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Development and Psychometric Testing of the Dogs and WalkinG Survey (DAWGS)

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Abstract

Purpose: Dog owners represent 40% of the population, a promising audience to increase population levels of physical activity. The purpose of this study was to develop and test the psychometric properties of a new instrument to assess social cognitive theory (SCT) constructs related to dog walking. **Methods:** Dog owners (*N*=431) completed the Dogs and WalkinG Survey (DAWGS). Survey items assessed dog walking behaviors, and self-efficacy, social support, outcome expectations, and outcome expectancies for dog walking. Test-retest reliability was assessed among 252 (58%) survey respondents who completed the survey twice. Factorial validity and factorial invariance by age and walking level were tested using confirmatory factor analysis. **Results:** DAWGS items demonstrated moderate test-retest reliability (*r*=.39-.79; *k*=.41-.89). Acceptable model fit was found for all subscales. All subscales were invariant by age and walking level, except self-efficacy, which showed mixed evidence of invariance. **Conclusions:** The DAWGS is a psychometrically sound instrument for examining individual and interpersonal correlates of dog walking.

Key Words: confirmatory factor analysis, measurement invariance, physical activity, social cognitive theory

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Participation in regular physical activity decreases the risk of cardiovascular disease, type 2 diabetes mellitus, osteoporosis, depression, obesity, and breast and colon cancers (Physical Activity Guidelines Committee [PAGC], 2008). There is also strong evidence that active adults have a 30% lower risk of all-cause mortality when compared to inactive adults (PAGC, 2008). Given the health benefits of physical activity participation, various public health guidelines have been established on the recommended volume and intensity of physical activity for healthy adults (PAGC, 2008, U.S. Department of Health and Human Services [USDHHS], 1996). The 2008 National Physical Activity Guidelines recommends adults obtain at least 150 min of moderate intensity physical activity a week to derive significant health benefits (PAGC, 2008). However, recent self-report data from the Behavioral Risk Factor Surveillance System show only 50% of U.S. adults met recommended guidelines (Centers for Disease Control and Prevention, 2010) and objective accelerometer assessments indicate that only 5% of U.S. adults met these guidelines (Troiano et al., 2007).

Given the strong evidence for the health benefits of physical activity and the low rates of physical activity in the U.S., there is an increasing focus on promoting moderate intensity physical activity such as walking (PAGC, 2008; USDHHS, 1996). One common physical activity that many in the general public could adopt is dog walking. It is estimated that 40% of U.S. households own a dog (American Pet Products Association [APPA], 2010) and several studies indicate that dog ownership is associated with higher levels of overall physical activity (Coleman et al., 2008; Lentino, Visek, McDonnell, & DiPietro, 2012). Initial studies have also shown that dog owners who participate in dog walking, defined as walking *with* a dog on or off leash, are more likely to meet physical activity recommendations than dog owners who do not walk their dog(s) (Hoerster et al., 2011) and non-dog owners (Reeves, Rafferty, Miller, & Lyon-Callo, 2011). It is important to note that studies have also shown that many dog owners do not walk their dog(s). Among dog owners in Australia, more than half did not walk their dog at all (Bauman, Russell, Furber, & Dobson, 2001). There are no comparable national statistics for the U.S. However, among dog owners in Michigan, only 27% walked their dog(s) enough to meet physical activity recommendations (Reeves et al., 2011). Therefore, promotion of dog ownership on its own is unlikely to be a feasible public health strategy to promote physical activity on a population level**.** Given the high prevalence of dog ownership in the US, and the potential of using dog walking as a strategy to promote overall levels of physical activity, developing a better understanding of the predictors of dog walking is an area that merits further research.

Currently there is limited knowledge about the determinants of dog walking. There is consistent evidence that perceptions of encouragement from the dog to walk (e.g., an eager dog ready for a walk whenever the leash is seen) (Christian, Giles-Corti, & Knuiman, 2010; Hoerster et al., 2011) and feelings of obligation to walk the dog are positively correlated with dog walking (Brown & Rhodes, 2006). There is also evidence that constructs from the theory of planned behavior such as normative beliefs and control beliefs are positively correlated with behavioral intention to walk the dog (Brown, 2006). To date, however; Bandura's (1998) social cognitive theory (SCT) has not been used to examine dog walking behaviors, despite evidence that key constructs from this theoretical perspective such as self-efficacy and social support are linked to walking in general (Dzewaltowski, 1994). Research has shown self-efficacy, a key SCT construct, to be the most powerful factor to consider when predicting physical activity behavior (McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003) and that self-efficacy is a stronger predictor of physical activity than perceived behavioral control, a TPB-based construct (Dzewaltowski, 1990).

Bandura's (1998) SCT suggests that health behavior is affected through the interactions between the person, their behavior, and the social and physical environment. The central SCT construct, self-efficacy, refers to an individual's confidence in the ability to perform a behavior, overcome barriers to that behavior, and exert control over the behavior (Bandura, 1998). In SCT, the environment is broadly defined to include social environmental factors such as social support (Baranowski, Perry, & Parcel, 2002). Outcome expectations are the consequences an individual anticipates from taking behavioral action and outcome expectancies are the value an individual places on those particular outcomes (Baranowski, 2002). It is believed that self-efficacy has a direct influence on physical activity and also acts as a mediator of other SCT constructs such as social support (Maddux, 1995). Self-efficacy is also thought to influence outcome expectations and expectancies, which then directly influence health behavior (Williams, Anderson, & Winett, 2005). Reinforcements and barriers are also important constructs in SCT which can increase or decrease the occurrence of health behaviors (Baranowski, 2002).

