Rural communities are more physically active in Indonesia: the results on Indonesian national survey data

Las comunidades rurales son más activas físicamente en Indonesia: resultados de una encuesta nacional indonesia

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How to cite in APA

Haru Pradani, W., Guspa, A., Akbar, A., Hidayati, I., Feny Rahayu, W., Sukma Deri, P., & Oktarisa, F. (2025). Rural communities are more physically active in Indonesia: the results on Indonesian national survey data. *Retos*, *69*, 646–653. https://doi.org/10.47197/retos.v69.115771

Abstract

Introduction: Physical activity is an important component of maintaining physical and mental health, including reducing the risk of chronic diseases and improving cognitive function. However, nearly a quarter of the global adult population is physically inactive, with factors such as geographic location (urban vs. rural) and socioeconomic conditions influencing participation levels.
Objective: To identify differences in physical activity levels between urban and rural communities in Indonesia and to identify the influence of residential location, wealth, and age on physical activity.
Methodology: This study used data from the 5th wave of the Indonesian Family Life Survey (IFLS), with a sample of 20,611 respondents (57.4% urban, 42.6% rural). Physical activity levels were measured based on the Metabolic Equivalent of Task (MET) and analyzed using ANCOVA (with residence as a fixed factor, and wealth and age as covariates) and Bayesian ANCOVA to compare predictive models.
Results: Significant difference in physical activity between urban and rural areas ($F = 100.893$, $*p* < 0.001$), with rural communities being more active. Wealth level had a significant effect ($F = 44.894$, $*p* < 0.001$), while age did not ($*p* = 0.428$). The best model in the Bayesian analysis included both residence and wealth (posterior probability: 96.7%), confirming the importance of geographic and economic context.
Conclusions: Rural communities in Indonesia are more physically active, compared to urban communities. Public health policies need to prioritize location-based interventions. Further studies are needed to explore other factors such as access to infrastructure and community perceptions of physical activity.

Keywords

Physical activity, urban vs rural, ANCOVA, Bayesian, health policy.

Resumen

Introducción: La actividad física es un componente importante para mantener la salud física y mental, incluida la reducción del riesgo de enfermedades crónicas y la mejora de la función cognitiva. Sin embargo, casi una cuarta parte de la población adulta mundial es físicamente inactiva y factores como la ubicación geográfica (urbana o rural) y las condiciones socioeconómicas influyen en los niveles de participación.
Objetivo: Identificar las diferencias en los niveles de actividad física entre las comunidades urbanas y rurales de Indonesia e identificar la influencia de la ubicación residencial, la riqueza y la edad en la actividad física.
Metodología: Este estudio utilizó datos de la quinta ola de la Encuesta de Vida Familiar de Indonesia (IFLS), con una muestra de 20.611 encuestados (57,4% urbanos, 42,6% rurales). Los niveles de actividad física se midieron según el equivalente metabólico de la tarea (MET) y se analizaron utilizando ANCOVA (con la residencia como factor fijo y la riqueza y la edad como covariables) y ANCOVA bayesiano para comparar modelos predictivos.
Resultados: Diferencia significativa en la actividad física entre áreas urbanas y rurales ($F = 100.893$, $*p* < 0.001$), siendo las comunidades rurales más activas. El nivel de riqueza tuvo un efecto significativo ($F = 44,894$, $*p* < 0,001$), mientras que la edad no lo tuvo ($*p* = 0,428$). El mejor modelo en el análisis bayesiano incluyó tanto la residencia como la riqueza (probabilidad posterior: 96,7%), lo que confirma la importancia del contexto geográfico y económico.
Conclusiones: Las comunidades rurales de Indonesia son más activas físicamente que las urbanas. Las políticas de salud pública deben priorizar las intervenciones basadas en la ubicación. Se requieren más estudios para explorar otros factores, como el acceso a la infraestructura y la percepción comunitaria de la actividad física.

Palabras clave

Actividad física, urbano vs rural, ANCOVA, bayesiano, política de salud.

