Published in final edited form as:

Am J Health Behav. 2014 March ; 38(2): 208–217.

How Do They Do It: Working Women Meeting Physical Activity Recommendations

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Abstract

Objective—To identify factors that facilitate adherence to physical activity among employed women.

Methods—Participants were 103 employed women (Mean 44.4 years $\pm$ 11.8). Measures included physical activity by accelerometry, location by global positioning systems, and psychosocial constructs, perception of worksite policies and the built environment by questionnaire.

Results—Meeting physical activity recommendations was significantly associated with use of the built environment, self-regulation, perception of higher land-use mix diversity, and perception of lower infrastructure and safety for walking. Perception of worksite policies, self-efficacy, and social support were not associated with meeting recommendations.

Conclusions—The findings provide evidence that working women's physical activity behavior is influenced by both psychosocial and environmental factors.

Keywords

physical activity; social-ecological; self-regulation; built environment; women

Despite the known benefits associated with regular physical activity, the majority of Americans do not achieve recommendations. Based on results of the Behavioral Risk Factor Surveillance System it is estimated that 49.5% of Americans in 2007 met the recommended levels for physical activity, with 22.6% reporting no leisure-time physical activity.¹ When examined by sex, only 47% of women met recommended levels for physical activity and 24.5% indicated no participation in leisure-time physical activity. Accelerometer data from the National Health and Nutrition Examination Survey showed that women were less physically active than men and less than 5% of the adults achieved minimum recommendations.² This finding of lower physical rates among women aligns with previous

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Human Subjects Statement

This study was approved by the Auburn University Institutional Review Board; all subjects gave informed consent to participate.

Conflict of Interest Statement

The authors declare no conflicts of interest related to this study.

studies^{3,4} and shows that questionnaire responses may not accurately reflect physical activity levels, especially in women.

Initial studies examining barriers and correlates of physical activity adherence in women evaluated demographic variables and psychosocial constructs related to behavior.⁵⁻⁷ Social support, self-efficacy, self-regulation and outcome expectancy have emerged as positive correlates⁷⁻¹² of physical activity adoption and maintenance in adult and older women, with social support and self-efficacy being the most consistent correlates. Despite positive associations, these constructs fail to explain the majority of variance in participation in physical activity.¹³

Physical activity levels have been shown to decrease in women during the transition from school to the workplace.^{14,15} Changes in family such as marriage and having children are also associated with a decrease in intensity and structure of physical activity in women under the age of 49.¹⁶ In studies examining perceived barriers to physical activity among working women, the most common reason cited was the time constraints associated with fulfilling multiple roles (eg, employee, caregiver, spouse, parent) and responsibilities.^{17,18} In 2009, surveillance from the Bureau of Labor Statistics found 59% of working age women were employed in the civilian labor force with projected increases of 9% by 2018.¹⁹ Previous studies have described barriers to physical activity for this population, and the complexities of time constraints limiting participation in physical activity. Yet, despite the majority of women being engaged in some type of employment, factors that specifically enable working women to meet physical activity recommendations have not been described.

Social ecological models propose that health behaviors are influenced across multiple domains, which include the personal, interpersonal, environmental, and policy; moreover, variables from each domain interact across the domains to effect behavior. However, few studies of adults have sought to identify correlates from multiple domains and among those that have considered more than one domain (ie, environmental, policy, personal, and psychosocial correlates) few have utilized objective measures of both physical activity and the built environment.

Although a majority of the United States adult population is inactive, there is a subset of the population that maintains regular exercise. Knowledge of how these individuals utilize environmental resources such as parks, sidewalks, or open space, exposure to specific physical activity related worksite policies such as exercise facilities and showers in the workplace, and the contribution of psychosocial variables such as social support, self-efficacy, and self-regulation may enable researchers to better understand regular exercise behavior in a free-living environment and implement effective intervention strategies. The purpose of this study was to identify characteristics and exposures that may contribute to differences in exercise behavior. The study used retrospective and current measures to explore the associations between major constructs of the social ecological model and meeting physical activity recommendations among employed women.