Constructs from SCT have been shown to explain up to 60% of the variance in physical activity behavior (Keller, Fleury, Gregor-Holt, & Thompson, 1999). Comprehensive literature reviews have found consistent, positive associations between self-efficacy and physical activity (Trost, Owen, Sallis, & Brown, 2002). Reviews of outcome expectations and expectancies have shown mixed results in physical activity research (Williams, 2005). However, some studies have shown small but significant associations between outcome expectancies and physical activity (Williams, 2005). Furthermore, there is extensive research showing that social support is a significant predictor of physical activity and is positively associated with self-efficacy (Trost, 2002). Consistent with SCT, the Dogs And WalkinG Survey (DAWGS) items were designed to assess individual-level constructs of self-efficacy beliefs regarding dog walking, outcome expectations and outcome expectancies of dog walking, barriers and reinforcements for dog walking and interpersonal constructs of social support from family, friends and the owner's dog(s).

A broader understanding of theory-based determinants of dog walking may lead to more effective efforts to promote this behavior, as well as inform theory-based interventions to promote walking in general. A first step in the process of identifying theory-based determinants is the development of reliable and valid instruments. The purpose of this study was to develop and test the psychometric properties (reliability, factorial validity, and factorial invariance) of the DAWGS. It was hypothesized that DAWGS items developed for specific factors would load onto nine respective factors (self-efficacy: making time, self-efficacy: resisting relapse, owner outcome expectations, dog outcome expectations, owner outcome expectancies, dog outcome expectancies, family support, friend support, dog support).

Methods

Instrument development

The Dogs and WalkinG Survey was developed after reviewing physical activity and dog walking literature and consulting with experts in survey methodology, health behavior theory, physical activity and dog walking research. Previous measures with demonstrated reliability and validity were adapted to dog walking (Cutt, Giles-Corti, Wood, Knuiman, & Burke, 2008; Sallis, Grossman, Pinski, Patterson, & Nader, 1987; Sallis, Pinski, Grossman, Patterson, & Nader, 1988; Steinhardt & Dishman, 1989). In the few cases where suitable items did not exist, such as dog-related social support and dog-related outcome expectations and expectancies, new items were created.

After initial development, the survey was reviewed by seven faculty with experience in survey methodology, health behavior theory, and physical activity research. Following this internal review, survey format changes were made to the layout of the survey. In addition, one item was added to the self-efficacy subscale: walk the dog even in the dark.

The survey was then reviewed by six experts in dog walking and human-animal interaction research from universities in the United States, Canada, and Australia. Based on this expert review, dog walking questions were reworded to explicitly state "Walk *with* your dog" instead of "Walk your dog" as it was thought these questions could have different meanings. A self-efficacy item originally assessing "Read, study, or watch T.V. less in order to walk your dog more" was edited to include the use of the Internet. Owning a large dog was added to the list of reinforcements for dog walking and owning a small dog, and having more than one dog to walk, an untrained dog, or a dog that is difficult to control were added as barriers to dog walking. The DAWGS tool was then pretested with a convenience sample of 17 adult dog owners to assess comprehension and wording of items, and the amount of time needed to complete the survey (12-25 min for this pretest).

Data collection procedures and sample

This study's procedures were approved by the Purdue University Committee on the Use of Human Research Subjects. Informed consent was obtained at the time of survey completion. A snowball technique, a non-probability sampling technique employed to identify potential research subjects was used to recruit a convenience sample of dog owners 18 years of age and older. Initial participants were asked to refer other potential participants to the study. Two local animal shelters were enlisted for recruitment using their social networking websites and contact lists. In addition, participants were recruited from an e-mail sent to faculty and staff at Purdue University, West Lafayette, Indiana. The recruitment e-mail included a statement to forward the e-mail to family and friends outside of the university to diversify the sample. Flyers were also distributed at local pet stores, groomers, and veterinarian offices. Recruitment was open for four weeks during the spring of 2010. In total, 224 participants were recruited from the university, 241 from forwarded e-mails and the social networking website, and 15 from flyers. One week after the initial e-mail, a reminder e-mail was sent to all participants who had not yet completed the survey. Of the 480 participants who provided contact information, 431 (89%) completed the initial survey. Ten to fourteen days after the first survey was completed, participants were sent an e-mail containing a website link to complete the DAWGS a second time. As an incentive for participation, a one dollar donation was made to local animal shelters for each survey completed. This measurement study is part of a larger study to examine the psychosocial and neighborhood environmental correlates of dog walking and relationships of dog walking with overall physical activity.

DAWGS items

Table 2 includes all DAWGS items. Dog walking was defined as an activity in which both the dog and the owner are walking together with the dog on or off leash. This specific definition of dog walking was intended to discourage participants from reporting time that the dog was active while the owner was inactive. Three open-ended questions were created to assess dog walking behavior. These items included the number of dog walks taken in a typical week, the average number of dog walks per day, and the typical duration (in min) per dog walk.

Items from the Self-efficacy for Exercise Scale were modified to specifically assess self-efficacy for dog walking (Sallis, et al., 1988). The subscale consists of nine 5-point Likert scale items that measure a person's confidence that they will participate in dog walking under various circumstances (1=very unconfident, 5=very confident).

