions can be substantially improved by increasing physical activity levels. Therefore discussion of physical activity should be treated as a priority. The following are recommendations for incorporating physical activity screening and counseling into health-care visits:

- Ask patients about physical activity behaviors *routinely* during visits. (Use questions such as those listed in Box 2.3 to assess whether patients are meeting physical activity recommendations described in Boxes 2.1 and 2.2.)
- Clearly advise that patients become and remain physically active and stress that physical activity is a key component to maintaining health and managing disease.
- Provide written information on physical activity recommendations and advise that patients set a goal to achieve that amount of physical activity weekly.
- Assist patients with specific plans for incorporating physical activity into their daily life.
- For physically inactive patients, ask about main barriers to physical activity and provide recommendations for dealing with these. Physical inactivity should not be an acceptable lifestyle.
- Become familiar with community resources for physical activity (i.e., organized exercise classes, parks and trails, recreation facilities) and recommend these to patients. Consider maintaining a written list of these resources to give to patients.
- Consider possibilities for incorporating more intensive physical activity interventions into a clinical practice, such as
 - Regular follow-up calls from a nurse or health educator to discuss progress toward physical activity goals
 - Internet-based programs for recording physical activity that can be accessed by the health-care provider prior to visits

- Facilitate creation of physical activity groups among patients and their family members (i.e., walking club)
- Become familiar with insurance companies that provide incentives or benefits aimed at promoting physical activity
- Access national organizations that provide materials aimed at promoting physical activity, such as the American College of Sports Medicine and the Centers for Disease Control and Prevention

References

1. U.S. Department of Health and Human Services. *Physical activity fundamental to preventing disease*. Washington, DC; 2002.
2. Colditz GA. Economic costs of obesity and inactivity. *Med Sci Sports Exerc.* 1999;31(11):S663–S667.
3. McGinnis JM, Foege WH. Actual causes of death in the United States. *JAMA.* 1993;270:2207–2212.
4. U.S. Department of Health and Human Services. *Healthy people 2010: Understanding and improving health. 2nd Ed.* Washington, DC: US Government Printing Office; 2000.
5. U.S. Department of Health and Human Services. *2008 Physical activity guidelines for Americans*; 2008.
6. Haskell WL, Lee I-M, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc.* 2007;39(8):1423–1434.
7. Dunn AL, Marcus BH, Kampert JB, Garcia ME, Kohl HW, Blair SN. Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness: a randomized trial. *JAMA.* 1999;281:327–334.
8. Matthews CE, Chen KY, Freedson PS, et al. Amount of time spent in sedentary behaviors in the United States, 2003–2004. *Am J Epidemiol.* 2008;167(7):875–881.
9. Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc.* 2008;40:181–188.
10. Sallis JF, Swelens BE. Assessment of physical activity by self-report: status, limitations, and future directions. *Res Q Exerc Sport.* 2000;71:S1–S14.
11. Morey MC, Pieper CF, Crowley GM, Sullivan RJ, Puglisi CM. Exercise adherence and 10-year mortality in chronically ill older adults [comment]. *J Am Geriatr Soc.* 2002;50(12):1929–1933.
12. Belza B, Topolski T, Kinne S, Patrick DL, Ramsey SD. Does adherence make a difference? Results from a community-based aquatic exercise program. *Nurs Res.* 2002;51(5):285–291.

