**Lift Offs Work!: the rapidly growing evidence base**

The inordinately high levels of sedentary behavior observed in population-based studies, e.g., the average adult engages in only 6-10 minutes per day of at least moderate intensity physical activity (Troiano et al., 2008) and more than 40% of Los Angeles County adults getting less than 10 minutes per week of continuous moderate-to-vigorous physical activity (Yancey et al., 2004a). These data are commensurate with an overweight rate of nearly two-thirds of US adults overall (Flegal et al., 2002) and one-third of children of color (Ogden et al., 2002), underscoring the critical need for incremental behavior change approaches, targeting the sedentary and overweight, while engaging everyone.

At least 20 demonstration projects, university or corporate research studies, or public health department service programs support the feasibility and efficacy of the concept of incorporating brief (usually 10-minute) structured group exercise breaks into daily organizational routine, as a major intervention component or as a singular approach. The most common settings for these interventions have been schools and workplaces. Many are described briefly below in an annotated bibliography. This evidence demonstrates that:

1. There is considerable receptivity to physical activity integration into the conduct of “business,” both at the individual and organizational levels (Pronk et al., 1995; Lloyd et al., 2004; Yancey et al., 2004d; Lobstein, 2006; Wilcox et al., 2006; Zahner et al., 2006);
2. These sessions contribute meaningfully to daily accumulation of moderate-to-vigorous physical activity (Cardon et al., 2004; Stewart et al., 2004; Andreyev & Sturm, 2006; Mahar et al., 2006; Naylor et al., 2008);
3. Exercise breaks serve as a motivational “teachable moment” linking sedentary behavior to health/fitness status for inactive individuals (Yancey et al., 2004c);
4. Improvements in clinical outcomes from as little as one 10-minute break/day (e.g., blood pressure, waist circumference, mood states, cumulative trauma disorders, attention span, on-task behavior; bone mineral density or architecture) have been demonstrated (Pronk et al., 1995; Mackelvie et al., 2001; 2002; 2003; 2004; Petit et al., 2002; Elley et al., 2006; Jurg et al., 2006; Metzler & Williams, 2006; Sibley et al., 2006; Yancey et al., 2006a; Liu et al., 2007; Verstraete et al., 2007; Lara et al., 2008; Naylor et al., 2008);
5. Organizational benefits have been documented, such as increased productivity (CA DHS, 2004) and decreased classroom disruptiveness (Sibley et al., 2006);
6. Provider counseling behavior is positively influenced (Crawford et al., 2004); and
7. Spill-over (generalization) to increase active leisure may occur (Yancey et al., 2006a).
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Such “push” or “opt-out” interventions, e.g., non-discretionary time structured group exercise breaks, walking meetings, and nearby parking and elevator restrictions, that rely less on (and potentially constructively influence) individual initiative and motivation to be active, particularly in ethnically diverse populations with numerous barriers to active leisure, may have greater organizational and societal impact (increased productivity, medical care cost savings) than past efforts (King et al., 1995; Kumanyika, 2001; Yancey et al., 2005; Yancey et al., 2004b; Taylor et al., 2005; Zimring et al., 2005; Kumanyika & Grier, 2006; Marcus et al., 2006; Sloane et al., 2006; Yancey et al., 2006a).

Key findings across studies include: (1) role models utilized (study and site staff, video subjects) must reflect the spectrum of characteristics of the target population—ethnicity, gender, age, weight; (2) experiential learning enhances sustainability and salience; (3) organizational leadership commitment is critical and must be secured at the outset and reinforced repeatedly; (4) organizations, and their staff members, are at different points on the change continuum, and intervention strategies must accommodate these difference, i.e. including both approaches that require active choice and passive structural ones; (5) intervention components linked to existing organizational structures/vehicles (e.g., staff meetings, newsletters) enhance exposure levels and sustainability; and (6) culturally salient music selection is an essential ingredient in engaging groups in movement. This concept is built on social cognitive theory, social ecological models; and social marketing approaches which incorporate the economic concerns of both organizational leaders/employers and individuals (Grier & Bryant, 2005; Bandura, 1998; 1989; Stokols, 2003; 1996; Sturm, 2004; 2002; Yancey et al., 2006c;d).

Westinghouse Strength & Flexibility Program. In a group-randomized, controlled, pre-test/post-test, intervention trial, employees who assembled computer boards performed a set of 23 flexibility and strength exercises, designed to prevent lower back and carpal tunnel injury, for 10 minutes each day on company time under supervision (Pronk et al., 1995). No study sample demographics were provided. Daily employee participation rates were 97-100%. After 6 months of program implementation, significant improvements were observed in wrist flexion, wrist extension, low-back flexibility, fatigue, anger, and mood state.

