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Original Research Article

Environmental and individual correlates of leisure-time physical activity in Ghana: a cross-sectional study

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ABSTRACT

Background: Leisure-time physical activity (LTPA) offers significant health benefits yet remains the least engaged domain of overall physical activity in sub-Saharan Africa. Limited evidence exists regarding how environmental and individual factors impact LTPA, particularly among healthcare professionals. This study explored the correlates of LTPA among Physician Assistants in Ghana, with a major focus on natural environmental conditions.
Methods: Data from a cross-sectional survey conducted among 439 Physician Assistants in Ghana between October and December 2024 was used. Participants reported their levels of LTPA using a revised Global Physical Activity Questionnaire. Climate data, including temperature, wind direction, rainfall, and humidity, from the Ghana Meteorological Agency were matched to participants' practice regions. An adjusted linear regression was used to examine the relationship between LTPA and individual/environmental correlates.
Results: The mean weekly moderate-to-vigorous-intensity physical activity was 179.3±18.3 minutes. Overall, 69% of respondents did not meet the recommended 150 minutes per week of activity levels by the World Health Organization. In adjusted models, each one-percentage-point increase in relative humidity was associated with an additional 10 minutes of LTPA per week (β =10.4, 95% *CI*: 1.9 to 18.9). Conversely, wind direction (β =-35.4, 95% *CI*: -57.3 to -13.5) and male gender (β =-112.9, 95% *CI*: -190.8 to -35.0) were associated with lower LTPA.
Conclusions: Climatic factors significantly influence LTPA in the Ghanaian setting. The findings underscore the need for context-specific interventions that consider climate variability and gender disparities in promoting active lifestyles.

Keywords: Climate, Ghana, Physical activity, Physician assistants, Weather

INTRODUCTION

Leisure-time physical activity (LTPA), defined as moderate-to-vigorous bodily movement undertaken during discretionary time for recreation, fitness, or enjoyment, has emerged as a determinant of physical and mental health.[1] It has been recommended by the World Health Organization (WHO) that adults within the ages of 18 to 64 years accumulate on average 150 minutes or more moderate-to-vigorous intensity physical activity (MVPA) each week, which is ideal for optimal health.[2] Evidence consistently links higher levels of LTPA to reduced risk of certain cancers, type 2 diabetes, cardiovascular disease, and depression, as well as improved quality of life and longevity.[3-5] Despite its benefits, global estimates suggest that many adults remain insufficiently active.[6] This inactivity is pronounced in sub-Saharan Africa, where a significant share of adults fall below the recommended WHO levels.[7,8] In this region, LTPA is often the least accumulated domain of total physical activity, especially when compared to

necessity-based forms of activity such as work- and transport-related movements.[9,10] Understanding the correlates of LTPA is key to promoting physical activity in Africa.

The socioecological model provides a guiding theoretical framework for examining correlates of LTPA.[11] The model posits that behavior is embedded within and shaped by multiple layers of influence, ranging from individual characteristics to interpersonal networks, institutional structures, community contexts, and broader policy environments.[11] Within this framework, this study will focus on two domains: (1) individual-level characteristics such as age, gender, educational attainment, and sleep duration, and (2) natural environmental exposures, including rainfall, temperature, relative humidity, and wind direction. These domains were selected based on both theoretical grounding and the paucity of empirical studies assessing their role in shaping LTPA behaviors in sub-Saharan Africa.

Individual-level factors have shaped LPTA levels globally. For example, factors such as income, gender, age, employment status, and sleep patterns have been reported to significantly influence LTPA levels in Taiwan, Ghana, and Australia.[12-14] At the environmental level, climatic factors are increasingly recognized as important determinants of LTPA. For example, a study among 368 adults in Australia indicated that wind speed, rainfall, and temperature significantly influenced LTPA.[15] Furthermore, a scoping review of 30 countries, predominantly high-income, indicated that temperature, wind speed, and humidity significantly influenced activity levels.[16] While individual-level factors are mostly examined as correlates of LTPA across country income levels, there is a striking evidence gap on how the natural environment influences LTPA in low- and middle-income settings.

In a low- and middle-income African country like Ghana, studies indicate that insufficient physical activity remains a public health concern among adults.[13] For instance, a study involving 1,635 adults in Ghana indicated that approximately 31% did not meet the WHO's recommended levels.[17] Although national campaigns have encouraged physical activity, empirical evidence on the specific correlates of LTPA in Ghana remains limited. The diverse lifestyle and weather patterns across regions, distinct from those in high-income countries, offer a valuable opportunity to explore how individual and environmental factors influence LTPA, with potential implications for promoting active living in Ghana.

