

Rural Physical Activity in the Mississippi Delta: the moderating influence of stray dogs

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Abstract

Concerns about stray dogs may lead to lower physical activity levels, especially in rural areas. Gender may play a moderating role in this relationship. Linear regression was used to assess relationships between physical activity days per week, stray dogs, and gender using the Rural Eastern Louisiana Food Accessibility and Active Transportation survey (N = 677). Potentially confounding covariates were controlled in analyses, including race, education, age, self-rated health, and poverty. Findings revealed that gender but not stray dogs was related to physical activity, with men averaging one more physical activity day per week than women. However, men with concerns about stray dogs reported significantly fewer physical activity days per week compared to men without such concerns. Reported physical activity days per week for women did not differ according to stray dog concerns. Rural men may be more impacted by concerns about stray dogs because they may be more likely to engage in solitary neighborhood-based physical activity. Policy implications include enforcement of leash laws and mobile spay/neuter clinic access in rural communities. Mitigating the threat of loose dogs would remove a barrier associated with physical activity in rural communities and help to ameliorate rural health disparities, especially among men.

Key words: loose animals, exercise, health disparities, rural

Residents of rural areas have poorer health outcomes on average in comparison to residents of urban areas. Rural health disparities include higher rates of type 2 diabetes and heart disease, prevalence of multiple chronic conditions, and lower life expectancy (Boersma et al., 2020; Callaghan et al., 2020; Dugani et al., 2021; Singh et al., 2017). Physical activity is an important modifiable determinant of health; however, residents of rural areas are less likely to meet physical activity recommendations compared to their urban counterparts (Whitfield, 2019). An array of barriers contributes to rural disparities in physical activity.

Rural Active Living: A Call to Action (Umstatt Meyer et al., 2016) applies the ecological framework for active living created by Sallis and colleagues (2006) to rural contexts, describing the interplay of environment, policy, and individual situations that impact physical activity disparities in rural areas. Those dwelling in rural locations are less active than those in urban locations and this is especially true in the Southern region of the United States (Aljabri, 2022; Whitfield, 2019). Lack of physical activity among residents in rural communities may be in part due to the local physical activity environment (DeGuzman et al., 2019). Rural communities often lack access to physical activity opportunities, including well-maintained parks and affordable exercise venues (Abildso et al., 2021; Hansen et al., 2015; Jilcott Pitts et al., 2015). Further, infrastructure deficits in rural communities, such as uneven roads, missing sidewalks, and certain high-speed roads, may reduce neighborhood-based physical activity and active transportation (Chrisman et al., 2015; DeGuzman et al., 2019; Jilcott Pitts et al., 2015). Additionally, loose dogs may also be a barrier to physical activity in rural communities due to fears of attacks.

In rural areas, dogs frequently live in open yards with freedom to roam at will (Hughes & Macdonald, 2013). Rural communities often lack animal control services and rely on the limited capacity of local police to respond to dog-related concerns (Payne et al., 2005). Lower-income residents have less access to spay and neuter services, particularly in areas with limited access to subsidized animal clinics (LaVallee et al., 2017). Previous qualitative work has found loose dogs to be a perceived barrier to physical activity in the United States among rural women, Black adults, rural Black women in the South, rural American Indian women, and rural adults in the Mississippi Delta (Wilcox et al., 2000, 2005; Bopp et al., 2007; Sanderson et al., 2002; Thompson et al., 2002; Ndirangu et al., 2007). Rural Black adults are the most likely of any racial/ethnic and geographic group to view loose dogs as a barrier to walking, according to nationally representative U.S. data (Whitfield et al., 2018). However, previous work has found little evidence of a relationship between concerns about loose dogs and self-reported physical activity behaviors (Strong et al., 2013; Wilbur et al., 2003). A notable exception using a probability sample of women over 40 in the United States found an unexpected positive relationship between physical activity and concerns about unattended dogs in Black participants, potentially because

Black women who exercise frequently may have more opportunity to encounter loose dogs, whereas Black women who do not exercise may be unaware of problematic dogs (King et al., 2000). Although concerns about stray dogs have been identified in previous qualitative studies focused on rural communities, no known quantitative rural study has examined the relationship of stray dogs to physical activity behaviors, or how that relationship might differ by gender.