13. Dishman RK. Overview. In: Dishman RK, ed. *Exercise adherence: It's impact on public health*. Champaign, IL: Human Kinetics; 1988.
14. Trost SG, Owen N, Bauman AE, Sallis JF, Brown W. Correlates of adults' participation in physical activity: review and update. *Med Sci Sports Exerc*. 2002;34(12):1996–2001.
15. Dishman RK, Sallis JF. Determinants and interventions for physical activity and exercise. In: Bouchard C, Shephard RJ, Stephens T, eds. *Physical activity, fitness and health: International proceedings and consensus statement*. Champaign, IL: Human Kinetics; 1994:214–238.
16. Rhodes RE, Martin AD, Taunton JE, Rhodes EC, Donnelly M, Elliot J. Factors associated with exercise adherence among older adults. An individual perspective. *Sports Med*. 1999;28(6):397–411.
17. Sallis JF, Owen N. Determinants of physical activity. *Physical activity and behavioral medicine*. Thousand Oaks, CA: Sage; 1999:110–134.
18. Centers for Disease Control and Prevention. Prevalence of self-reported physically active adults, United States, 2007. *MMWR*. 2008;57(48):1297–1300.
19. Barnes PM, Schoenborn CA. *Physical activity among adults: United States 2000. Advance data from vital and health statistics; no. 333*. Hyattsville, MD: National Center for Health Statistics; 2003.
20. U.S. Department of Health and Human Services. *Physical activity and health: A report to the surgeon general*. Atlanta, GA: U.S. Department of Health and Human Services; 1996.
21. Stephens T, Caspersen CJ. The demography of physical activity. In: Bouchard C, Shephard RJ, Stephens T, eds. *Physical activity, fitness, and health*. Champaign, IL: Human Kinetics; 1995:204–213.
22. Caspersen CJ, Merritt RK, Stephens T. International physical activity patterns: a methodological perspective. In: Dishman RK, ed. *Advances in exercise adherence*. Champaign, IL: Human Kinetics; 1994:73–110.
23. Schutzer KA, Graves BS. Barriers and motivations to exercise in older adults. *Prev Med*. 2004;39:1056–1061.
24. Brawley LR, Rejeski WJ, King AC. Promoting physical activity for older adults: the challenges for changing behavior. *Am J Prev Med*. 2003;25(3Sii):172–183.
25. Stephens T, Craig CL. *The well-being of Canadians: highlights from the 1988 Campbell's soup survey*. Ottawa, ON: Canadian Fitness and Lifestyle Research Institute; 1990.
26. Craig CL, Russell SJ, Cameron C, Beaulieu A. *1997 Physical activity benchmarks report*. Ottawa, ON: Canadian Fitness and Lifestyle Research Institute; 1998.
27. Burton LC, Shapiro S, German PS. Determinants of physical activity and maintenance among community-dwelling older persons. *Prev Med*. 1999;29:422–430.
28. Morey MC, Sullivan RJ. Medical assessment for health advocacy and practical strategies for exercise initiation. *Am J Prev Med*. 2003;25(3Sii):204–208.