Five items from Steinhardt's Outcome Expectations of Exercise Scale (Steinhardt, 1989) were modified to specifically assess outcome expectations and outcome expectancies of dog walking (improve health, improve mood, companionship, enjoyment, and accomplishment). In addition, two new items were created to assess dog-specific outcome expectations and expectancies of dog walking: improving dog behavior and having a happy dog. Outcome expectation items assessed the benefits participants believed they would derive from walking their dog(s) using a 5-point Likert scale (1=strongly disagree; 5=strongly agree). Outcome expectancy items assessed how valued the specific outcomes were to the participant (1=very unimportant, 5=very important).

Based on prior studies identifying barriers to and reinforcements of dog walking (Cutt et al., 2008), 10 dichotomous (yes/no) reinforcement items and 15 dichotomous barrier items were created. Examples of reinforcements included enjoyable weather and enhancement of personal health or dog health. Examples of barriers included more than one dog to walk, lack of time, having an untrained dog(s), inclement weather, and poor personal or dog health.

Social support items from the Social Support for Exercise Scale were modified to be specific to dog walking (Sallis et al., 1987). The subscale consists of eight 5-point Likert scale items assessing perceived support for dog walking from both family and friends (1=never, 5=very often). In addition to one item from the Dogs and Physical Activity (DAPA) Tool (Cutt et al., 2008) two new items were created to assess dog support for dog walking.

Walking measure

Walking was assessed to allow examination of invariance between groups of participants engaged in more or less walking. Two items from the self-administered short form of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) assessed walking during the past seven days. Questions assessed the number of days and min per day of walking performed for at least 10 min at a time. Based on self-reported min of walking per day and days of walking per week, a continuous variable of weekly min of walking was created.

Demographic variables

Demographic variables included age, gender, race, ethnicity, highest level of education (high school, trade school, 2 or 4 year college, masters or professional degree, doctorate), marital status (single, married, partnered, widowed, separated, divorced), and annual household income (<$50,000, $50-79,999, ≥$80,000). Body mass index (BMI) was calculated based on self-reported height and self-reported weight. Participants were classified as overweight/obese if BMI was ≥25.

Statistical Analysis

SAS® version 9.2 (SAS Institute, 2009) and AMOS™ version 18.0 (Arbuckle, 2008) were used for statistical analyses. All survey data were screened for normality and missing data. Descriptive statistics were used to summarize social cognitive theory, walking and demographic variables. Test-retest reliability was assessed among 252 (58%) survey respondents who completed the survey twice. The Kappa statistic was used to examine reliability of categorical variables and Spearman rank correlations were used for Likert-scale and continuous variables. Landis and Koch's (1977) classification of Kappa statistics was used: .00-.20 = slight, .21-.40 = fair, .41-.60 = moderate, .61-.80 = substantial, > .80 =almost perfect reliability. Classification of

Spearman correlation coefficients was consistent with prior research: .50-.69 = moderate, ≥ .70 = substantial reliability (Cutt, 2008).

Given that the DAWGS measures were based on social cognitive theory constructs and in most cases were modified from previously validated scales (Sallis et al., 1987; Sallis et al., 1988; Steinhardt, 1989), factorial validity of the subscales was assessed with confirmatory factor analysis (CFA). In line with the general hypothesis and based on previous factorial validity research (Sallis et al., 1987; Sallis et al., 1988), we expected the self-efficacy items to comprise two correlated factors (resisting relapse and making time) and the social support items were hypothesized to comprise three correlated factors (family, friend, and dog support). Based on previous qualitative research and psychometric testing (Cutt, 2008; Steinhardt, 1989), the outcome expectation and expectancy items were each hypothesized to load onto two factors: owner-specific expectations/expectancies and expectations/expectancies related to the dog(s).

Models were estimated using structural equation modeling with full information maximum likelihood (FIML) estimation (Arbuckle, 2008; Kline, 2005). The comparative fit index (CFI) and root mean square error of approximation (RMSEA) were used as the primary criteria to determine model fit with a CFI ≥ .95 and RMSEA ≤ .08 interpreted as good model fit (Kline, 2005). Factor loadings were considered adequate if they were ≥ .30 (Kline, 2005). Internal consistency reliability of subscale items was assessed using Cronbach's alpha and considered acceptable if ≥ .70 (Cicchetti, 1994).

Factorial invariance of the DAWGS subscales was assessed to determine whether underlying constructs had the same theoretical structure for older versus younger adults and those who met physical activity recommendations via walking versus those who did not. A median split was used to group participants into younger (≤45 years, n=237) and older groups

(>45 years, *n*=194). Participants were grouped into meeting and not meeting physical activity recommendations based on weekly min of walking (≥150 min, *n*=213 and <150 min, *n*=198). Four levels of invariance were assessed: configural, metric, scalar and error invariance (Dimitrov, 2010).