The purpose of this study is to examine relationships between gender, stray dogs, and physical activity in rural communities. The current study advances previous research through a community-based probability sample ($n = 479$) from two rural towns in Louisiana within the Mississippi Delta. Using linear regression with gender as a moderator, we examine relationships between concerns about stray dogs and self-reported physical activity. Potentially confounding covariates are controlled to assess the independence of relationships. The study contributes to our understanding of how the relationship between stray dog concerns and physical activity differs for men and women.

Data & Methods

The Rural Eastern Louisiana Food Accessibility and Active Transportation (RELFA) study ($N = 677$) is a population-based probability sample with an 84% response rate in three Louisiana county seats. The survey was collected as a part of baseline data for the Centers for Disease Control and Prevention (CDC) High Obesity Program grant through the Louisiana State University (LSU) AgCenter. Survey items were pilot tested with residents of varying educational backgrounds to test readability. All participants in the study were 18 or older and provided written informed consent prior to survey completion. Survey participation was requested from one household member involved in food purchasing. The first survey attempt was administered through postcards with QR codes and web links with a household survey ID. After the postcard attempt, community data collectors canvassed all households in the probability sample, using iPads loaded with an offline Qualtrics survey application. If a household did not answer the door or an address was deemed unsafe to approach, a house five doors down on the same side of the road was sampled. The data collection team reported 14 separate accounts of loose dogs which prevented an address included in the probability sample from being surveyed. Institutional Review Board approval for the study was provided through the LSU AgCenter. Details on the Community Based Participatory Research methodological approach and survey collection protocols have been published elsewhere (Seals et al., 2022). For the current analysis, two towns within counties classified as rural by Rural-Urban Continuum Codes (RUCC) were included in the analysis ($n = 479$), with RUCC scores of 7 and 9. The third town is in a county (RUCC = 2) located closer to a large metro area and thus excluded from this analysis (¹ Including the town from the third county (RUCC = 2) yields very similar results, with the same statistically significant variables). Participants with zip codes outside of the included two towns were excluded from analysis.

Measures

Physical Activity was measured by the following item, similar to the Single-Item Physical Activity Question (Bauman & Richards, 2022). “In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to make you breathe harder? This may include sports, exercise, and brisk walking or biking for recreation or to get to and from places,” with response options of 0-7 and choose not to answer. The predictor variable, presence of stray dogs, was assessed by asking “Stray dogs keep me from walking or biking near my home,” with response options of strongly agree, agree, disagree, strongly disagree, and choose not to answer. Answers were coded as a binary variable (strongly agree/agree versus disagree/strongly disagree; choose not to answer responses were dropped) due to small cell sizes in some categories and to simplify interpretation of moderation results (when stray dogs is included as a continuous variable, results mirror findings presented here) (Fritz & Arthur, 2017). Gender was placed as a moderating variable (one non-binary respondent was not included in analysis). Covariates included race, education, age, self-rated health, and poverty. Because only seven people identified as Hispanic, ethnicity was not included in the analysis. Race was measured as a binary variable (Black compared to all other race categories). Continuous variables included age (range: 18-90) and self-rated health (poor, fair, good, very good, excellent), education (up to 8th

grade, some high school-no degree, high school graduate / GED, trade/technical/associate degree, bachelor degree, master degree or higher). Poverty was measured using a binary food insecurity variable, which indicates participation in a food assistance program and/or charitable food system.

Analytic Method

Covariate-adjusted OLS regression using list-wise deletion (used due to ease of post-estimation commands) results are presented. Results are similar in models using data with missing values managed using multiple imputation (see Supplementary Materials). The interaction effect is tested for statistical significance and presented by predictive days per week of physical activity using the margins command in Stata 18.0. The statistical significance of the lower-order effect of stray dog concerns is also assessed by gender and reported.

Results

Descriptive statistics are presented in Table 1. The sample (n = 479) was 82% Black, 60% female, with a mean age of 50.28 (standard deviation = 17.36). Participants reported a mean of 2.75 days per week physical activity (range: 0-7; standard deviation = 2.42), with 56% reporting that stray dogs inhibit neighborhood walking and biking.