LAC DHS Lift Off Feasibility Study. A randomized, controlled, post-test only, intervention trial tested the effect of incorporating a 10-minute exercise break (Lift Off) into longer (>1 hour) staff meetings and training seminars: (a) in engaging sedentary, “pre-contemplators” in physical activity; and (b) on self-reported mood/well-being indicators (Yancey, 2004c). The study was implemented in 26 meetings with 449 employees, predominantly overweight, middle-aged women of color. More than 90% of meeting attendees participated in the exercises. Results showed that captive audiences may be engaged in brief exercise bouts as a part of the workday, regardless of physical activity stage of change or weight status. Furthermore, participation in the breaks may produce at least short-term motivational benefit, by appropriately eroding complacent self-perceived good health and fitness status among the sedentary. Being confronted experientially with one’s own sub-optimal fitness level (a common refrain is “are you sure it’s only been 5 minutes?!”) may provide a teachable moment/reality check, potentially increasing motivation to be active by assisting them in making the link between good health status and a physically active lifestyle. Importantly, while most interventions operate psychologically to motivate behavior change, the social conformity-influenced exercise participation by sedentary individuals here adds physiological synergy to the psychological impetus—enjoyment/enhanced feelings of well-being complemented by a reminder of her/his unfit state.
Steppin’ Up to Better Health/AABLH Organizational Wellness Program. AABLH adapted and implemented the Los Angeles County organizational wellness intervention, providing training in incorporating physical activity and healthy food choices into the routine “conduct of business” in a variety of predominantly public and private, non-profit sector agencies. A total of 35 organizational units, with more than 700 individuals as staff, members or clients (mostly overweight/obese African-American women), completed the 12-, or shortened and retooled 6-week curriculum. Attendance and retention rates between baseline and post-intervention assessment were quite low for the 12-week curriculum (37% retention), but substantially higher for the 6-week offering (66% attendance, 92% retention). Feelings of sadness or depression decreased significantly among 12-week participants (p=0.00), fruit/vegetable intake increased significantly (+0.5 servings/day, p=0.00), and BMI decreased marginally (-0.5 kg/m², p=0.08), with no significant changes in these outcomes in the 6-week group. However, the #s of days on which individuals participated in vigorous physical activity increased significantly among 6-week (not 12-week) participants (+0.3, p=0.00) (Yancey et al., 2006a).

African Americans Building a Legacy of Health (AABLH). As a part of this project of the CDC’s REACH 2010 initiative (Yancey et al., 2004d), community-based organizations serving targeted areas of Los Angeles participated in one or more interventions originally developed by the LAC DHS to incorporate physical activity into routine organizational practice. These interventions centered on leadership cultivation to model the behaviors promoted. Level of organizational support for physical activity integration was assessed, as reflected in the extent of organizational commitment associated with each intervention: participation in exercise breaks at REACH meetings and events (lowest level); inviting REACH staff to lead exercise breaks at their organizational functions (low intermediate level); hosting an organizational wellness training series on these types of practical strategies to increase physical activity and healthy food access (high intermediate level); and subcontracting with REACH to provide physical activity-related programs and services (high level). Individual-level data characterizing the socio-demography, health status and health behaviors of organization staff/members/clients underscored the risk burden in the targeted population: 66% overweight, 30% obese; >40% completely sedentary (<10 minutes of physical activity weekly); 33% hypertensive, 26% hypercholesterolemic; 86% female, 73% African-American, 22% college-educated. Nearly half of the ~240 participating organizations actively embraced physical activity integration (intermediate-high level), with >25% committed at the highest level of support. Broad capacity and support for organizational integration of physical activity was demonstrated, with level of commitment varying by organization type.

FitWIC Wellness Programs. Six WIC sites (3 intervention, 3 control) at three California agencies participated in a pilot staff wellness intervention program to improve staff effectiveness in preventing childhood obesity (Crawford et al., 2004). Compared to control site staff, intervention site staff perceived greater workplace environmental support for their efforts to make healthy food choices and be physically active, and reported changes in the types of foods served during meetings and the priority placed on physical activity in the workplace. Intervention staff was also more likely to encourage WIC participants to engage in physical activities with their children and reported greater sensitivity in handling weight-related issues. This study has important implications for the potential reach of internal fitness promotion in organizations serving high risk populations, given this “multiplier effect” (positive influence) of healthy provider behavior on clients.