Configural invariance assesses the invariance of the number of factors in each subscale and the pattern of factor loadings. The presence of configural invariance indicates that across groups, individuals use the same conceptual framework to answer subscale items. To test for configural invariance, a baseline model was fitted for each group separately and the number of factors and the pattern of factor loadings were constrained to be equal across groups. Metric invariance assesses the invariance of the factor loadings across groups. The presence of metric invariance suggests that the same unit of measurement is being used for the items across groups and that individuals within both groups understand and respond to the subscale items in a similar way. Scalar invariance is a strong measure of invariance which assesses the invariance of item intercepts across groups. The presence of scalar invariance indicates that the strength of the relationship between each item and the underlying construct is the same across groups. Scalar invariance is necessary to compare means and the lack of scalar invariance suggests there may be bias in how individuals in different groups respond to items. Finally, error invariance was examined by constraining error variances to be equal across groups. This level of invariance has been described as a strict measure of invariance and indicates that items have the same internal consistency across groups (Dimitrov, 2010).

Multi-group confirmatory factor analysis was used to assess all four levels of invariance (Brown, 2006; Kline, 2004). Using recommended guidelines, metric, scalar, and error invariance were tested using the sequential constraint approach where models are nested hierarchically starting with the least constrained model and placing subsequent constraints of equality across groups allowing systematic invariance tests to be conducted (Dimitrov, 2010). Invariance was evaluated by examining the $\Delta\chi^2$ and ΔCFI. A subscale was considered invariant by a grouping variable (e.g., age) when the $\Delta\chi^2$ was non-significant and/or the ΔCFI ≤.01 (Cheung & Rensvold, 2002). If invariance was not supported at one of the four levels, the measure was considered non-invariant at that level and for more constrained models.

Results

Descriptive statistics

Participants (*N* =431) primarily consisted of middle-aged adult (mean age = 44.0±12.4 years; range 18-83 years old) Caucasian (97%) females (85%). Sixty-five percent were married and a majority were employed full-time (78%) with household incomes of $50,000 or greater (73%). Seventy percent of participants had a two-year college degree or higher and 80% resided in Indiana. Table 1 shows survey subscale correlations, means, and standard deviations.

Test-retest reliability

As shown in Table 2, items assessing dog walking, self-efficacy, outcome expectations, reinforcements and barriers for dog walking, and social support demonstrated moderate test-retest reliability (*r*=.49-.79; *k*=.41-.89). Items assessing outcome expectancies (*r*=.39-.54) had lower test-retest reliability overall. Attrition between the first and re-test survey was not significantly related to any of the variables in the study.

Factorial validity

The initial two factor self-efficacy model did not have adequate fit (CFI=.96; RMSEA=.10). The fit of the model improved with the removal of one item: read, study, or watch television less in order to walk your dog more. Therefore, this item was dropped from the final measurement model. The final two factor self-efficacy model (making time and resisting relapse) had adequate fit and items within each factor demonstrated strong internal consistency (α=.87 and .92, respectively). Fit statistics and factor loadings for the factorial validity analyses of final subscale models are shown in Table 3.

The initial outcome expectations and outcome expectancies measurement models, with one owner-specific factor and one dog-specific factor in each model resulted in unacceptable fit (CFI=.79-.83; RMSEA .16-.18). Several outcome expectation and expectancy items had high intercorrelations indicating potential redundancy (*r*=.73-.94). Owner-specific expectation and expectancy items pertaining to reducing stress, coping with stress, maintaining health, increasing energy and providing opportunities for socialization were removed. In addition, dog-specific expectation and expectancy items related to maintaining dog health and improving dog health were highly correlated with other dog-specific items (*r*=.72-.86) suggesting redundancy. These seven items were removed one at a time in an iterative fashion which resulted in adequate model fit and adequate internal consistency for both outcome expectation and outcome expectancy factors (α=.65-.89).

Social support items were tested on three factors: dog (three items), family (seven items), and friend (seven items) support for dog walking (CFI=.88; RMSEA=.12). Social support items assessing offers to walk the dog, providing reminders to walk the dog, and talking about dog walking from both family and friends were highly correlated with other social support items in their respective subscales. Due to the similarity between these items, one item at a time was removed from the model until the adequate fit was achieved. This resulted in adequate model fit with each factor demonstrating strong internal consistency (α=.89-.92). The factor structure of the reinforcement and barrier items were not tested due to the dichotomous response scaling.

The final DAWGS tool included 62 items: dog walking behaviors (3), self-efficacy for dog walking (9), barriers to dog walking (15), reinforcements for dog walking (10), outcome expectations of dog walking (7), outcome expectancies of dog walking (7), dog support for walking (3), family (4) and friend (4) social support for dog walking (see Table 2).

Factorial invariance

Configural, metric, scalar, and error invariance was supported on all four subscales across the younger and older age groups (Table 4). Configural and metric invariance was supported on all survey subscales across groups meeting and not meeting current physical activity recommendations by walking (Table 5). Scalar invariance by physical activity level was supported on the outcome expectations, outcome expectancies, and social support subscales but not for self-efficacy (Table 5). Error invariance by physical activity level was only supported on the outcome expectations and expectancies subscales (Table 5). In some instances, the $\Delta \chi^2$ suggested non-invariance, while the ΔCFI supported invariance. In these cases, a subscale was considered invariant with a ΔCFI $\leq$.01, since this statistic is not influenced by sample size (Cheung, 2002).

Discussion

The purpose of this study was to test the reliability and validity of survey measures which assess social cognitive theory constructs that may influence dog walking behaviors. Overall, DAWGS items assessing self-efficacy, outcome expectations, reinforcements and barriers to dog walking, and social support, demonstrated moderate test-retest reliability. However, outcome expectancy items demonstrated lower test-retest reliability (r=.39-.54) which may be attributable to these items describing outcomes that dog owners may not routinely think about.