Table 1: Descriptive Statistics

<i>Variable</i>	<i>n</i>	<i>% / mean</i>	<i>Std Dev</i>	<i>min</i>	<i>max</i>
Full Sample	479	100%			
Gender					
Female	289	60.46%			
Male	188	39.33%			
Non-binary / other	1	.21%			
Race / ethnicity					
Black	384	81.88%			
White	80	17.06%			
Native American	2	.43%			
Black + one or more other race	3	.64%			
Hispanic	7	1.47%			
Age	479	50.28	17.36	18	90
Self-rated health					
Poor	12	2.52%			
Fair	101	21.17%			
Good	176	36.9%			
Very good	141	29.56%			
Excellent	47	9.85%			
Education					
Up to 8 th grade	16	3.44%			
Some high school, no degree	58	12.47%			
High school degree or GED	216	46.45%			
Some college, no degree	60	12.90%			
Trade/technical/vocational training	31	6.67%			
Associate’s degree	19	4.09%			
Bachelor’s degree	42	9.03%			
Master’s degree or higher	23	4.95%			
Food Insecure Household	125	27.78%			
Days per week exercise	465	2.75	2.42	0	7
Stray dogs inhibit walking/biking	254	55.58%			

RELFA, 2020-2021. *N* = 479, Lake Providence & St. Joseph, Louisiana. Variables that do not total 479 contain missing data. Source: Author

Table 2 presents results from OLS linear regression. Unadjusted results with similar findings may be found in Supplemental Table 1. Results are similar in models using data with missing values managed using multiple imputation (see Supplemental Table 2). Controlling for the effects of all other variables in the model, men who do *not* report dogs as a barrier to walking or biking report .93 higher days per week of physical activity (*p* = 0.006). The presence of stray dogs was not significantly associated with physical activity; however, the interaction effect of male

and stray dogs was negative and significant. For men, reporting stray dogs as a deterrent to neighborhood biking and walking was associated with 1.13 fewer days per week of physical activity (*p* = 0.015). Figure 1 depicts this interaction with 95% confidence intervals, controlling for the effects of all other variables in the model. For women, there was no difference in days per week of physical activity based on stray dogs inhibiting neighborhood physical activity.

Table 2. OLS Regression: Days per week of at least 30 minutes physical activity

	<i>b</i>	SE	P-value	95% CI		Std Beta
Male	.93	0.33	0.006	0.27	1.59	.19
Black	-1.41	.31	0.000	-2.03	-.79	-.22
Education	0.01	0.07	0.891	-0.12	0.14	.01
Age	0.00	0.01	0.569	-0.01	0.02	-.03
Self-rated health	0.36	0.13	0.005	0.11	0.61	.14
Food insecurity	0.86	0.26	0.001	0.34	1.38	.16
Stray dogs	-0.01	0.30	0.981	-0.60	0.59	.00
Stray Dogs*male	-1.13	0.46	0.015	-2.04	-0.34	-.19
Intercept	2.75	0.70	0.000	1.38	4.12	.

*r*² = .14

Adj. *r*² = .12

RELFA, 2020-2021. *n* = 397, list-wise deletion. Lake Providence & St. Joseph, Louisiana. *b* = beta, *SE* = Standard Error, *CI* = Confidence Intervals, *Std Beta* = Standardized Beta (standardized coefficients). Source: Author

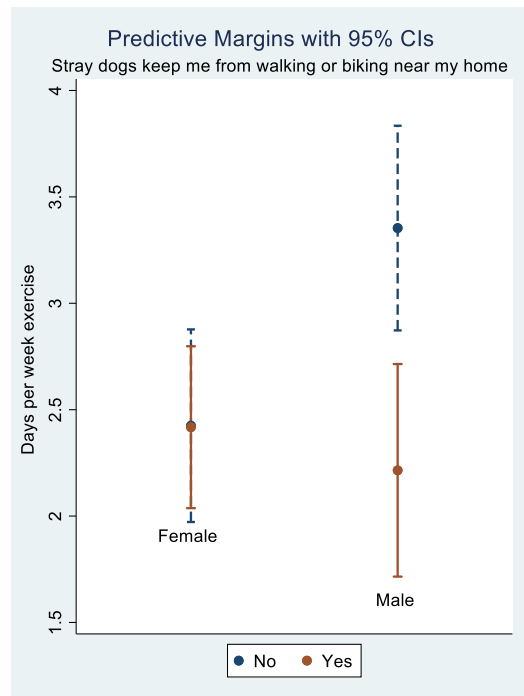


Figure 1. Adjusted predicted days per week exercise by gender and concerns about stray dogs (yes versus no). RELFA, 2020-2021, *n* = 397, list-wise deletion. Estimates are from the regression model in Table 2. Source: Author