This aimed to generate context-specific insights on how both individual and environmental factors influence LTPA in Ghana among an adult population. The findings are intended to contribute to the development of climate-responsive strategies that promote active living among the adult population.

METHODS

Study design and participants

This cross-sectional analysis utilized data from a survey conducted among Physician Assistants in Ghana, whose methods have been described sufficiently.[18] In brief, 439 respondents were recruited through email invitations distributed between October and December 2024. Ethical approval was obtained for the original study, with informed consent secured electronically. The current study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[19] All 439 responses were analyzed for this study.

Measures

Outcome variable: leisure-time physical activity

A revised version of the Global Physical Activity Questionnaire (GPAQ), which has been validated for assessing MVPA, was used to measure LTPA.[20] The internal consistency of the revised GPAQ was moderate (Cronbach alpha=0.681). MVPA minutes were generated from the number of days and the duration of activities per week reported by respondents. LTPA was further categorized into sufficient (≥150 minutes per week of MVPA) and insufficient (<150 minutes per week of MVPA) based on WHO's recommendation.[2]

Potential correlates

The socio-ecological model[11] guided the identification of potential factors associated with LTPA, which were grouped into the following domains:

Individual factors

Respondents reported their actual age and gender (male vs. female). Their monthly income was categorized as either Gh¢5,000 and above or below Gh¢5,000. Education level was reported as either an advanced diploma, bachelor's degree, or master's degree/higher. Average daily sleep duration was self-reported by participants.

Natural environment factors

Each participant identified the region in which they practiced, corresponding to ten administrative regions in Ghana. Monthly data on rainfall, temperature, relative humidity, and wind direction for October to December 2024 were obtained from the Ghana Meteorological Agency. The weather data were derived from satellite monitoring stations located in each region. For analysis, weather variables were averaged across the three months per region and linked to participants based on their reported practice location.

Analysis strategy

Descriptive statistics were computed to summarize both individual and environmental variables. Means with standard errors were used to summarize continuous variables, while frequencies with percentages were used for categorical variables. To assess the associations between LTPA and potential correlates, multivariable linear regression was performed. Adjusted regression coefficients and 95% confidence intervals were estimated. STATA version 18.0 was used for analysis.

RESULTS

Respondents' characteristics are summarized in Table 1. The average age for respondents was 37.8±0.3 years, and the sample was predominantly male (65.8%). Approximately 47% earned less than Gh¢5,000 per month as income. Overall, 69% of the respondents did not meet the WHO physical activity recommendation.

Climate variables and LTPA levels are presented in Table 2. The data reflect moderate average temperature, rainfall, humidity, and MVPA levels. Wind direction during the study period indicated a predominance of north-easterly winds.

Table 3 presents the results from the multivariable linear regression examining the associations between LTPA and individual/environmental correlates. In the adjusted model, there was a negative association between wind direction and LTPA (β =-35.4, 95% *CI*: -57.3 to -13.5), while each one-percentage-point increase in relative humidity was associated with an additional 10 minutes of LTPA per week (β=10.4, 95% *CI*: 1.9 to 18.9). In terms of individual factors, being male was associated with a reduction of approximately 113 minutes of MVPA per week compared to females (β=-112.9, 95% *CI*: -190.8 to -35.0).

Table 1: Respondents' characteristics.

Variables	Overall (n=439) Mean±SE, N (%)
Sleep duration	6.1±0.5
Age (years)	37.8±0.3
WHO recommendation	
Insufficient (<150 minutes per week)	304 (69.2)
Sufficient (≥150 minutes per week)	135 (30.8)
Gender	
Female	150 (34.2)
Male	289 (65.8)
Level of education	
Advanced diploma	42 (9.6)
Bachelors	305 (69.5)
Master's and above	92 (21.0)
Income (monthly)	
Gh¢5,000 and above	231 (52.6)
Below Gh¢5,000	208 (47.4)

Table 2: Natural environment (climate) and LTPA.