Introduction

Physical activity is an important component in maintaining one's physical and mental health (Giandonato et al., 2021). Regular physical activity can reduce the risk of chronic diseases such as diabetes and cardiovascular disease (Lu et al., 2024). Physical activity can also help relieve symptoms of depression and improve sleep quality (Wang et al., 2025) and can reduce anxiety and improve mood (Li et al., 2022). In addition, good physical activity can play a role in cognitive function, which can be a foundation for thinking and learning (Alimuddin et al., 2024). Despite the enormous positive impact physical activity has on health, research shows that nearly a quarter of adults worldwide remain physically inactive (World Health Organization, 2018). This level of participation in physical activity is strongly influenced by various factors such as socioeconomic factors (Li et al., 2022), sociodemographic factors (Cheah et al., 2017) and environmental factors (Pelletier et al., 2021). One of the main factors often associated with physical activity levels is whether a person lives in an urban or rural area (Li et al., 2024; Lin et al., 2024).

The rapid urbanization process in recent decades has changed the way urban people live, including the way they spend time engaging in physical activity (Boakye et al., 2023). This is increasingly evident as sedentary lifestyles develop (Yang et al., 2019). These changes can affect individuals' health and well-being, given the importance of physical activity in daily life (Halbreich, 2023). Although urban areas offer more modern facilities, such as sports facilities and efficient public transportation, the growing sedentary behavior among urban residents reduces their opportunities for physical activity in daily life (Stappers et al., 2023). This suggests the need for effective interventions to increase people's participation in physical activity, especially in increasingly busy urban environments (McCormack et al., 2022). Research shows that individuals living in urban areas perform more sedentary work and tend to reduce physical activity such as walking or cycling, which is exacerbated by easy access to transportation and the habit of using private vehicles (Vancampfort et al., 2018; Sallis et al., 2016).

Meanwhile, people in rural areas are more physically active but engaged in daily work, such as farming or raising animals (Marcen et al., 2022). They often face challenges in accessing adequate health and exercise facilities, leading to limited levels of physical activity in formal contexts such as regular exercise (Cleland et al., 2014). This is certainly an imbalance in how people engage in physical activity between rural and urban areas (Gilbert et al., 2019). In rural areas, people have lower incomes, which limits their access to formal sports facilities or structured physical activity (Kellstedt et al., 2021). Although rural communities are more physically active in their daily work, they still face major problems regarding adequate access to prevent and manage diseases (Anggraini, 2023). This suggests the need for a more holistic approach in designing public health policies to bridge the gap between urban and rural communities (Pelletier et al., 2022).

In the Indonesian context, there are significant geographical and socioeconomic differences between urban and rural areas that may affect people's physical activity levels (Badan Pusat Statistik, 2021). Differences in physical activity between rural and urban areas vary by measurement method, which is related to rural residents spending more time on low-intensity household physical activity but less time on structured high-intensity physical activity (Jessie et al., 2019). This difference suggests the need for a deeper understanding of the factors that influence physical activity in both environments to design more effective interventions (Tummers et al., 2022).

The importance of physical activity has become a concern in various countries including Indonesia. The Indonesian government has launched the Healthy Living Community Movement (Germas), a program that aims to increase public awareness of the importance of physical activity, reduce sedentary behavior and improve overall quality of life (Ministry of Health of the Republic of Indonesia, 2022). Although the program has been running, major challenges remain, especially in adapting the program to different social and geographical conditions across Indonesia.

Therefore, while several studies have examined physical activity and its impact on public health in Indonesia, few have in-depth examined the differences in physical activity levels between urban and rural communities using nationally representative data. This study aims to fill this gap and provide a more comprehensive insight into the factors that influence physical activity in both environments, as well as

its impact on the health of Indonesians. Therefore, this study can provide a snapshot of the state of physical activity levels so that the Indonesian government can develop community-specific guidelines to intervene in physical activity equity.