Items assessing self-reported frequency and duration of dog walking demonstrated substantial test-retest reliability. Overall, reliability results indicate that responses to DAWGS items are relatively consistent over a short period of time.

Furthermore, results support the factorial validity of all survey subscales. The two factor structure for self-efficacy and the family and friend social support factor structures are consistent with previous findings in U.S. adults (Sallis et al., 1987; Sallis et al., 1988). In addition, results demonstrate the factorial invariance of all survey subscales which supports the assumption that measurement properties are the same across different groupings of study participants. Among groups of participants meeting and not meeting physical activity recommendations, all subscales were invariant at the scalar-level, except for self-efficacy. Given the well-documented relationship between self-efficacy and physical activity levels (Trost, 2002), conceptually it is not surprising that the self-efficacy subscale would display variance at the scalar level among groups who differed in their level of participation in physical activity. In this instance, the lack of scalar invariance demonstrates the differences in mean values for self-efficacy, which is expected between more and less active participants (Vandenberg & Lance, 2000). Results support the validity of the self-efficacy subscale across these two groupings. Although there was non-invariance at the error level with the self-efficacy and social support subscales across physical activity groups, error invariance is generally not considered essential for establishing multi-group invariance (Vandenberg, 2000).

As previously noted, there is a rapidly growing body of research on dog walking, including its potential to contribute to overall physical activity levels in adults. The current findings demonstrate that the DAWGS is a psychometrically sound tool for assessing SCT constructs that may influence dog walking behaviors. A major contribution of this study is that the development of this tool creates new opportunities for research on dog walking and physical activity behavior. By developing a tool to assess SCT constructs, two of the more consistent predictors of physical activity, self-efficacy and social support (Dzewaltowski, 1994; Trost, 2002) can now be measured relative to dog walking. The SCT-based measures in the DAWGS add substantially to theory-based measures available in the dog walking literature, which is limited primarily to theory of planned behavior (TPB) constructs (Cutt, 2008). DAWGS not only has applicability in correlates studies, but could also have utility in dog walking interventions, which to-date are limited in number. Intervention strategies could be designed to positively influence the SCT constructs measured by DAWGS. For example, self-efficacy for dog walking could be enhanced by fostering a sense of social support among family and friends through walking groups. In addition, veterinarians could promote awareness of the owner and dog related health outcomes of dog walking.

Strengths and Limitations

Strengths of this study include the application of a sound theoretical framework to a specific form of physical activity, dog walking, that is receiving increasing attention in physical activity and public health research. The DAWGS is the first tool to use SCT in relation to dog walking and is only the second theory-based instrument developed to measure correlates of dog walking behaviors. The assessment of measurement invariance across age and physical activity groups is also a unique feature of this study. The current findings are encouraging and indicate that meaningful comparisons across age and physical activity groups can be made using DAWGS subscales.

The primary limitations of this study pertain to the sampling methods and participant characteristics. Since a convenience sample was recruited, participants may not be representative of dog owners at-large. Though the snowball sampling technique has certain limitations, a priority was to recruit a specific population and this sampling method efficiently reached an informal community of dog owners. Survey respondents were primarily from Indiana and were mostly well educated Caucasian women of relatively high socioeconomic status. Therefore, results may not be generalizable to many adult dog owners in the US. Self-report measures of physical activity are prone to bias, such as over reporting certain types of activity, and this is likely a limitation of the dog walking measure in DAWGS. Furthermore, because some items were dropped from the DAWGS' measures, additional validation studies with confirmatory factor analysis should be carried out with more diverse samples of dog owners.

Further research applications of the DAWGS

The DAWGS has several potential uses in physical activity and dog walking research. Future studies should evaluate the invariance of DAWGS subscales across other grouping variables, such as gender, race, ethnicity, and urban/rural locations. The DAWGS could be used in dog walking intervention studies to examine whether dog walking among dog owners could be enhanced through strategies that positively influence self-efficacy and other SCT constructs. In conclusion, the DAWGS appears to be a reliable and valid instrument that can be used to identify correlates of dog walking and inform the design of dog walking interventions.

"What does this paper add?"

Though there is a rapidly growing body of research of dog walking and physical activity, both in the U.S. and internationally over the past five years, much of this work has not had a strong theoretical framework to guide research questions. Even though constructs from SCT have been shown to be correlated with walking in general, this theory has not been examined in relation to dog walking. This study contributes to current literature by demonstrating the validity of a new social cognitive theory-based tool specific to dog walking. The development of this tool creates new opportunities for theoretically-based studies on dog walking and physical activity behavior. For example, two of the more consistent psychosocial predictors of physical activity in adults, self-efficacy and social support, can now be measured relative to dog walking. Furthermore, this tool has relevance for both determinants and intervention studies. To date, very few physical activity interventions have included a dog walking component. This study highlights an opportunity to develop dog walking interventions based on SCT constructs and utilize DAWGS for evaluation purposes. Overall, given the high prevalence of dog ownership in the US and other developed countries, the DAWGS can be used to better understand psychosocial factors that influence dog walking behaviors. This evidence can then inform the development of novel theory-based interventions to promote population levels of walking.