Indicators (Units)	Minimum	Maximum	Mean±SE	95% CI
Rainfall (mm)	22.9	265.2	107.9±3.3	101.4 to 114.5
Temperature (°C)	26.7	29.1	28.2±0.1	28.1 to 28.3
Relative Humidity (%)	47.0	86.0	74.3±0.5	73.3 to 75.4
Wind Direction (°)	9.0	22.0	16.6±0.2	16.2 to 17.1
MVPA (minutes/week)	0	4385	179.3±18.3	143.4 to 215.3

mm=millimeters. °C=degree Celsius. %=percentage. CI: confidence interval

Table 3: Association between leisure-time physical activity and potential correlates.

Variable	Observed coefficient	Standard error	95% CI
Sleep duration	-10.1	16.8	-43.1 to 23.0
Age	4.4	3.1	-1.5 to 10.4
Rainfall	-1.0	0.5	-2.0 to 0.1
Temperature	13.7	46.6	-78.0 to 105.4
Relative humidity	10.4*	4.3	1.9 to 18.9

Continued.

Variable	Observed coefficient	Standard error	95% CI
Wind direction	-35.4**	11.2	-57.3 to -13.5
Gender			
Female	REF	REF	REF
Male	-112.9**	39.6	-190.8 to -35.0
Education			
Advanced diploma	REF	REF	REF
Bachelors	-101.2	65.3	-229.5 to 27.0
Master's and above	-36.8	72.7	-179.7 to 106.2
Income (monthly)			
≥ ¢5,000	REF	REF	REF
< ¢5,000	21.6	41.1	-59.1 to 102.3

REF: reference. CI: confidence intervals. *p<0.05; **p<0.001

DISCUSSION

This study examined the potential correlates of LTPA among Ghanaian Physician Assistants. The majority (69%) of respondents were insufficiently active. Climate indicators were moderate, with wind direction indicative of north-easterly flows. While relative humidity was positively associated with LTPA, being male and wind direction were negatively associated with LTPA.

The WHO recommends that adults engage in at least 150 minutes per week of MVPA to achieve health benefits.[2] In this sample, 69% of respondents did not meet this recommendation. This finding is consistent with global estimates and patterns observed across sub-Saharan Africa.[6-8] These trends are concerning and signal slow progress toward the global target of a 15% reduction in physical inactivity prevalence.[21] Given that sustaining moderate-to-vigorous physical activity is vital for both individual and population health, there is an urgent need for coordinated action by the Ministry of Health, Ghana Health Service, and other key stakeholders to address the ongoing decline in physical activity levels.[22]

Wind direction was negatively associated with LTPA, while relative humidity showed a positive association. Increases in intensity and frequency of weather events are attributed to ongoing global warming and climate change.[23] These findings may be understood in the context of climate dynamics in Ghana. The months of October to December are characterized by the onset of the harmattan (dry) season, which brings dry, dust-laden north-easterly winds.[24] Wind is essential in moving and dispersing air pollution. North-easterly winds make air quality poor and affect visibility, which may discourage outdoor recreational physical activity.[25,26] In contrast, average relative humidity may improve perceived air quality and environmental comfort, thereby supporting recreational activity.[27] While wind can transport particulate matter and reduce outdoor air quality, humidity may reduce the effects of airborne dust, potentially explaining the contrasting associations observed in our study.

These findings are partially aligned with previous literature. For example, a study in Australia reported that wind speed was negatively correlated with LTPA.[15] However, a systematic review reported varying associations between weather and physical activity.[28] Most of the studies in the review were conducted in high-income countries with seasonal variations, like winter and summer, which differ markedly from tropical settings such as Ghana.[28] Furthermore, a scoping review highlighted that certain weather variables, such as humidity, are often neglected in physical activity research.[16] This underscores the importance of context-specific studies to inform interventions tailored to the local climate and environment.

Another key finding was that males engaged in significantly less LTPA than females. In our sample, 37.3% of females met WHO's recommendation, compared to only 27.2% of males (p=0.031). Moreover, moderate-intensity activity was higher among women compared to men (181.9±35.4 vs. 88.5±14.3, p=0.004), but not for vigorous-intensity activity (p=0.871). These results differ from previous studies, which have reported that males are generally more active than females.[12,29] However, the findings from this study support research suggesting that women may accumulate more moderate-intensity activity through daily routines, whereas men tend to participate in more structured vigorous-intensity activities.[30] In this context, public health strategies that promote moderate-intensity activities specifically targeted at men may be particularly beneficial.