Method

Participants

Participants in the study were drawn from participants in Indonesia's longitudinal socio-economic and health survey, the Indonesian Family Life Survey (IFLS). We used data from the fifth wave of the IFLS, which included 13,535 households and 44,103 respondents across 13 provinces in Indonesia (Strauss et al., 2016). The sample represents 83% of the Indonesian population (Strauss et al., 2016). IFLS 5 was conducted by the RAND Corporation, a non-profit research organization in the United States, in collaboration with the Center for Population and Policy Studies (PSKK) of Universitas Gadjah Mada. IFLS uses a stratified random sampling method, which categorizes urban and rural areas and then randomly samples each stratum. This sampling takes into account the socio-economic and cultural diversity of Indonesia and represents Indonesia's four most populous islands - Java, Sumatra, Kalimantan and Sulawesi - which account for 83% of Indonesia's total population (Strauss et al., 2016). The first IFLS sample frame was based on the 1990 census and the 1993 SUSENAS (National Socio-Economic Survey) (Strauss et al., 2009).

From the entire IFLS dataset, the total number of participants in this study was 20,611 people. The inclusion criteria were: (1) Completing both residence data; (2) Completing physical activity level data; (3) Completing subjective wealth level data We compiled and organized the dataset based on characteristics using SPSS Syntax. The number of people from urban areas was 11,843 (57.4%), while participants from rural areas were 8,768 people (42.6%). The average age of the students was 39.4 (SD=13.7). The IFLS survey was reviewed and approved by IRBs in the United States and in Indonesia at Gadjah Mada University (UGM). The ethical clearance number from the RAND Human Subjects Protection Committee (RAND IRB) was s0064-06-01-CR01.

Procedure

Physical activity level

Physical activity level was measured by the KK (Health Condition) section of Book IIIB. There were nine questions in the section that measured the type of activity and its duration. Participants were asked to measure their activity in the previous 7 days. Physical activity levels were heavy activity, moderate physical activity, and walking. Physical activity data were then converted into metabolic equivalent (MET) values according to the Physical Activity Compendium (Herrman et al.,2024). One MET is equal to the energy expended when a person is sitting still. METs for walking range from two to eight, depending on speed and obstacles. In this study, strenuous physical activity was categorized as multiple (vigorous) household tasks in the Physical Activity Compendium equivalent to four METs. Moderate physical activity was categorized as multiple household tasks (moderate) at 3.5 METs, while walking was categorized at 2.5 METs. Participants' METs were then converted to MET minutes (METs × 60 seconds). The mean MET minutes of participants was 61.5 (SD = 51.1).

Residence

The variable of residence was taken from book K section SC number 05. There was an answer choice of region of residence. Participants can choose the answer options of 1 for urban and 3 for rural. Then, in this K book, the age of the participants in section AR (List of household members) number 08a and gender number AR07 were also taken. Previous studies have shown that wealth can affect physical activity levels (Sfm et al., 2020). Therefore, in this study, wealth level was included in the analysis to control for its influence on physical activity levels. Question SW01 of Book IIIA of the IFLS questionnaire measures the subjective wealth of participants, who are asked to rate their overall wealth from 1 'Poorest' to 6 'Richest'. The mean subjective wealth of participants was 3.03 (SD=0.99).

Data Analysis

ANOVA and ANCOVA provide better analysis than performing multiple t-tests to compare means between groups, because performing multiple t-tests will increase the error rate by group ANCOVA is an advanced version of ANOVA (Analysis of variance). ANCOVA is useful for analyzing differences in means between groups while including one or more continuous variables that affect the dependent variable (Field, 2017). These variables are known as covariates. These covariates can be confounding factors and bias estimates. Covariate variables are usually not of interest to the main objective of the main study but can affect the outcome variables of the study and therefore need to be controlled. This study used physical activity as the dependent variable, place of residence as the fixed factor and wealth and age as covariates.