Other covariates also contribute to the model. For every improved category of self-reported health, there is an additional predicted .36 day of physical activity ($p = 0.005$). Being food insecure is associated with an increase of .86 days of physical activity ($p = 0.001$). Additionally, Black race is associated with 1.41 fewer days per week of physical activity ($p = 0.000$).

Discussion

People in rural areas have lower levels of physical activity than urban residents. Previous work has identified loose dogs as a barrier to physical activity (Bopp et al., 2007; Ndirangu et al., 2007; Whitfield et al., 2018; Wilcox et al., 2000). Using a rural probability sample, we find that rural men who view stray dogs as a barrier to neighborhood-based walking and biking, on average, accrued more than one day *less* physical activity per week than men without concerns about dogs. For women, there was no difference in reported days per week physical activity between those who viewed dogs as a barrier to neighborhood-based physical activity and those who did not. Previous work has not examined gender as a moderator or has used samples that included only women (Strong et al., 2013; Wilbur et al., 2003).

Although we did not directly measure the reasons for the gender difference in the effects of stray dogs on physical activity, previous research provides potential explanations. Women in rural areas may prefer walking in groups, thus lessening the threat of neighborhood stray dogs (Cadmus-Bertram et al., 2020; Evans, 2011). Other barriers may impact women's physical activity choices more directly, such as household responsibilities, societal expectations, and weather, making concerns about neighborhood dogs a less salient factor in whether a woman engages in physical activity (Evans, 2011; Gilbert et al., 2019; Perry et al., 2008; Thompson et al., 2002). Additionally, many women prefer indoor physical activity, which may make concerns about neighborhood dogs irrelevant for physical activity behaviors (van Uffelen et al., 2017). Although limited research exists, it could be that compared to rural women, rural men may be more likely to exercise alone in a neighborhood setting, and thus more impacted by concerns about stray dogs near their home.

Other covariates are noteworthy in the model. Food insecurity is associated with more days per week physical activity, with participants receiving food assistance programs or participating in the charitable food system reporting an average of .86 more days per week of physical activity than residents who were not food insecure. This could be because our measure for physical activity included all physical activity, such as active transportation and occupational-based physical activity, not just leisure activities. Unsurprisingly, better self-rated health is associated with more days per week of physical activity. Notably, identifying as Black was the strongest predictor in the model. Controlling for the effects of all other variables in the model, participants who identify as Black accrue fewer days per week of physical activity than participants who identified as other races. This could be because the

barriers to exercise in rural communities are compounded with other barriers to physical activity faced by Black residents. Most rural residents report a built environment unsupportive of physical activity; Black residents may also feel unsafe to exercise in certain places, such as rural trails furthering limited access (Whitfield et al., 2019; Davis, 2019). For rural Black men with concerns about loose dogs in their neighborhood, options for physical activity are further constrained.

In rural communities where loose dogs cause concerns, community coalitions working with partners such as Cooperative Extension, churches, libraries, and rural health clinics may be an avenue to garner broad community support for policy change (Holston et al., 2020; Stroope et al., 2024). Community coalitions can promote awareness and foster positive engagement between law enforcement and community members to effectively change behavioral norms around dog ownership behaviors (Joseph et al., 2015). Collective action to make funds available for low-cost fencing options and community-builds of electric and physical fences may be needed to make safe containment of pets accessible for all community members and could function as a modern-day barn-raising effort. Mobile spay/neuter clinics could help minimize stray animals, as well as reduce aggressive behavior towards strangers (Farhoody et al., 2018). Local communications campaigns through local papers, radio, church bulletins, and community board flyers could help share local stories to build support for why containing animals is important for their town, featuring older adults, children, and other community members likely to be seen as needing protection to encourage containing loose animals as a form of civic responsibility and care for others.