References

American Pet Products Association (APPA). (2010). *APPA National Pet Owners Survey.* Greenwich, CT: American Pet Products Association. Retrieved from http://www.humanesociety.org/issues/pet_overpopulation/facts/pet_ownership_statistics.html

Arbuckle, J. (2008). *Amos™ user's guide.* Crawfordsville, FL: Amos Development Corporation.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman and Company.

Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology and Health, 13,* 623-649.

Baranowski, T., Perry, C. L., & Parcel, G. S. (2002) How individuals, environments, and health behavior interact: Social Cognitive Theory. In. K. Glanz, B, Rimer, & F. Lewis. (Eds.), *Health behavior and health education: Theory, research, and practice*. (pp. 165-184). San Francisco, CA: Jossey-Bass Publishers.

Brown, S. G., & Rhodes, R. E. (2006). Relationships among dog ownership and leisure-time walking in Western Canadian adults. *American Journal of Preventive Medicine, 30,* 131-136.

Brown, T. (2006). *Confirmatory factor analysis for applied research.* New York, NY: Guilford Press.

Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, GA: Centers for Disease Control and Prevention. Retrieved from http://www.cdc.gov/brfss/

Cheung, G. W., & Rensvold, R B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal, 9,* 233-255.

Christian, H., Giles-Corti, B., & Knuiman, M. (2010). I'm just a walking the dog: Correlates of regular dog walking. *Family & Community Health, 33,* 44-52.

Cicchetti, D. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychology Assessment, 26,* 284-290.

Coleman, K. J., Rosenberg, D. E., Conway, T. L., Sallis, J. F., Saelens, B. E., Frank, L. D., & Cain, K. (2008). Physical activity, weight status, and neighborhood characteristics of dog walkers. *Preventive Medicine, 47,* 309–312.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., … Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise, 35,* 1381-1395.

Cutt, H. E., Giles-Corti, B., Knuiman, M. W., & Pikora, T. J. (2008). Physical activity behavior of dog owners: Development and reliability of the Dogs and Physical Activity (DAPA) tool. *Journal of Physical Activity & Health, 5,* S73-S89.

Cutt, H. E., Giles-Corti, B., Wood, L. J., Knuiman, M. W., & Burke, V. (2008). Barriers and motivators for owners walking their dog: Results from qualitative research. *Health Promotion Journal of Australia, 19,* 118-124.

Dimitrov, D. (2010). Testing for factorial invariance in the context of construct validation. *Measurement and Evaluation in Counseling and Development, 43,* 121-149.

Dzewaltowski, D., Noble, J., & Shaw, J. (1990). Physical activity participation: Social cognitive theory versus the theories of reasoned action and planned behavior. *Journal of Sport & Exercise Psychology, 12*, 388-405.

Dzewaltowski, D. A. (1994). Physical activity determinants: A social cognitive approach. *Medicine and Science in Sports and Exercise, 26,* 1395-1399.

Hoerster, K. D., Mayer, J. A., Sallis, J. F., Pizzi, N., Talley, S., Pichon, L. C., & Butler, D. A. (2011). Dog walking: Its association with physical activity guideline adherence and its correlates. *Preventive Medicine, 52,* 33-38.

Keller, C., Fleury, J., Gregor-Holt, N., & Thompson, T. (1999), Predictive ability of social cognitive theory in exercise research: An integrated literature review. *The Online Journal of Knowledge Synthesis for Nursing, 6.*

Kline, R. B. (2004). *Principles and practice of structural equation modeling*. (2nd ed.). New York, NY: Guilford Press.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33,* 159-174.

Lentino, C., Visek, A. J., McDonnell, K., & DiPietro, L. (2012) Dog-walking is associated with a favorable risk profile independent of moderate to high volume of physical activity. *Journal of Physical Activity and Health, 9,* 414-420.

Maddux, J. (1995). *Self-efficacy, adaptation, and adjustment: Theory, research and application*. New York, NY: Plenum Press.

McAuley, E., Jerome, G., Marquez, D., Elavsky, S., & Blissmer, B. (2003). Exercise self-efficacy in older adults: Social, affective, and behavioral influences. *Annals of Behavioral Medicine, 25,* 1-7.

Physical Activity Guidelines Advisory Committee. (2008). Physical Activity Guidelines Advisory Committee Report. Rockville, MD: U.S. Department of Health and Human Services. Retrieved from http://www.health.gov/paguidelines/

Reeves, M. J., Rafferty, A. P., Miller, C. E., & Lyon-Callo, S. K. (2011). The impact of dog walking on leisure-time physical activity: Results from a population-based survey of Michigan adults. *Journal of Physical Activity and Health, 8,* 436-444.

Sallis, J. F., Grossman, R. M., Pinski, R. B., Patterson, T. L., & Nader, P. R. (1987). The development of scales to measure social support for diet and exercise behaviors. *Preventive Medicine, 16,* 825-836.

Sallis, J. F., Pinski, R. B., Grossman, R. M., Patterson, T. L., & Nader, P. R. (1988). Development of self-efficacy scales for health-related diet and exercise. *Health Education Research, 3*, 283-292.

SAS Institute Inc. (2009*). SAS/STAT ® 9.2 user's guide, second edition*. Cary, NC: SAS Institute Inc.

Steinhardt, M. A., & Dishman, R. K. (1989). Reliability and validity of expected outcomes and barriers for habitual physical activity. *Journal of Occupational Medicine, 31,* 536-546.