Implications of findings

These findings emphasize the variability and importance of climate-specific factors in shaping physical activity behavior. Most existing studies have focused on seasonal climates in high-income countries, but our results highlight unique challenges and opportunities in low- and middle-income countries like Ghana. As climate change continues to impact environmental conditions in Ghana, its influence on health behaviors, including physical activity, is likely to grow.[23,24] There is a need to create built environments that support recreational physical activity regardless of weather conditions. Policymakers

may consider establishing community-based, environmentally friendly indoor recreational spaces that are freely accessible. Additionally, the Ghana Meteorological Agency could leverage digital platforms in collaboration with telecommunication companies to provide real-time weather updates and advice via mobile devices, helping individuals plan outdoor activities more effectively. Such interventions could be piloted among the studied Physician Assistant population or suitable populations in the Ghanaian setting.

Potential future directions for research

Causality cannot be inferred in this study because of the cross-sectional design. Therefore, longitudinal research is needed to establish temporal relationships between climate variables and physical activity. Future studies should aim to include physical activity and weather data from all twelve calendar months to account for seasonal variability.

The first limitation is the voluntary participation through an online platform, which may have introduced selection bias. Secondly, there is the possibility of recall bias with the self-reported activity levels. Third, weather data covered only three months, limiting the ability to assess seasonal trends. Finally, causality cannot be inferred from the cross-sectional design.

This appears to be the first study investigating climate influences on LTPA among an adult population in Ghana and one of the few within the sub-Saharan African context. The findings contribute important insights for the design of climate-responsive public health interventions in similar low-resource settings. They also highlight the need for further investigation into the intersection of climate, active behavior, and health in the context of global climate change.

CONCLUSION

Climatic factors can influence health behaviors by either facilitating or hindering opportunities for LTPA. This study provides cross-sectional evidence that increased wind direction (likely indicative of dusty, dry harmattan conditions) may suppress physical activity, while average humidity may promote it. In addition, males in the studied population were less active in terms of moderate-intensity physical activity, contributing to their lower overall LTPA levels. These findings highlight the need for locally relevant interventions that account for both environmental and sociodemographic contexts. Future longitudinal studies are needed to explore these relationships over time and guide climate-sensitive policy interventions aimed at increasing physical activity in Ghana.

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REFERENCES

1. Janssen TI, Voelcker-Rehage C. Leisure-time physical activity, occupational physical activity and the physical activity paradox in healthcare workers: A systematic overview of the literature. Inter J Nurs Stud. 2023;141:104470.
2. World Health Organization. Who guidelines on physical activity and sedentary behaviour, 2020. Available at: https://www.who.int/publications/i/item/9789240015128. Accessed 01 June 2025.
3. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: An analysis of burden of disease and life expectancy. Lancet. 2012;380(9838):219-29.
4. Guthold R, Stevens GA, Riley LM, Bull FC. Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1·6 million participants. Lancet Child and Adolescent Health. 2020;4(1):23-35.
5. Asamoah-Boaheng M, Sarfo-Kantanka O, Tuffour AB, et al. Prevalence and risk factors for diabetes mellitus among adults in ghana: A systematic review and meta-analysis. Intern Health. 2019;11(2):83-92.
6. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1·9 million participants. Lancet Global Health. 2018;6(10):e1077-86.
7. Adeloye D, Ige-Elegbede JO, Auta A, Ale BM, Ezeigwe N, Omoyele C. Epidemiology of physical inactivity in nigeria: A systematic review and meta-analysis. Journal of public health (Oxford, England). 2022;44(3):595-605.
8. Afrifa–Anane E, Agyemang C, Codjoe SN, Ogedegbe G, de-Graft Aikins A. The association of physical activity, body mass index and the blood pressure levels among urban poor youth in accra, ghana. BMC Public Health. 2015;15(1):1-9.
9. Guthold R, Louazani SA, Riley LM, Cowan MJ, Bovet P, Damasceno A, et al. Physical activity in 22 african countries: Results from the world health organization stepwise approach to chronic disease risk factor surveillance. Amer J Prevent Medi. 2011;41(1):52-60.
10. Salvo D, Jáuregui A, Adlakha D, Sarmiento OL, Reis RS. When moving is the only option: The role of necessity versus choice for understanding and promoting physical activity in low- and middle-income countries. Annual Revi Publ Heal. 2023;44(1):151-69.