METHODS

Participants

The study population consisted of 103 women recruited from the general population of adult working women residing in 2 adjacent small cities in the southeastern United States. Participants were recruited through posted fliers, targeted emails, active recruitment at local businesses, fitness facilities, local clubs such as running clubs, tennis courts, recreational facilities, postings in e-news-letters through the local chambers of commerce, and Facebook notices. An additional requirement to participate was full time employment (30 or more hours/week). Recruitment targeted women who self-reported performing moderate exercise for at least 30 minutes 5 days per week, or vigorous exercise for at least 20 minutes 3 days per week, or a combination of the above for at least the previous 6 months, and those who self-identified as doing insufficient physical activity or no physical activity. Informed consent was obtained from all participants.

Instruments

Demographics, health history, and exercise history—Participants completed a questionnaire regarding age, height, weight, family demographics, health history, education level, race, current employment, stage of change for physical activity adherence,²⁰ exercise equipment at home, and exercise history including participation in sports and recreational activities in elementary, high school, and, if applicable, college.

Psychosocial measures—Self-efficacy was assessed using the 12-item “Self-Efficacy and Exercise Habits Survey.” It has established reliability, internal consistency, and construct validity.²¹ The 12-item scale has 2 factors that were used in the analyses: “sticking to it,” based on the mean of 8 items (potential score range 1–5), and “making time for exercise,” based on the mean of 4 items (potential score range 1–5). Internal consistency for the full instrument as measured by Cronbach’s alpha was .91.

Six aspects of self-regulation were measured with the PASR-12²² including time-management, goal-setting, relapse prevention, self-monitoring, reinforcement, and social support. The instrument contains 12 measures on a 5-point Likert-type scale (1=never to 5=very often) to assess the degree to which self-regulation strategies are used to support participation in regular exercise. The self-regulation score is calculated as the sum of the 12 responses (range 12–60). Both structural and construct validity were established using confirmatory factor analysis and Pearson product-moment correlation coefficients against self-efficacy and physical activity.²² Internal consistency (Cronbach’s alpha) for this study was .94.

Social support for exercise was measured using the “Social Support and Exercise Survey,”²³ a 23-item questionnaire to measure 3 factors: family participation, family rewards and punishment, and friend participation. The potential score ranges from 10–50 for both family participation and friend participation, and from 3–15 for family rewards and punishment for a total potential score of 23–115. Test-retest and internal consistency reliability have been

established along with criterion-related validity.^{6,23} Cronbach's alpha for the current study was .88 for the social support measure.

Outcome expectancy was assessed using the "Expected Outcomes for Habitual Exercise."²⁴ This survey measures outcome expectations, (the anticipated consequences of exercise behavior), and outcome expectancies, (value placed on the anticipated consequences). The questionnaire is scored by multiplying the 2 ratings for each item and then summing all of the scores (range: 19–285). Validity and reliability has been previously established for this measure.²⁴ Internal consistency, as measured by Cronbach's alpha, was .92 for this study.

Perception of the neighborhood built environment—Perceptions of the neighborhood environment to support walking was assessed using the Neighborhood Environment Walkability Scale abbreviated version (NEWS-A).²⁵ This instrument was validated using geographic information system (GIS) measures of the built environment where significant concordance was found between the NEWS-A and the GIS measures.²⁶ Given that the NEWS-A instrument is designed primarily to capture perception of the local environment for walking and not other types of physical activity, perception of the built environment was also measured using 4 questions from the Physical Activity Neighborhood Survey (PANES). Both construct validity (association with meeting physical activity guidelines) and test-retest reliability have been established for the PANES.^{27,28}

Perception of worksite policies—Perception of employer policies to promote or support physical activity at the worksite was assessed using an index modified from the Neighborhood Quality of Life Study.²⁹ The modified version of the questionnaire has been used in previous studies^{29,30} with acceptable validity and reliability.³¹ Cronbach's alpha for the current study was .80. Individual item responses are "Yes" (value=1) or "No" (value=0) for a score range of 0–8 for the full index.