Troiano, R. P., Berrigan, D., Dodd, K. W., Masse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and Science in Sports and Exercise, 40,* 181-188.

Trost, S. G., Owen, N., Sallis, J. F., & Brown, W. (2002). Correlates of adults' participation in physical activity: Review and update. *Medicine and Science in Sports and Exercise, 34,* 1996-2001.

U.S. Department of Health and Human Services. (1996). *Physical Activity: A Report of the Surgeon General- Executive Summary*. Rockville, MD: U.S. Department of Health and Human Services.

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods, 3,* 4-70.

Williams, D. M., Anderson, E. S., & Winett, R. A. (2005). A review of the outcome expectancy construct in physical activity research. *Annals of Behavioral Medicine, 29,*70-79.

RUNNING HEAD: The Dogs and WalkinG Survey

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Table 1. *DAWGS subscale correlations, means, and standard deviations*

	1	2	3	4	5	6	7	8	9
1. Self-efficacy: Making time									
2. Self-efficacy: Resisting relapse	0.88								
3. Outcome expectations: Owner	0.46	0.48							
4. Outcome expectations: Dog	0.45	0.49	0.90						
5. Outcome expectancies: Owner	0.27	0.31	0.72	0.56					
6. Outcome expectancies: Dog	0.46	0.50	0.63	0.86	0.75				
7. Dog social support	0.43	0.44	0.45	0.55	0.25	0.42			
8. Family social support	0.31	0.25	0.25	0.35	0.09	0.18	0.02		
9. Friend social support	0.32	0.33	0.27	0.30	0.16	0.26	0.30	0.24	
M±SD	3.6±1.0	3.5±1.0	4.2±0.7	4.3±0.7	4.1±0.7	4.4±0.7	3.7±1.1	2.3±1.1	1.5±0.7

Table 2. *Means with standard deviations and test-retest reliability of final DAWGS items*

	M±*SD* *N*=431	Reliability coefficient*
Dog walking		
Days per week of dog walking	3.76±2.63	0.93
Minutes per dog walk	28.06±15.10	0.85
Dog walks per day	1.50±0.86	0.70
Self-efficacy		
Making time		
Get up early, even on weekends, to walk the dog	3.29±1.33	0.69
Walk the dog after a long, tiring day at work	3.83±1.21	0.72
Walk the dog even if you are feeling depressed	3.83±1.10	0.71
Walk the dog when undergoing a stressful life change	3.84±1.10	0.62
Walk the dog even in the dark	3.34±1.43	0.79
Resisting relapse		
Walk the dog when family is asking for more time from you	3.44±1.15	0.62
Walk the dog when you have household chores to do	3.68±1.16	0.66
Walk the dog when you have time consuming social obligations	3.37±1.15	0.71
Walk the dog when you have excessive demands at work	3.55±1.15	0.67
Outcome expectations		
Owner expectations		
Improve my health	4.39±0.76	0.60
Provide me with companionship	4.12±0.90	0.57
Improve my mood	4.18±0.85	0.61
I will enjoy walking with my dog	4.42±0.80	0.63
Give me a sense of accomplishment	3.99±0.93	0.57
Dog expectations		
Make my dog happy	4.46±0.70	0.49
Make my dog behave better	4.04±0.97	0.68
Outcome expectancies		
Owner expectancies		
Improve my health	4.30±0.81	0.54
Provide me with companionship	4.00±0.91	0.54
Improve my mood	4.14±0.81	0.46
I will enjoy walking with my dog	4.27±0.78	0.39
Give me a sense of accomplishment	3.88±0.93	0.47
Dog expectancies		
Make my dog happy	4.58±0.69	0.48
Make my dog behave better	4.15±0.91	0.51
Social support		
Dog support		
Having my dog makes me walk more	3.77±1.24	0.73
My dog provides encouragement for me to go on walks	3.84±1.21	0.72

My dog provides social support for me to go on walks	3.60±1.22	0.60
Family support		
Family walk the dog with me	2..64±1.14	0.79
Family encourage me to walk dog	2.45±1.29	0.64
Family change their schedule to walk dog with me	1.97±1.21	0.71
Family plans activities with me that include dog walking	2.45±1.30	0.72
Friend support		
Friends walk the dog with me	1.73±0.75	0.65
Friends encourage me to walk dog	1.39±0.81	0.50
Friends change their schedule to walk dog with me	1.31±0.72	0.58
Friends plan activities with me that include dog walking	1.55±0.94	0.67
Reinforcements †		
My health	67.3%	0.54‡
Dog health	88.2%	0.46‡
Maintain weight	34.4%	0.54‡
Lose weight	38.9%	0.61‡
Good weather	70.0%	0.47‡
Dog enjoyment	87.0%	0.44‡
Maintain dog weight	55.5%	0.54‡
Reduce dog weight	20.9%	0.41‡
Large dog	18.8%	0.65‡
Energetic dog	51.4%	0.61‡
Barriers †		
Cold weather	60.0%	0.64‡
Hot weather	45.1%	0.60‡
Rain	77.8%	0.57‡
Snow	51.8%	0.63‡
Lack of time	46.5%	0.44‡
Difficult to walk	7.2%	0.66‡
My health	6.3%	0.70‡
Old dog	9.2%	0.89‡
Wild dog	4.8%	0.55‡
Poor dog health	7.0%	0.56‡
Small dog	3.1%	0.49‡
Untrained dog	6.0%	0.69‡
Dog difficult to control	13.3%	0.69‡
Own multiple dogs	15.4%	0.62‡
Takes away from my exercise time	5.5%	0.74‡