29. Eden KB, Orleans CT, Mulrow CD, Pender NJ, Teutsch SM. Does counseling by clinicians improve physical activity? A summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med.* 2002;137:208–215.
30. Kerse NM, Elley CR, Robinson E, Arroll B. Is physical activity counseling effective for older people? A cluster randomized, controlled trial in primary care. *J Am Geriatr Soc.* 2005;53(11):1951–1956.
31. Kolt GS, Schofield GM, Kerse N, Garrett N, Oliver M. Effect of telephone counseling on physical activity for low-active older people in primary care: a randomized, controlled trial. *J Am Geriatr Soc.* 2007;55(7):986–992.
32. Sallis JF, Haskell WL, Fortmann SP, Vranizan KM, Taylor CB, Solomon DS. Predictors of adoption and maintenance of physical activity in a community sample. *Prev Med.* 1986;15:331–341.
33. Vrazel J, Saunders RP, Wilcox S. An overview and proposed framework of social-environmental influences on the physical-activity behavior of women. *Am J Health Promot.* 2008;23(1):2–12.
34. Crespo CJ. Encouraging physical activity in minorities: eliminating disparities by 2010. *Physician Sports Med.* 2000;28(10):36–51.
35. Crespo CJ, Smit E, Andersen RE, Carter-Pokras O, Ainsworth BE. Race/ethnicity, social class and their relation to physical activity during leisure time: results from the Third National Health and Nutrition Examination Survey, 1988–1994. *Am J Prev Med.* 2000;18(1):46–53.
36. Washburn RA, Kline G, Lackland DT, Wheeler FC. Leisure time physical activity: are there black/white differences? *Prev Med.* 1992;21:127–135.
37. Wilcox S, Castro C, King AC, Housemann R, Brownson RC. Determinants of leisure time physical activity in rural compared to urban older and ethnically diverse women in the United States. *J Epidemiol Community Health.* 2000;54:667–672.
38. Henderson KA, Ainsworth BE. Sociocultural perspectives on physical activity in the lives of older African American and American Indian women: a cross cultural activity participation study. *Women Health.* 2000;31(1):1–20.
39. Whitt MC, Kumanyika SK. Tailoring counseling on physical activity and inactivity for African-American women. *Ethn Dis.* 2002;12(4):62–71.
40. Dergance JM, Calmbach WL, Dhanda R, Miles TP, Hazuda HP, Mouton CP. Barriers and benefits of leisure time physical activity in the elderly: differences across cultures. *J Am Geriatr Soc.* 2003;51(6):863–868.
41. Henderson KA, Ainsworth BE. A synthesis of perceptions about physical activity among older African American and American Indian women. *Am J Public Health.* 2003;93(2):313–317.
42. Richter DL, Wilcox S, Greaney ML, Henderson KA, Ainsworth BE. Environmental, policy, and cultural factors related to physical activity in African American women. *Women Health.* 2002;36(2):91–109.
43. Wilcox S, Richter DL, Henderson KA, Greaney ML, Ainsworth BE. Perceptions of physical activity and personal barriers and enablers in African American women. *Ethn Dis.* 2002;12(3):353–362.

44. Van Duyn MAS, McCrae T, Wingrove BK, et al. Adapting evidence-based strategies to increase physical activity among African Americans, Hispanics, Hmong, and Native Hawaiians: a social marketing approach. *Prev Chronic Dis.* 2007;4(4):1–11.
45. Salmon JW, Owen N, Bauman A, Schmitz MKH, Booth M. Leisure-time, occupational, and household activity among professional, skilled, and less-skilled workers and homemakers. *Prev Med.* 2000;30:191–199.
46. Rimmer JH, Nicola T, Riley B, Creviston T. Exercise training for African Americans with disabilities residing in difficult social environments. *Am J Prev Med.* 2002;23(4):290–295.
47. Billings J, Zeitel L, Lukomnik J, Carey T, Blank A, Newman L. Impact of socioeconomic status on hospital use in New York City. *Health Aff (Millwood).* 1993;12:162–173.
48. Daly J, Sindone AP, Thompson DR, Hancock K, Chang E, Davidson P. Barriers to participation in and adherence to cardiac rehabilitation programs: a critical literature review. *Prog Cardiovasc Nurs.* 2002;17(1):8–17.
49. King AC, Blair SN, Bild DE, et al. Determinants of physical activity and interventions in adults. *Med Sci Sports Exerc.* 1992;24(6):S221–S236.
50. Brawley LR, Rejeski WJ, Lutes L. A group-mediated cognitive behavioral intervention for increasing adherence to physical activity in older adults. *J Appl Biobehav Res.* 2000;5:47–65.
51. Brownson RC, Eyler AA, King AC, Brown DR, Shyu YL, Sallis JF. Patterns and correlates of physical activity among US women 40 years and older. *Am J Public Health.* 2000;90:267–270.
52. Rejeski WJ, Brawley LR, Ambrosius WT, et al. Older adults with chronic disease: benefits of group-mediated counseling in the promotion of physically active lifestyles. *Health Psychol.* 2003;22(4):414–423.
53. Pargman D, Green L. The Type A behavior pattern and adherence to a regular running program by adult males ages 25–39 years. *Percept Mot Skills.* 1990;70(3 Pt 1):1040–1042.
54. Kreuter MW, Chheda SG, Bull FC. How does physician advice influence patient behavior? Evidence for a priming effect. *Arch Fam Med.* 2000;9(5):426–433.
55. Wallace JP, Raglin JS, Jastremski CA. Twelve month adherence of adults who joined a fitness program with a spouse vs without a spouse. *J Sports Med Phys Fit.* 1995;35(3):206–213.
56. Perri MG, Anton SD, Durning PE, et al. Adherence to exercise prescriptions: effects of prescribing moderate versus higher levels of intensity and frequency. *Health Psychol.* 2002;21(5):452–458.
57. Murphy MH, Hardman AE. Training effects of short and long bouts of brisk walking in sedentary women. *Med Sci Sports Exerc.* 1998;30(1):152–157.
58. Jacobsen DJ, Donnelly JE, Snyder-Heelan K, Livingston K. Adherence and attrition with intermittent and continuous exercise in overweight women. *Int J Sports Med.* 2003;24(6):459–464.