Researchers in psychology most often use frequency statistics or null hypothesis significance testing (NHST) rather than Bayesian statistics. However, Bayesian statistics are gaining popularity (van de Schoot et al., 2017; Kruschke, 2021). Some advantages of Bayesian inference are: the possibility of incorporating background knowledge (prior distributions), more flexibility in model specification, providing an evaluation of the predictive adequacy of competing hypotheses, a clear and intuitive way of interpreting results, and more robustness in small sample sizes (Kruschke, 2014; van de Schoot et al., 2014; van de Schoot et al., 2017; Wagenmakers et al., 2016; Faulkenberry et al., 2020).

This study used Bayesian analysis to compare eight models with different predictors of physical activity levels: (1) a model with residence and wealth; (2) a model with residence, wealth and age; (3) a model with only residence as a predictor; (4) a model with residence and age as predictors; (5) a model with only wealth; (6) a model with wealth and age; (7) the null model; and (8) a model with only age. Based on the null hypothesis there is no difference in the level of physical activity between rural and urban communities, this study expects an effect size of 0; hence, $\mathcal{H}0$: $\delta = 0$. The alternative hypothesis is twofold, $\mathcal{H}1$: δ ¿≠ 0, there is a difference in the physical activity of rural and urban communities. Before observing the data, this study assumes that δ is distributed as a Cauchy distribution with scale r = 0.707 as suggested as the default-prior Bayes factor for ANOVA settings (Rouder et al., 2012). Analyses were conducted using JASP version 0.18 (JASP-Team, 2023) and followed recommended Bayesian analysis procedures (Rouder et al., 2012; Faulkenberry et al., 2020).

Results

Based on Table 1, the variable of residence had a significant effect on physical activity F (100.893), P < 0.001. For the wealth covariate, it is also significantly associated with physical activity F= 44.894, P < 0.001. As for the covariate variable of age, it did not have a significant effect on physical activity F = 0.628, P=0.428. Therefore, place of residence and wealth have a significant effect on physical activity, while age has no significant effect. This model shows that differences in physical activity are more influenced by external factors such as residence and wealth than age.

Table 1. Influence between variables

Cases	Sum of Squares	df	Mean Square	F	p
Resident	$1.283\times10^{+7}$	1	$1.283\times10^{+7}$	100.893	< .001
Wealth	$5.707\times10^{+6}$	1	$5.707\times10^{+6}$	44.894	< .001
Age	79876.212	1	79876.212	0.628	0.428
Residuals	$2.620\times10^{+9}$	20607	127119.551		

Note. Type III Sum of Squares

Table 2 shows a comparison of model probabilities based on Bayesian inference, which includes model prior and posterior probabilities, Bayes factors, and errors. The Bayes Factor Model (BFM) describes the change in model probabilities after observing the data, while BF10 shows the predictive adequacy relative to the best model (Faulkenberry et al., 2020). The results showed that only Model 1 and Model 2 had improved odds after observing the data (BFM = 202.821 for Model 1 and BFM = 0.242 for Model 2). Model 1 has the greatest chance of increasing, with P(M|data) = 0.967. Therefore, the most appropriate model for predicting physical activity levels is one that includes residential location and wealth level as predictors. BF10 indicates that Model 1 has higher predictive adequacy than the other models. In

contrast, Model 3, which only included type of residence as a predictor, yielded a BF10 = <0.001, indicating that it was less adequate than Model 1. Model 8, which only used age as a predictor, also had a BF10 = <0.001, indicating that this model was very weak in explaining physical activity.