Pausa para tu salud! project (Lara et al., 2007). In the first year of implementation (January 2003), 335 employees of the Mexican Ministry of Health (national department of health and social services) (population statistics: 24% overweight/non-obese, 38% obese, 81% of women with abdominal obesity or waist circumference > 80 cm) participated in daily 10-minute mid-day exercise breaks during work time. 271 were evaluated after one year of intervention, and, on average, weight decreased by 1 kg and waist circumference decreased by 1.6 cm.
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Health-e-AME Faith-Based Physical Activity initiative. This 3-year, CDC-funded, statewide faith-based physical activity promotion initiative of University of South Carolina’s/Medical University of South Carolina’s (Wilcox et al., 2006; 2006) built upon a nutrition promotion program featuring a website in which nutritionists adapted recipes submitted by church members to increase fiber and decrease fat. This project trained 215 representatives from 98 African Methodist Episcopal churches. A menu of passive and active strategies are offered, and 54% are implementing at least one program component—66% of these are implementing their adaptation of the 10-minute Lift Off, Exercise your Faith for 10, one of the top 3 components selected. Exercise breaks are also conducted by project staff at all annual AME pastors’ conferences and post-conference meetings. Baseline data on a random sample of 571 members, all African-American, show that 29% are regularly active and 18% are sedentary, 71% women, 75% overweight/obese, 56% 50+ years of age, 50% with <high school education.

L.L. Bean Manufacturing Worker In-House Studies. Maine sporting goods manufacturer L.L. Bean has been incorporating stretch breaks into its workday for the past 14 years. On manufacturing floors, three formalized 5-minute stretch periods are led each day by a trained co-worker, in addition to regular breaks. Participation is mandatory for everyone on the floor, including management and visitors. In-house studies have demonstrated that productivity gains offset the time devoted to stretching by 100%, i.e. a return on investment of 30 minutes of productivity for the 15 minutes of stretch time, and the program also contributes to reduced injuries and sick days. L.L. Bean’s wellness coordinator refers to these stretching breaks as the equivalent of “safety glasses” (California Department of Health Services, 2004; Simon, 2006).

Review of PA intervention effectiveness in children: activity breaks. The aim of this narrative review was to summarize the evidence of the effectiveness of interventions that report physical activity outcomes in children aged 4–12 years and adolescents aged 13–19 years. A systematic search of electronic databases identified 76 interventions. Most interventions were delivered via the school setting (57 interventions), nine through the family setting, six via primary care, and four in community- or Internet-based settings. Children’s physical activity interventions that were most effective in the school setting included some focus on physical education, activity breaks, and family strategies. Two studies have investigated the effectiveness of activity breaks on children’s physical activity (Ernst & Pangrazi, 1999; Pangrazi et al., 2003). The intervention termed “Promoting Lifetime Activity in Youth” (PLAY) included the introduction of 15-minute play breaks during class time among children. In the first evaluation, intervention class teachers taught games and activities during the breaks for 4 weeks, and children self-monitored their physical activity for the next 8 weeks (Ernst & Pangrazi, 1999). The comparison classes also had activity breaks but without prompting to be active, and the children recorded their television viewing rather than physical activity. After 12 weeks, boys and girls in the intervention group had significantly higher self-reported physical activity (10 percent and 7 percent increases, respectively) than did those in the control group (no change). The second evaluation assessed the effectiveness of PLAY in schools that did or did not have a physical education program (Pangrazi et al., 2003). Of the four groups (PLAY and physical education schools, PLAY-only schools, physical education only schools, and no treatment control schools), children in the PLAY-only and PLAY and physical education schools recorded significantly higher steps/day at post-intervention than did children in the control schools, and girls in the PLAY and physical education and physical education-only schools recorded significantly higher steps/day than did girls in the control schools. Although this latter study did not collect baseline physical activity data, it is notable that both studies found that the PLAY intervention had a significant effect on children’s overall physical activity, by using either self-report or objective measures.”
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**Take 10! or Physical Activity Across the Curriculum** (DuBose et al., 2008; Honas et al., 2008; Gibson et al., 2008). This 3-year, NIH-funded University of Kansas study has successfully engaged 60-80% of elementary school non-physical education teachers in conducting 10-minute exercise breaks in 14 low-income K-12 intervention schools in 3 Kansas cities—Kansas City, Topeka and Lawrence (Donnelly, 2005; Koplan et al., 2006). One 6-hour, off-site in-service training session is provided at the beginning of each year, which teachers are paid $100 to attend. At the end of each school year, they attend a follow-up session for which they're paid $50, a sort of focus group in which teachers discuss barriers, facilitators, etc. Music to use in leading the exercise sessions was requested in the staff training sessions, has been provided in the form of several oldies tapes/CDs popular with both teachers and students. The gradual increase in the number of teachers engaged each year and the number of minutes provided (average of 70 minutes/wk provided and nearly 50% of teachers achieving the 90-100 minute/wk goal after two years) is evidence of promulgation of a social/cultural norm change. Mean energy expenditure of 3.1 ± 1.0 Cal/min (3.4 METs) was measured by accelerometry. Earlier studies of *Take 10!* by ILSI (a Georgia non-profit) have demonstrated the feasibility and utility of this approach in regularly engaging students and teachers in exercise of at least moderate intensity in 10-minute bouts of sufficient length to count toward the minimum 30-minute/day CDC daily recommendation (Metzler & Williams, 2006; Lloyd et al., 2005; Stewart et al., 2004), e.g., average MET levels of 5-7 for first, third and fifth graders, with commensurate caloric expenditures of 27-36 kcal and step counts of 800-1000 per 10-minute session.