This study has several limitations. The RELFA survey used the phrase "stray dogs." However, "loose dogs" would have been more inclusive and perhaps a more accurate measure of threat. The survey item was tested and reviewed by residents of each community in which the survey was fielded; it could be that the phrases are viewed as interchangeable, or similar enough to not have raised concerns during pilot testing (Seals et al., 2022). In future surveys, replacing "stray dogs" with "loose dogs" is preferable. Additionally, participants may have achieved physical activity recommendations with fewer than 3 days per week of physical activity, as our measure was limited to days per week of at least 30 minutes of physical activity. Furthermore, people who spend time walking and biking in their neighborhoods are likely to have greater exposure to loose dogs than those who do not. The presence of loose dogs may function as a latent barrier for those not yet engaging in outdoor physical activity. Future work should explore how to galvanize community support in low resource rural communities to effectively reduce the presence of loose dogs.

Although these findings are representative of Lake Providence and St. Joseph, Louisiana, caution should be used in interpreting the results more broadly, especially outside of the Mississippi Delta region of the rural South. More work is needed to understand the dynamics between

gender, loose dogs, and physical activity, especially in places with other rural demographic dynamics, such as areas with high Hispanic or Native American populations.

However, this study makes a unique contribution through its community-based probability sample, placement of gender as a moderator, and robust controls. Additionally, this study provides insight to physical activity behaviors in the rural Delta South, an understudied area with high health disparities (Gennuso, 2016). Understanding the role of loose dogs in suppressing physical activity among rural men provides actionable steps to reducing health disparities in rural communities.

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Conceptualization, J.S., Methodology, J.S. & K.S., Analysis, J.S., Writing—Original Draft, J.S. L.E.B., A.C.G., K.S., and D.H., Writing—Review & Editing, J.S., A.C.G., L.E.B., D.H., K.S., Funding Acquisition, D.H., Supervision, D.H. and A.C.G.

Acknowledgements

The author would like to thank the LSU AgCenter, Jamila Freightman, Joy K. Sims, Matthew Greene, Maria Gonzales, Marquetta Anderson, the community data collectors, as well as all RELFA participants for their contributions to this study.

Conflict of Interest Statement

The authors declare no conflicts of interest related to the research, authorship, and/or publication of this article.

Financial Disclosure

This publication was supported by cooperative agreement number 58DP006570 funded by the Centers for Disease Control.

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Supplementary Materials

Supplemental Table 1. Unadjusted OLS regression results: Days per week of at least 30 minutes physical activity, predicted in 3 unadjusted models

	<i>b</i>	SE	P-value	95% CI	
Male	0.54	0.23	0.018	0.10	0.99
intercept	2.49	0.14	0.000	2.21	2.78
n=459					
Stray dogs	-.29	0.23	0.210	-0.74	0.16
intercept	2.83	0.17	0.000	2.50	3.17
n=441					
Male	1.33	0.34	0.000	0.66	1.99
Stray Dogs	0.32	0.30	0.282	-0.26	0.91
Male * Stray dogs	-1.39	0.46	0.003	-2.30	-0.48
intercept	2.21	0.23	0.000	1.76	2.65
n = 437					

RELFA, 2020-2021. List-wise deletion. Lake Providence & St. Joseph, Louisiana. Source: Author

Supplemental Table 2. Multiple Imputation estimates, OLS Regression. Days per week of at least 30 minutes physical activity

	<i>b</i>	SE	P-Value	95% CI	
Male	0.94	0.34	0.006	0.27	1.60
Black	-1.47	0.30	0.000	-2.06	-0.89
Education	0.02	0.06	0.757	-0.11	0.15
Age	-0.01	0.01	0.398	-0.02	0.01
Self-rated health	0.49	0.12	0.000	0.25	0.72
Food insecurity	0.70	0.26	0.008	0.18	1.23
Stray dogs	0.13	0.30	0.661	-0.46	0.73
Stray dogs*male	-0.95	0.46	0.039	-1.85	-0.05
Intercept	2.65	0.67	0.000	1.33	3.96

RELFA, 2020-2021. n = 491, multiple imputation estimates (20 imputations). Lake Providence & St. Joseph, Louisiana.