Note: *Test-retest reliability is reported as Spearman correlations, *r*, unless otherwise noted; † Categorical variable with percent reporting yes; ‡Kappa statistic

Table 3. *Final fit statistics and factor loadings for DAWGS subscales from confirmatory factor analysis*

	A	χ^2	*df*	CFI	RMSEA	Factor loadings
Self-efficacy		94.1	26	0.98	0.08	
Making time (5 items)	0.87					0.65-0.92
Resisting relapse (4 items)	0.92					0.86-0.90
Outcome expectations		55.8	13	0.97	0.09	
Owner (5 items)	0.89					0.70-0.89
Dog (2 items)	0.65					0.67-0.72
Outcome expectancies		29.5	13	0.99	0.05	
Owner (5 items)	0.84					0.66-0.86
Dog (2 items)	0.74					0.65-0.85
Social support		138.8	41	0.97	0.07	
Dog support (3 items)	0.92					0.81-0.99
Family support (4 items)	0.91					0.71-0.90
Friend support (4 items)	0.89					0.62-0.89

Note: α= Cronbach's alpha; χ^2= chi-square; *df* = degrees of freedom; CFI= comparative fit index; RMSEA= root mean square error of approximation

Table 4. *Factorial invariance of DAWGS subscales between younger (≤ 45 years) and older (> 45 years) participants*

	χ^2	*df*	CFI	RMSEA	Δ*df*	Δ χ2	*p*	ΔCFI	Invariance
Self-efficacy									
Configural	145.97	52	0.97	0.07	-	-	-	-	Yes
Metric	147.79	59	0.97	0.06	7	1.82	0.97	0.00	Yes
Scalar	158.64	68	0.97	0.06	9	10.85	0.29	0.00	Yes
Error	214.93	80	0.96	0.06	12	56.29	<0.01	0.01	Yes*
Outcome expectations									
Configural	75.04	26	0.97	0.07	-	-	-	-	Yes
Metric	77.85	31	0.97	0.06	5	2.81	0.73	0.00	Yes
Scalar	81.75	38	0.97	0.05	7	3.90	0.79	0.00	Yes
Error	103.42	48	0.96	0.05	10	21.67	0.02	0.01	Yes*
Outcome expectancies									
Configural	41.58	26	0.99	0.04	-	-	-	-	Yes
Metric	47.08	31	0.99	0.04	5	5.50	0.36	0.00	Yes
Scalar	60.68	38	0.98	0.04	7	13.60	0.06	0.01	Yes
Error	72.91	48	0.98	0.04	10	12.23	0.27	0.01	Yes
Social support									
Configural	182.39	82	0.97	0.05	-	-	-	-	Yes
Metric	193.09	90	0.97	0.05	8	10.70	0.22	0.00	Yes
Scalar	225.30	101	0.96	0.05	11	32.21	<0.01	0.01	Yes*
Error	282.28	118	0.95	0.06	17	56.98	<0.01	0.01	Yes*

Note: *Evidence of invariance with ΔCFI but not with Δχ2 χ^2= chi-square; *df* = degrees of freedom; CFI= comparative fit index; RMSEA= root mean square error of approximation

Table 5. *Factorial invariance of DAWGS subscales between participants meeting (≥ 150 minutes) and not meeting (<150 minutes) physical activity recommendations based on walking*

	χ^2	*df*	CFI	RMSEA	Δ*df*	Δ χ2	*p*	ΔCFI	Invariance
Self-efficacy									
Configural	126.72	52	0.97	0.06	-	-	-	-	Yes
Metric	136.82	59	0.97	0.06	7	10.10	0.18	0.00	Yes
Scalar	200.65	68	0.95	0.07	9	63.83	<0.01	0.02	No
Error	235.48	80	0.94	0.07	12	34.83	<0.01	0.01	No
Outcome expectations									
Configural	77.69	26	0.96	0.07	-	-	-	-	Yes
Metric	81.63	31	0.96	0.06	5	3.5	0.62	0.00	Yes
Scalar	98.39	38	0.96	0.06	7	16.75	0.02	0.00	Yes*
Error	122.90	48	0.95	0.06	10	24.51	<0.01	0.01	Yes*
Outcome expectancies									
Configural	42.51	26	0.99	0.04	-	-	-	-	Yes
Metric	45.07	31	0.99	0.03	5	2.56	0.77	0.00	Yes
Scalar	63.89	38	0.98	0.04	7	18.82	<0.01	0.01	Yes*
Error	85.72	48	0.97	0.04	10	21.83	0.02	0.01	Yes*
Social support									
Configural	180.17	82	0.97	0.05	-	-	-	-	Yes
Metric	186.67	90	0.97	0.05	8	6.50	0.58	0.00	Yes
Scalar	212.38	101	0.96	0.05	11	25.71	<0.01	0.01	Yes*
Error	299.98	118	0.94	0.06	17	87.60	<0.01	0.02	No

Note: *Evidence of invariance with ΔCFI but not with Δχ2 ;χ^2= chi-square; *df* = degrees of freedom; CFI= comparative fit index; RMSEA= root mean square error of approximation