59. King AC, Haskell WL, Taylor CB, Kraemer HC, DeBusk RF. Group- vs home-based exercise training in healthy older men and women. A community-based clinical trial. *JAMA*. 1991;266(11):1535–1542.
60. Carlson JJ, Johnson JA, Franklin BA, VanderLaan RL. Program participation, exercise adherence, cardiovascular outcomes, and program cost of traditional versus modified cardiac rehabilitation. *Am J Cardiol*. 2000;86(1):17–23.
61. Cox KL, Burke V, Gorely TJ, Beilin LJ, Puddey IB. Controlled comparison of retention and adherence in home- vs center-initiated exercise interventions in women ages 40–65 years: the S.W.E.A.T. Study (Sedentary Women Exercise Adherence Trial). *Prev Med*. 2003;36(1):17–29.
62. Franklin BA. Program factors that influence exercise adherence: Practical adherence for the clinical staff. In: Dishman RK, ed. *Exercise adherence: Its impact on public health*. Champaign, IL: Human Kinetics; 1988:237–258.
63. Huston SJ, Evenson KR, Bors P, Gizlice Z. Neighborhood environment, access to places for activity, and leisure time physical activity in a diverse North Carolina population. *Am J Health Promot*. 2003;18(1):58–69.
64. Powell KE, Martin LM, Chowdhury PP. Places to walk: convenience and regular physical activity. *Am J Public Health*. 2003;93(9):1519–1521.
65. Kriska A, Caspersen C. Introduction to a collection of physical activity questionnaires. *Med Sci Sports Exerc*. 1997;29(6):5–9.
66. Smith BJ, Marshall AL, Huang N. Screening for physical activity in family practice: evaluation of two brief assessment tools. *Am J Prev Med*. 2005;29(4):256–264.
67. Taylor-Piliae RE, Norton LC, Haskell WL, et al. Validation of a new brief activity survey among men and women aged 60–69 years. *Am J Epidemiol*. 2006;164(6):598–606.
68. Sallis JF, Bauman A, Pratt M. Environmental and policy interventions to promote physical activity. *Am J Prev Med*. 1998;15(4):379–397.
69. Marcus BH, Owen N, Forsyth LH, Cavill NA, Fridinger F. Physical activity interventions using mass media, print media, and information technology. *Am J Prev Med*. 1998;15(4):362–378.
70. Blamey A, Mutrie N, Aitchison T. Health promotion by encouraged use of stairs. *Br Med J*. 1995;311:289–290.
71. Brownell KD, Stunkard AJ, Albaum JM. Evaluation and modification of exercise patterns in the natural environment. *Am J Psychiatry*. 1980;137:1540–1545.
72. Brownson RC, Ballew P, Dieffenderfer B, et al. Evidence-based interventions to promote physical activity: what contributes to dissemination by state health departments. *Am J Prev Med*. 2007;33(1S):S66–S78.
73. Kahn EB, Ramsey LT, Brownson RC, et al. The effectiveness of interventions to increase physical activity: a systematic review. *Am J Prev Med*. 2002;22(4S):73–107.
74. Foster C, Hillsdon M, Thorogood M. Interventions for promoting physical activity. *Cochrane Database Syst Rev*. 2005;1. Art No.: CD003180. DOI: 003110.001002/14651858.CD14003180.pub14651852.