**Medical University of Ohio Study.** A study of a different model to *Take 10!*, using a similar strategy, implemented three basic physical activity and nutrition school environmental changes: (1) restructuring the school day to provide 15 minutes of teacher-led PA each morning, (2) access to a free breakfast program for all students to promote nutritionally sound practices, and (3) reversal of the order of lunch and recess. Adopting these changes produced a 67% decline in nurse visits, a 58% decrease in disciplinary referrals, and an increase in academic performance such that the school improved from passing two of the state achievement tests to passing all five after 4 years (Sibley et al., 2006). A similar concept has been implemented in Cyprus, a 15-minute work-out for school staff and students every morning (Lobstein, 2006).

**Moving School Study.** “Moving school” principles aimed at early back pain prevention have been implemented in elementary schools in Hannover, Germany, structuring movement into lessons through organizational changes and furniture re-design, to decrease sitting time, improve sitting posture and increase PA during the school day. Increased time spent in moderate-to-vigorous physical activity has been demonstrated (Cardon et al., 2004).

**East Carolina University Energizers Study.** A 12-week RCT of 10-minute *Energizer* PA breaks in a sample of 243 3rd and 4th grade students at an eastern NC public school (Mahar et al., 2006). Breaks integrated grade-appropriate learning materials, involved no equipment, and required little teacher preparation (one 45-minute training session). In-school steps were higher in intervention (5587±1633) conditions (p<0.05). Pre-/post- *Energizer* on-task behavior improved by 8% overall (p<0.017) and by 20% among the least on-task students (those who were on-task less than 50% of the time before intervention onset).

**JUMP-in.** A quasi-experimental pre-test/post-test intervention trial conducted during one school year and involving 4th-6th graders in 4 intervention and 2 control schools in Amsterdam (Jurg et al., 2006). The Class Moves® offered regular physical activity breaks during normal lessons one of several program components, including a card game that worked with assignments done in the class and at home, a parent information service and school sports activities (designed to acquaint students with a variety of sports in order to prompt them to join a sports club outside of school hours). The activity levels of children in the control group
decreased while those of intervention group children remained stable (corrected overall odds ratio of 1.63, mostly attributable to a 4.33 OR among 6th graders).

Happy 10. An 8-month controlled trial of an intervention modeled on Take 10! in two comparable schools in urban Beijing, 14 intervention classes and 12, control (Liu et al., 2008). Average energy expenditure of Happy 10 sessions was measured in 80 students in the intervention school over 5 days at baseline, using objective physical activity monitoring, demonstrating small but significant differences in physical activity energy expenditure before and after intervention. A total of 753 students, fairly evenly divided between schools and between boys and girls, participated in the trial. There were modest but significant differences in the changes between the intervention and control school after intervention in physical activity expenditure (+12.7 Cal/kg/d) and physical activity (+2 hr/d), but not in BMI overall. However, there was a small significant difference between changes in intervention girls vs. control girls in weight (-2 kg), BMI (-1.01 kg/m²). There were only non-significant trends in changes in overweight and obese children, decreasing by 3.3% (girls) and 3.8% (boys), and 0.4% (girls) and 5.6% (boys), respectively among in the intervention school, while increasing among controls by 3.7% (girls) and 4.5% (boys), and 0.7% (girls) and 0.6% (boys).

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