Moderate-to-vigorous physical activity—Physical activity was assessed by the Actigraph GT3X+ accelerometer. The Actigraph GT3X+ uses similar technology as the previously validated CSA activity monitor (Computer Science and Applications, Inc.) which had the highest overall reliability and lowest variability compared to 3 other types of accelerometers.³² Participants were provided with a clip or belt for attaching the accelerometer at their right hip/waist. Participants were instructed to wear the accelerometer during all waking hours except during showering and aquatic activities. Based on previous studies and best practice guidelines, an epoch length of one minute was chosen as the standard for the current study with a sampling rate of 30 Hz.³³ Additional criteria for analysis included a minimum of 10 hours daily wear time and 4 days of monitoring.³⁴ Consistent with other studies, non-wear time was defined as more than 60 minutes of consecutive zero counts and excluded from analysis.^{35,36} For physical activities reported but not captured by the accelerometer such as swimming, water aerobics, and bicycling, participants were asked to rate the intensity of the activity using the Omni perceived exertion scale including ratings for the warm-up, cool-down, and approximate time at the highest intensity.³⁷ This scale was chosen based on its validity and applicability to a wide range of physical activities and populations.³⁸

Global positioning system monitors—Location of physical activity was assessed by the QStarz BT-Q1000XT global position travel recorder. In comparison to 6 other portable GPS models, this model had the smallest mean error and the highest accuracy at canopy sites.³⁹ Participants were provided with a range of options for carrying the GPS unit including a clip, an arm band holder, and a carrying case with a belt attachment option. Consistent with rates used in previous studies the units were configured to record latitude and longitude every 10 seconds.^{35,40}

Procedure

Participants were asked to wear the accelerometer and carry or wear the GPS for 7 days. Written and oral instructions were given to each participant regarding wearing and charging the devices. For consistency, one investigator provided the instructions for device wearing and completing the questionnaire for all participants individually. Participants were given a journal sheet to record the times the accelerometer and GPS unit were put on and removed each day. Additionally, participants were asked to record any periods of time the accelerometer or GPS units were removed while physical activity was performed (ie, swimming). Participants were asked to record the mode of physical activity performed that day (ie, running, biking, class, machines, etc.), or if none was performed. After the 7 days of monitoring, participants completed the questionnaire described previously.

Data Validation and Analysis

Accelerometer data cut points using the vector magnitude calculated from 3 axes, as determined by Sasaki, John, and Freedson, were used to identify moderate (2690–6166 counts•min⁻¹) and vigorous (6167 counts•min⁻¹) activity for the respective equivalent of 3.0–5.99 METs and 6.0 METs.⁴¹ Based on public health physical activity recommendations, a minimum bout of 10 minutes at 2690 counts•min⁻¹ was required to count towards time spent in moderate-to-vigorous physical activity (MVPA); an interruption of 1–2 minutes was allowed as long as the time-intensity threshold was achieved.^{33,42}

Based on the accelerometer output, participants were categorized as achieving minimum recommended physical activity levels or not.⁴³ A subject was considered as meeting activity recommendations by achieving one of the following criteria: (1) 30 minutes of moderate activity 5 days; (2) 20 minutes of vigorous activity 3 days; or (3) a combination of moderate and vigorous activity to achieve a range of 450 to 750 MET•min•wk⁻¹ such as 4 days of 30 minutes of moderate activity or 20 minutes of vigorous activity per day, with at least 20 minutes of vigorous activity on one day.

Accelerometer and GPS data were combined based on timestamps using the GPS correlator option within the Actilife software and exported to a GIS. The output provided latitude and longitude coordinates matched to corresponding counts for each minute available. Location for each MPVA bout was assigned the latitude and longitude of the first minute of the bout and confirmed by a check against the activity log and a visual inspection of the geospatial coordinates. Home and work latitude and longitude coordinates were identified within the GIS and confirmed against questionnaire data. Additional analysis of the GIS identified the location and type of environment where MVPA took place. The categories for type of

environment were defined as home, work, private facility (eg, fitness centers), or built environment, (eg, sidewalk, bike lane, free public access resources, open space, municipal tennis courts, and trails).

Data analyses were conducted using the Statistical Package for the Social Sciences, version 18.0 (SPSS, Inc., Chicago, IL) and Stata, version 12.1 (Stata Corporation, College Station, TX). Bivariate analysis using t-tests (for continuous variables) or chi-square analysis (for categorical variables) was performed on participants by group (meet recommendations, do not meet recommendations) comparing them for baseline demographics, exercise history, psychosocial constructs, worksite policy perceptions, and perceptions of the built environment. Stepwise logistic regression was performed using “meets recommended levels of physical activity” as the dependent variable to create a model based on the data collected during the study.