75. The Writing Group for the Activity Counseling Trial Research Group. Effects of physical activity counseling in primary care: the activity counseling trial: a randomized controlled trial. *JAMA*. 2001;286: 677–687.
76. Friedman RH. Automated telephone conversations to assess health behavior and deliver behavioral interventions. *J Med Syst*. 1998;22(2):95–102.
77. Sullivan T, Allegrante JP, Peterson MG, Kovar PA, MacKenzie CR. One-year followup of patients with osteoarthritis of the knee who participated in a program of supervised fitness walking and supportive patient education. *Arthritis Care Res*. 1998;11(4):228–233.
78. Noland MP. The effects of self-monitoring and reinforcement on exercise adherence. *Res Q Exerc Sport*. 1989;60(3):216–224.
79. King AC, Pruitt LA, Phillips W, Oka R, Rodenburg A, Haskell WL. Comparative effects of two physical activity programs on measured and perceived physical functioning and other health-related quality of life outcomes in older adults. *J Gerontol Ser A-Biol Sci Med Sci*. 2000;55(2): M74–83.
80. Heesch KC, Masse LC, Dunn AL, Frankowski RF, Mullen D. Does adherence to a lifestyle physical activity intervention predict changes in physical activity. *J Behav Med*. 2003;26(4):333–348.
81. Wilson DK, Friend R, Teasley N, Green S, Reaves IL, Sica D. Motivational versus social cognitive interventions for promoting fruit and vegetable intake and physical activity in African American adolescents. *Ann Behav Med*. 2002;24(4):310–319.
82. Miller WC, Pollock S. *Motivational interviewing: Preparing people to change addictive behaviour*. London: Gilford Press; 1991.
83. Marcus BH, Williams DM, Dubbert PM, et al. Physical activity intervention studies: what we know and what we need to know: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity); Council on Cardiovascular Disease in the Young; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research. *Circulation*. 2006;114:2739–2752.
84. Conn VS, Hafdahl AR, Brown SA, Brown LM. Meta-analysis of patient interventions to increase physical activity among chronically ill adults. *Patient Educ Couns*. 2008;70:157–172.
85. Simons-Morton DG, Calfas KJ, Oldenburg B, Burton NW. Effects of interventions in health care settings on physical activity or cardiorespiratory fitness. *Am J Prev Med*. 1998;15(4):413–430.
86. Blissmer B, McAuley E. Testing the requirements of stages of physical activity among adults: the comparative effectiveness of stage-matched, mismatched, standard care, and control interventions. *Ann Behav Med*. 2002;24(3):181–189.
87. Peterson TR, Aldana SG. Improving exercise behavior: an application of the stages of change model in a worksite setting. *Am J Health Promot*. 1999;13:229–232.