11. Lee Y, Park S. Understanding of physical activity in social ecological perspective: Application of multilevel model. Frontiers in Psychology. 2021;12:622929.
12. Agyemang K, Banstola A, Pokhrel S, Anokye N. Determinants of physical activity and dietary habits among adults in ghana: A cross-sectional study. Inter J Environ Res Publ Heal. 2022;19(8):4671.
13. Afrifa-Anane E, De-Graft Aikins A, Dodoo F, Agyemang C. The prevalence and determinants of physical activity among ghanaians in ghana and ghanaian migrants in europe: The rodam study. Europ J Publ Health. 2018;28(suppl_1):cky047.040.
14. Chen YJ, Huang YH, Lu FH, Wu JS, Lin LL, Chang CJ, et al. The correlates of leisure time physical activity among an adults population from southern Taiwan. BMC Public Health. 2011;11:427.
15. Ferguson T, Curtis R, Fraysse F, Olds T, Dumuid D, Brown W, et al. Weather associations with physical activity, sedentary behaviour and sleep patterns of australian adults: A longitudinal study with implications for climate change. Int J Behav Nutri Phy Activ. 2023;20(1):30.
16. Turrisi TB, Bittel KM, West AB, Hojjatinia S, Hojjatinia S, Mama SK, et al. Seasons, weather, and device-measured movement behaviors: A scoping review from 2006 to 2020. Int J Behav Nutrit Phys Activ. 2021;18(1):24.
17. Osei E, Amu H, Appiah-Kubi P, Konlan KD, Mumuni H, Orish VN, et al. Prevalence and predictors of selected risk factors of non-communicable diseases in Ghana: evidence from a sub-national survey. J Glob Heal Sci. 2021;3(2).
18. Akwaboah PK, Ntiri KA, Baah G, Larweh R, Somuah AA. Work engagement levels and correlates among physician assistants in ghana: A cross-sectional study. Global Health Journal. 2025;9(2):153-8.
19. Vandenbroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the reporting of observational studies in epidemiology (strobe): Explanation and elaboration. PLoS Medicine. 2007;4(10):e297.
20. Cleland CL, Hunter RF, Kee F, et al. Validity of the global physical activity questionnaire (gpaq) in assessing levels and change in moderate-vigorous physical activity and sedentary behaviour. BMC Public Health. 2014;14:1255.
21. World Health Organization. Global action plan on physical activity 2018–2030: More active people for a healthier world, 2018. Available at: https://www.who.int/publications/i/item/9789241514187. Accessed 01 June 2025.
22. Katzmarzyk PT, Friedenreich C, Shiroma EJ, Lee IM. Physical inactivity and non-communicable disease burden in low-income, middle-income and high-income countries. Brit J Spo Medi. 2022;56(2):101-6.
23. Masson-Delmotte V, Zhai P, Pirani A, Connors SL, Péan C, Berger S,, et al. Ipcc, 2021: Summary for policymakers. In: Climate change 2021: The physical science basis. Contribution of working group I to the sixth assessment report of the intergovernmental panel on climate change. Cambridge, United Kingdom and New York, NY, USA; 2021:2021-01.
24. Ghana Meteorological Agency. State of the climate Ghana, 2024. Available at: https://www.meteo.gov.gh/documents/4836/State_of_the_climate_Ghana_2024.pdf. Accessed 01 June 2025.
25. Aguilera R, Corringham T, Gershunov A, Benmarhnia T. Wildfire smoke impacts respiratory health more than fine particles from other sources: Observational evidence from southern california. Nature Commun. 2021;12(1):1493.
26. Zabrocki L, Alari A, Benmarhnia T. Improving the design stage of air pollution studies based on wind patterns. Sci Rep. 2022;12(1):7917.
27. Zender-Świercz E, Galiszewska B, Telejko M, Starzomska M. The effect of temperature and humidity of air on the concentration of particulate matter - pm2.5 and pm10. Atmosph Res. 2024;312:107733.
28. Garriga A, Sempere-Rubio N, Molina-Prados MJ, Faubel R. Impact of seasonality on physical activity: A systematic review. Int J Environm Res Publ Heal. 2021;19(1).
29. Azevedo MR, Araújo CL, Reichert FF, Siqueira FV, da Silva MC, Hallal PC. Gender differences in leisure-time physical activity. Int J Publ Heal. 2007;52(1):8-15.
30. Wang R, Bishwajit G, Zhou Y, Wu X, Feng D, Tang S, et al. Intensity, frequency, duration, and volume of physical activity and its association with risk of depression in middle- and older-aged chinese: Evidence from the china health and retirement longitudinal study, 2015. PLOS ONE. 2019;14:e0221430.
31. Larouche R. Children's active transportation. Elsevier; 2018.

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