RESULTS

Overall, 115 women volunteered to participate in the study. Of the 103 participants who completed data collection, 41 met minimum exercise recommendations as measured through accelerometry (hereafter referred to as cases), 35 were inactive, and 27 had insufficient activity to qualify as meeting recommendations. For the purpose of analysis, the inactive and insufficiently active were combined for one category as “not meeting recommendations” (controls N = 62). The mean age of all participants was 44.4 (± 11.8 , range: 23–65) years with a mean BMI of 26.2 (± 5.5 , range: 18.2–43.0). Table 1 shows demographic measures by group. Participants were recruited from 36 different employers with varied types of work including teachers/ school system staff (7%), healthcare workers (24%), custodial workers (3%), university employees (staff 23% and faculty 12%), self-employed (2%), bank employees (3%), and others (26%).

There was an average of 6.44 valid days (range: 4–8 days) of accelerometer data for all participants. Location coordinates were identifiable for 80% of all MVPA episodes. Seventeen control participants had no MVPA episodes and 17 (7 cases, 10 controls) had some missing location data for MVPA episodes.

Physical Activity

Cases had an average of 271.0 (± 105.0 , range 81–527) minutes of MVPA during the week of monitoring compared to controls with an average of 50.7 (± 52.2 , range 0–190) minutes of MVPA ($p < .001$). Cases performed an average of 1.3 episodes of MVPA for at least 10 minutes per day (± 0.31 , range 1–2.3) which was significantly higher compared to all control participants (.85 bouts/day, $\pm .59$, range 0–2, $p < .001$). Cases performed sufficient MVPA to meet daily recommendations on 76% of days measured ($\pm 18\%$, range 43–100%) compared to 13% for controls ($\pm 17\%$, range 0–60%, $p < .001$). Based on responses to the “stages of change” questions, all of the cases confirmed they had been regularly physically active for the past 6 months.

Personal Factors

Mean scores for self-efficacy, self-regulation, outcome expectancies, and social support are presented in Table 2. There was a significant difference between cases and controls with cases scoring higher on all social cognitive measures that were assessed except for social support “by family participation” and “by family rewards and punishment.” There was no significant difference between cases and controls for history of family encouragement to engage in physical activity or history of physical activity participation in school.

Physical Activity Location

Approximately 85% of cases used the built environment for at least one episode of MVPA compared to 39% of controls ($p < .001$). Out of all MVPA episodes, use of the built environment for MVPA was significantly higher for cases compared to controls (49.7% vs. 28.2%, $p = .006$). There was no significant difference between groups for percent of MVPA episodes at home, work, or exercise facilities.

Perception of the Built Environment

Results of the independent sample t-tests for perceived neighborhood built environment to support physical activity are presented in Table 3. There was a significant difference between cases and controls for perception of more land-use mix diversity within walking distance of home, such as grocery stores, the post office, banks, parks, and restaurants ($p = .04$). Of note, both cases and controls, on average, “disagreed” that their neighborhoods provided infrastructure and safety for walking.

Perception of Worksite Policies

The mean score for the worksite policy index was not significantly different between cases and controls (2.9 ± 2.3 vs. 2.2 ± 2.2 , $p = .09$). There were no significant differences in the perception of individual worksite policies between groups.

Correlates of Physical Activity

Logistic regression was used to identify differences in cases and controls using demographic, psychosocial, perceived worksite policy, and perceived built environment variables as the independent variables. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between cases and controls (chi-square = 53.751, $p < .001$, $df = 4$, Nagelkerke's $R^2 = .55$). The logistic regression results are presented in Table 4. Goodness-of-fit was shown to be acceptable with a Homer-Lemeshow Test ($\chi^2 = 5.513$, $df = 8$, $p = .70$). There was no indication of multi-collinearity with the lowest tolerance at 0.53 and the highest variance inflation factor for all variables in the model at 1.90.

The odds of meeting physical activity recommendations increased 13% for every one point increase in the self-regulation scale (range: 12–60). For every one point increase in the perception of land-use mix diversity (range: 1–5) in the neighborhood of residence a subject was 2.6 times more likely to meet physical activity recommendations. Conversely, participants who met recommendations perceived their neighborhoods to have lower

infrastructure and safety for walking. For every one point increase in the perception of safety and infrastructure for walking, the odds of meeting physical activity recommendations decreased 60%. Participants who used the built environment for MVPA were 7.4 times more likely to achieve recommended levels of physical activity. The model did not change when adjusted for age, BMI, race, and education level.