88. Dunn AL, Gracia ME, Marcus BH, Kampert JB, Kohl HW, Blair SN. Six-month physical activity and fitness changes in Project Active, a randomized trial. *Med Sci Sports Exerc.* 1998;30(7):1076–1083.
89. Andersen RE, Bartlett SJ, Moser CD, Evangelisti MI, Verde TJ. Lifestyle or aerobic exercise to treat obesity in dieting women. *Med Sci Sports Exerc.* 1997;29(Suppl 5):S46.
90. Cardinal BJ, Sachs ML. Effects of a mail-mediated, stage-matched exercise behavior change strategies on female adults' leisure-time exercise behavior. *J Sports Med Phys Fit.* 1996;36(2):100–107.
91. Schappert SM. *National ambulatory medical care survey: 1991. 230th Ed.* Hyattsville, MD: National Center for Health Statistics; 1993.
92. Godin G, Shephard R. An evaluation of the potential role of the physician in influencing community exercise behavior. *Am J Health Promot.* 1990;4:225–229.
93. Wee CC, McCarthy EP, Davis RB, Phillips RS. Physician counseling about exercise. *JAMA.* 1999;282(16):1583–1588.
94. Lewis CE, Clancy C, Leake B, Schwartz JS. The counseling practices of internists. *Ann Intern Med.* 1991;114:54–58.
95. Centers for Disease Control and Prevention. Missed opportunities in preventive counseling for cardiovascular disease – United States, 1995. *MMWR.* 1998;47:91–95.
96. Eakin EG, Glasgow RE, Riley KM. Review of primary care-based physical activity intervention studies: effectiveness and implications for practice and future research. *J Fam Pract.* 2000;49:158–168.
97. The ACT Writing Group. Effects of physical activity counseling in primary care. The activity counseling trial: a randomized controlled trial. *JAMA.* 2001;286:677–687.
98. Pinto BM, Goldstein MG, Marcus BH. Activity counseling by primary care physicians. *Prev Med.* 1998;27:506–513.
99. Calfas KJ, Long BJ, Sallis JF, Wooten WJ, Pratt M, Patrick K. A controlled trial of physician counseling to promote the adoption of physical activity. *Prev Med.* 1996;25(3):225–233.
100. US Preventive Services Task Force. *Guide to clinical preventive services. 2nd Ed.* Baltimore, MD: Williams & Wilkins; 1996.
101. Castro CM, King AC. Telephone-assisted counseling for physical activity. *Exerc Sport Sci Rev.* 2002;30(2):64–68.
102. Cress ME, Buchner DM, Prohaska T, et al. Best practices for physical activity programs and behavior counseling in older adult populations. *J Aging Phys Act.* 2004;13(1):61–74.
103. Brassington GS, Atienza AA, Perczek RE, DiLorenzo TM, King AC. Intervention-related cognitive versus social mediators of exercise adherence in the elderly. *Am J Prev Med.* 2002;23(2 Suppl):80–86.
104. Conn VS, Minor MA, Burks KJ, Rantz MJ, Pomeroy SH. Integrative review of physical activity intervention research with aging adults. *J Am Geriatr Soc.* 2003;51:1159–1168.

105. Pasick RJ, D'Onofrio CN, Otero-Sabogal R. Similarities and differences across cultures: questions to inform a third generation for health promotion research. *Health Educ Q.* 1996;23:S142–S161.
106. Taylor WC, Baranowski T, Young DR. Physical activity interventions in low-income, ethnic minority, and populations with disability. *Am J Prev Med.* 1998;15(4):334–313.
107. Kumanyika SK, Charleston JB. Lose weight and win: a church-based weight loss program for blood pressure control among black women. *Patient Educ Couns.* 1992;19:19–32.
108. Albright CL, Pruitt L, Castro C, Gonzales A, Woo S, King AC. Modifying physical activity in a multiethnic sample of low-income women: one-year results from the IMPACT (Increasing Motivation for Physical Activity) project. *Ann Behav Med.* 2005;50(3):191–200.
109. Miller YD, Trost SG, Brown WJ. Mediators of physical activity behavior changes among women with young children. *Am J Prev Med.* 2002;23(2S):98–103.
110. King AC, Baumann K, O'Sullivan P, Wilcox S, Castro C. Effects of moderate-intensity exercise on physiological, behavioral, and emotional responses to family caregiving: a randomized controlled trial. *J Gerontol Ser A-Biol Sci Med Sci.* 2002;57(1):M26–M36.

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