Table. 2. Model Comparison

Models	P(M)	P(M|data)	BF_M	BF_{10}	error %
resident + wealth	0.125	0.967	202.821	1.000	
resident + age + wealth	0.125	0.033	0.242	0.035	3.165
resident	0.125	1.380×10^{-8}	9.660×10^{-8}	1.428×10^{-8}	2.553
resident + age	0.125	3.276×10^{-10}	2.293×10^{-9}	3.389×10^{-10}	28.252
wealth	0.125	7.269×10^{-21}	5.088×10^{-20}	7.520×10^{-21}	2.553
age + wealth	0.125	2.944×10^{-22}	2.061×10^{-21}	3.046×10^{-22}	2.553
Null model	0.125	3.747×10^{-31}	2.623×10^{-30}	3.876×10^{-31}	2.553
age	0.125	7.536×10^{-33}	5.276×10^{-32}	7.797×10^{-33}	2.553

Discussion

This study aims to determine the effect of place of residence on physical activity levels. The study compared the physical activity levels of rural communities and urban communities. The study hypothesized that there is a difference in physical activity between urban and rural communities. The results show that the alternative hypothesis is acceptable. This study tested the difference using Ancova and Bayesian Ancova analysis. We included covariate variables of wealth and age. The results showed that the combination of residence and wealth level provided the best model, confirming the importance of geographical and economic context. Adding the covariate variable age to the model had no effect on physical activity, suggesting that age is not significant in the context of this study. This could be because the impact of age is already accommodated through other variables or is less relevant in the geographic and economic context. We also add that the covariate variable wealth has a significant effect on physical activity levels.

This study is noteworthy for several reasons. First, although there are several studies that may have measured physical activity levels of urban and rural Indonesians, they did not control for other variables such as wealth and age. Secondly, the data in this study was collected from a large sample so that it can provide representative results. Third, the data was collected based on structured interviews; thus, the data is more reliable than self-administered questionnaires. Fourth, this study used Bayesian inference, providing better evidence than classical null hypothesis significance testing (NHST).

This study highlights that the physical activity level of rural communities is higher than that of urban communities, even after controlling for wealth and age. It is also worth noting that the physical activity level of rural communities is higher than urban communities despite the lower wealth level of rural communities. This is in accordance with previous research which states that income is not associated with physical activity levels (Kushlev et al., 2015). Based on research conducted by Ngadi et al (2023) which states that most of the rural population in Indonesia works in the agrarian sector such as agriculture, plantations, or fisheries so that these activities require intensive physical labor, such as hoeing, planting, harvesting, or catching fish. Meanwhile, the sedentary behavior of urban communities is increasing (Yulia et al., 2018). Some of these studies support the results of this study which state that the level of physical activity of rural communities is higher than that of urban communities.

In addition, the ongoing urbanization process in Indonesia has driven significant urban population growth from 17.5% in 1970 to 48.1% in 2005 and is projected to reach 66.6% in 2035 (Setiawan & Sunarharum, 2020). With this finding, more people urbanizing will change the way people do physical activity.

In Indonesia, physical activity becomes more important because the highest causes of death in Indonesia are caused by cardiovascular disease, hypertension and diabetes militus (BPS, 2022). Research conducted by Lu et al (2024) which says that high levels of physical activity can reduce the risk of death from cardiovascular death and type 2 diabetes mellitus. By doing physical activity these diseases can be prevented. The government can prioritize area-based policies, especially to improve welfare in less developed areas. Efforts should also be made to reduce economic disparities between regions to improve

overall welfare. Another thing to note about the importance of physical activity levels in rural and urban communities in Indonesia is the inequality of facilities. As discussed earlier, rural communities are more likely to engage in physical activity due to work, they have more difficulty accessing structured physical activity due to low income. While urban communities although they are closer to sports facilities, the level of sedentary behavior is higher.

Conclusions

This study shows that there are significant differences in physical activity levels between urban and rural areas in Indonesia. Residents in rural areas tend to have higher levels of physical activity due to the demands of physical labor, while urban residents are more involved in sedentary lifestyles. Socioeconomic factors such as income also influence physical activity levels, with clear variations between the two regions.

The results of this study are important to consider in the development of public health policies that focus on physical activity promotion, especially in increasingly urbanized areas. Further studies are needed to explore other factors that may influence physical activity levels, including access to sports infrastructure and people's perceptions of physical activity.

Acknowledgements

Not applicable.

Financing

Not applicable.

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