DISCUSSION

The purpose of this study was to identify key environmental and psychosocial factors that enable working women to meet physical activity recommendations. The results showed that cases utilize the built environment as well as self-regulation skills to meet physical activity recommendations. There were also significant differences between cases and controls in perception of the home neighborhood environment to support physical activity. Cases perceived themselves as living in neighborhoods with more land-use mix diversity but less safety and infrastructure for walking as compared to controls. Other variables shown in previous studies to be correlates of physical activity, such as age, race, education, and self-efficacy, did not contribute to the current model when holding the other variables constant. These results may be attributable, in part, to the inclusion criteria of employed women only. It is possible the employed population is distinct from the overall population with respect to correlates of physical activity.

The logistic regression model reveals some associations with physical activity that have not been identified clearly in past research. Research findings on the association between the built environment and physical activity have been mixed. This is the first known study to quantify how much employed women use the built environment for MVPA in relation to facilities, home equipment, and work-related MVPA. The finding that women who used the built environment were 7.4 times more likely to meet physical activity recommendations could indicate that women who meet recommendations are doing vigorous activities such as running, biking, tennis, and fast walking. That is, the variable of built environment could be a proxy for more intensive or vigorous activities, which allows these women to meet recommendations more readily. An alternative interpretation is that those who use the built environment are more likely to meet recommendations because it is more readily available and is accommodating to physical activity. In other words, women who use the built environment for physical activity are not dependent on getting to a specific facility, or attending an exercise class at a specific time, thereby reducing the chances they will not engage in MVPA in a day when events prevent them from getting to a facility or class. Similarly, women who plan to use home exercise equipment are limited to doing physical activity in a single environment which has competing interests such as family and home responsibilities in addition to leisure options. The increased chance of meeting physical activity recommendations by use of the built environment is important for future policy development and interventions to promote physical activity. The results of the current study suggest municipal infrastructure for physical activity, including sidewalks, trails, bike paths, recreational facilities such as tennis courts, and parks or open space are key components to achieving physical activity recommendations. Development, maintenance, and promotion of these options for physical activity may help more women with physical activity adherence.

The psychosocial variables that were consistently correlated with MVPA in previous studies, including self-efficacy, social support, and to a lesser extent, outcome expectancies, failed to predict exercise participation in the current sample. Whereas the current study did not assess adherence to physical activity objectively, cases affirmed doing physical activity on a regular basis for at least 6 months prior to the study. For this study, based on bivariate comparisons, cases had significantly higher scores on all of the psychosocial constructs except for 2 measures of social support (family participation and family rewards and punishment). However, when all of the other predictors were held constant, these relationships did not significantly contribute to the model predicting meeting of physical activity recommendations, except for self-regulation. Longitudinal studies are needed to identify if the factors that predict short term behavior change, such as self-efficacy and social support do so in the context of behavior maintenance. These constructs may be important in supporting the initial behavior change, but once the behavior is integrated, they may have less relevance to behavior maintenance.

Self-regulation was a significant predictor of physical activity adherence in the current study. This aligns with previous studies showing associations between self-regulation and physical activity behavior,⁴⁴ especially for adult women.¹¹ Self-regulation encompasses 6 skills used to overcome personal and situational barriers for the purpose of carrying out exercise intentions including time-management, goal-setting, relapse prevention, self-monitoring, reinforcement, and social support. Given that other psychosocial constructs did not contribute to the predictive model, it appears the women who met physical activity recommendations rely on self-regulation skills versus external stimuli (friend and family social support) and perceptions (outcome expectancies) for physical activity adherence. This is consistent with social cognitive theory that posits that maintenance of behavior change is a result of self-regulation and that motivation and willpower are not enough to sustain consistent physical activity behavior over the long-term without the implementation of self-regulation.⁴⁵ This also coincides with Bandura's explanation of the final level of self-regulation in which rewards and motivation are intrinsic in nature. Furthermore, according to social cognitive theory, the environment becomes a key factor in helping to regulate the behavior, which is consistent with the results of this study. Additional research is needed to determine if interventions can target specific aspects of self-regulation, and development of these skills, to improve physical activity adherence in working women.

The findings of an inverse relationship between perception of the home neighborhood infrastructure and safety for walking were not predicted. However, Duncan and Mummery⁴⁶ had similar findings in a study of the built environment and physical activity, where a significant predictor of recreational walking in adults was the perception that footpaths near home (.4 km) were not in good condition. Presumably, people who use the built environment, such as the cases in the present study, are more cognizant of the conditions available for physical activity. Furthermore, cases who do use their neighborhood for physical activity know through direct experience that the infrastructure could be better.

The perception of neighborhood land-use mix diversity was predictive of meeting physical activity recommendations. The control participants had an average score on this measure of 1.9 ($\pm .9$) which, on the 5-point scale, represents a perceived average time to walk to a wide

range of facilities (schools, restaurants, parks, stores, etc.) as 21 or more minutes. The cases had a mean score of 2.3 (± 1.0), which also averages out to a walk of 21 or more minutes to the same types of facilities, but with more destinations perceived to be within a 20-minute walk of home. Further research is needed to discern if cases, being more physically active, merely perceive the various facilities as being closer to walking distance compared to controls, or if women who live in neighborhoods with greater land-use mix diversity are more likely to meet physical activity guidelines.

There were no differences in perceptions of worksite policies to support physical activity between cases and controls. Overall, the average for the worksite policy index was relatively low (2.47 ± 2.25) on an 8-point scale. A previous study by Crespo et al³⁰ of working men and women, using the same measure, found those who met physical activity guidelines had an average index of $3.34 (\pm 2.51)$ compared to an average index of $2.63 (\pm 2.27)$ for participants who did not meet MVPA guidelines ($p < .01$). This suggests that the policies for employees in the current study may not have been sufficient to influence physical activity levels; moreover, the lack of variance in the index scores makes it difficult to detect worksite policy influences on physical activity. Despite the low perception of worksite policies, cases met MVPA recommendations, indicating they were able to capitalize on other factors, such as self-regulation and the use of built environment, to achieve recommended physical activity levels. Given the overall perception of a lack of supportive employer policies, the data are not conclusive to speculate that worksite policies do or do not influence activity levels. This study did not assess employer policies, and therefore, it is not known if the perceptions of the participants are congruent with what is actually offered to them in the workplace. Additional research is needed to determine how worksite policies influence employee participation in MVPA, differences between perception of policies and actual policies in place, and how discrepancies between perception and reality of policies influence MVPA.

Several of the personal factors shown to be correlates of physical activity in previous studies, such as age, marital status, parenthood, education level, history of engagement in sports or exercise, and weight status, did not contribute to the predictive model, and none except BMI and education level were significantly different between groups. The finding of no differences between groups for these personal factors suggests that they need not be considered “barriers” to engagement in physical activity. For example, women without a history of engagement in sports or women with children living at home can and do meet current physical activity recommendations. Interventions to promote physical activity may take these factors into consideration for tailoring of programs, but should still target these populations for physical activity behavior change.

A strength of this study was the use of the 10-minute episode as the threshold to count towards MVPA. Previous studies utilizing accelerometry often used a gross sum of total MVPA minutes over the course of the day;^{47,48} however, public health recommendations specifically state that physical activity episodes should reach a 10-minute minimum.^{43,49} The practice of using 150 minutes of MVPA over a week to evaluate correlates of physical activity may lead to spurious conclusions if the participants accumulated minutes over the course of a day without engaging in any sustained aerobic exercise resulting in an increased

heart rate. In other words, if these participants do not engage in purposeful and sustained MVPA, can we associate their psychosocial profiles and built environment perceptions as correlates of physical activity behavior? As Troiano et al² demonstrate in one of the only accelerometry studies to use the 10-minute episode criterion, less than 5% of the US population meets physical activity recommendations by this standard.²

We acknowledge limitations to this study. The participant population was intentionally recruited from 2 adjacent small cities (population <100,000). Our findings may be directly related to the size of these communities, and therefore, not generalizable to more urban or rural areas. Whereas attempts were made to recruit women from multiple employers and equally from throughout the 2 cities it is possible the sample recruited for the study may not be representative of the greater population. Additionally, the study population had higher overall education levels compared to the population in general. Procedures to minimize data loss were instituted; however, the potential for data loss or mischaracterization needs to be acknowledged. GPS data loss may have occurred due to conditions associated with particular participant characteristics (failure to charge batteries, failure to wait for initial fix, signal drop-out in certain environmental conditions). This particular data loss may result in nonrandom missing data which could lead to bias in the study results. Accelerometers measure whole body and lower extremity movement but do not capture upper body movement in isolation or accurately measure energy expenditure with strength training or flexibility. Additionally, accelerometers cannot accurately measure MVPA in water or on bicycles.

Conclusions

Our results provide evidence that working women achieve recommended levels of activity through use of the built environment for MVPA, whether as the sole choice of environment for MVPA, or in addition to home and private facilities. Interventions seeking to promote physical activity can capitalize on this finding in helping working women find ways to include physical activity as a regular behavior. Self-regulation was a significant predictor of meeting physical activity recommendations in this sample of working women. Interventions seeking to promote maintenance of physical activity may consider addressing how these skills are developed and implemented. Perception of the neighborhood built environment to support physical activity, particularly land-use mix diversity, was also associated with meeting physical activity recommendations. However, the perception of poorer infrastructure and safety for walking in the home neighborhood did not preclude working women from achieving sufficient MVPA. Our findings provide further evidence that working women's physical activity behavior is influenced by both psychosocial and environmental factors. Exclusion of either of these factors from a physical activity intervention will limit both effectiveness and reach of the intervention.

Acknowledgments

This project was supported by the National Institute on Aging (T32 AG027677) and Auburn University.

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Table 1

Demographic Measures by Activity Status

	Cases N = 41	Controls N = 62	p
Age mean (SD)	45.1 (11.6)	43.9 (12.0)	.64
BMI mean (SD)	24.2 (4.5)	27.3 (6.6)	.02
Average hours/week at work mean (SD)	43.9 (7.1)	41.9 (5.8)	.12
Spouse/partner (% Yes)	80.5	77.4	.71
Children living at home (% Yes)	34.2	38.7	.64
Hypertension (% Yes)	14.6	21.0	.42
Current smoker (% Yes)	2.4	6.5	.35
Education level (%)			
High school diploma or less	2.4	3.2	
Some college or associates degree	7.3	32.3	
Bachelors degree or higher	90	64.5	.01
Race (% White)	90.2	80.7	.19

Table 2

Social Cognitive Measures by Activity Status

	Cases N = 41 Mean (SD)	Controls N = 62 Mean (SD)	Levene's Test of Equality of Variances F (sig)	p
Self-efficacy: Making time for exercise (Range: 1–5)	4.3 (.6)	3.9 (.9)	3.0 (.08)	.006
Self-efficacy: Sticking to it (Range: 1–5)	4.2 (.7)	3.5 (.8)	1.8 (.18)	<.001
Self-regulation (Range: 12–60)	47.1 (7.7)	33.5 (13.8)	11.1 (.001)	<.001
Outcome expectancies (Range:19–285)	160.3 (44.2)	122.2 (45.7)	.002 (.97)	<.001
Social support: Family participation (Range: 10–50)	21.8 (8.2)	20.5 (8.0)	.17 (.69)	.46
Social support: Family rewards and punishment (Range: 3–15)	4.3 (1.8)	3.7 (1.4)	5.6 (.02)	.08
Social support: Friend participation (Range: 10–50)	25.8 (11.5)	20.6 (8.8)	6.7 (.01)	.02

Table 3

Perception of the Neighborhood Built Environment to Support Physical Activity

	Cases N = 41 Mean (SD)	Controls N = 62 Mean (SD)	p
PANES (0–4)	2.4 (1.1)	2.0 (1.1)	.08
Land diversity (1–5)	2.3 (1.0)	1.9 (.9)	.04
Aesthetics (1–5)	3.1 (.7)	2.8 (.8)	.16
Land use mix-access (1–5)	2.4 (1.2)	2.0 (1.2)	.07
Infrastructure and safety for walking (1–5)	2.0 (.8)	2.1 (.9)	.63
Street connectivity (1–5)	2.5 (1.0)	2.4 (1.1)	.56
Crime (1–5)	2.2 (.4)	2.2 (.3)	.68
Traffic hazards (1–5)	2.4 (.6)	2.3 (.8)	.63

Table 4

Association of Multi-level Variables with Meeting Physical Activity Recommendations

	Odds Ratio	B	SE	Wald	p	Confidence Interval
Self-regulation	1.13	.13	.03	15.40	<.001	1.06, 1.21
Use of built environment for MVPA	7.35	2.00	.61	10.66	.001	2.22, 24.33
Land use mix diversity	2.56	.94	.36	6.97	.008	1.27, 5.14
Infrastructure and safety for walking	.40	-.91	.39	5.37	.02	.19, .87