Ecological barriers to physical activity among people with mobility disabilities in Indonesia

Barreras ecológicas a la actividad física entre personas con discapacidad motriz en Indonesia

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Abstract

Introduction: Despite global evidence of profound physical activity disparities affecting individuals with mobility disabilities, context-specific investigations in low-resource settings like Indonesia remain critically limited.
Objective: In general, this study identifies the main barriers to physical activity participation in this population using the Health Ecology Model framework, while specifically analysing the comparison of disability type variables based on mobility aids, sex, age, and other barriers.
Methodology: Applying the Health Ecology Model, this cross-sectional study identified key participation barriers among 75 participants with mobility disabilities across five Javanese provinces using the BPAQ-MI instrument (SPSS v25; descriptive statistics, EFA, Spearman, logistic regression).
Results: Inaccessible infrastructure/transportation was the dominant barrier (83%), significantly reducing engagement odds (OR=0.11, p=0.01). Family support increased participation (r=0.301, p=0.001), surpassing intrapersonal (61%) and interpersonal (57%) constraints.
Discussion: Crucially, while structural and gender barriers align with global patterns, the centrality of family support (OR=2.3) contrasts with individualistic-society models emphasising peer influence.
Conclusions: This study identified structural barriers as the predominant impediment to physical activity among Indonesians with mobility disabilities, surpassing intrapersonal and interpersonal factors while revealing systemic gaps in disability-inclusive support systems. Consequently, transforming accessible infrastructure, inclusive policies, and kinship networks is imperative; future research necessitates mixed-methods designs, multi-regional cohorts, and longitudinal analyses to decode socio-cultural determinants and intervention efficacy.

Keywords

Disability inclusion; health ecology model; mobility disabilities; physical activity barriers; structural barriers.

Resumen

Introducción: A pesar de la evidencia global sobre las profundas disparidades en la actividad física que afectan a las personas con discapacidades de movilidad, las investigaciones contextuales en entornos de bajos recursos como Indonesia siguen siendo extremadamente limitadas.
Objetivo: En general, este estudio identifica las principales barreras para la participación en la actividad física en esta población utilizando el marco del Modelo de Ecología de la Salud, analizando específicamente la comparación de variables de tipo de discapacidad basadas en ayudas para la movilidad, sexo, edad y otras barreras.
Metodología: Aplicando el Modelo de Ecología de la Salud, este estudio transversal identificó las principales barreras de participación en 75 participantes con discapacidades de movilidad en cinco provincias de Java mediante el instrumento BPAQ-MI (SPSS v25; estadística descriptiva, EFA, Spearman, regresión logística).
Resultados: La inaccesibilidad de la infraestructura/transporte fue la barrera dominante (83%), reduciendo significativamente la probabilidad de participación (OR = 0,11, p = 0,01). El apoyo familiar incrementó la participación (r = 0,301, p = 0,001), superando las limitaciones intrapersonales (61%) e interpersonales (57%). Discusión: Si bien las barreras estructurales y de género se alinean con los patrones globales, la centralidad del apoyo familiar (OR = 2,3) contrasta con los modelos de sociedad individualista que enfatizan la influencia de los pares.
Conclusiones: Este estudio identificó las barreras estructurales como el principal impedimento para la actividad física en indonesios con discapacidades de movilidad, superando a los factores intrapersonales e interpersonales, a la vez que revela deficiencias sistémicas en los sistemas de apoyo inclusivos para la discapacidad. Por consiguiente, es imperativo transformar la infraestructura accesible, las políticas inclusivas y las redes de parentesco; la investigación futura requiere diseños de métodos mixtos, cohortes multirregionales y análisis longitudinales para descifrar los determinantes socioculturales y la eficacia de las intervenciones.

Palabras clave

Inclusión de la discapacidad; modelo de ecología de la salud; discapacidades motrices; barreras a la actividad física; barreras estructurales.

Introduction

Physical activity (PA) is a key health promotion and disease prevention pillar. Engaging in movement generated by skeletal muscles that requires energy expenditure—commonly called physical activity (WHO, 2022)—plays a vital role in preventing non-communicable diseases, supporting mental well-being, and enhancing overall quality of life. However, for individuals with mobility disabilities—those who have significant difficulty or an inability to walk, stand, or move without assistance—opportunities to engage in physical activity are very limited (UN, 2015). Globally, people with disabilities are one of the most physically inactive populations. Estimates show that more than 1.3 billion people live with some form of disability, and among them, individuals with mobility impairments show very low participation in physical activity (DHDS, 2020; Ginis et al., 2021; WHO, 2011). As highlighted in the WHO Global Status Report on Physical Activity (2022), fewer than 30% of adults with mobility-related disabilities engage in the recommended 150 minutes of moderate-intensity physical activity per week (WHO, 2024). This inequality persists despite growing evidence about the benefits of PA and increasing global policy commitments to inclusive health.

According to United Nations (UN) data in 2021, about 15 percent of the world's population is an individual with a disability. Among these numbers, about 80 percent live in developing countries (Elekanachi et al., 2023). Increased PA participation in high-income countries is influenced by more inclusive environments, sports initiatives and awareness campaigns for people with disabilities (MacEachern et al., 2022; Yu et al., 2022). In contrast, stagnation or decline in PA participation in low- and middle-income countries (LMICs) is due to persistent infrastructural, social and economic barriers (Devarajan et al., 2020). Systematic reviews have shown that people with disabilities often face physical limitations, which are exacerbated by limited access to resources and facilities that meet their specific needs (Suryadi et al., 2024). For example, in Southeast Asia, limited inclusive urban design and transportation contribute to high levels of physical inactivity among people with disabilities (Ashadi et al., 2024).

Barriers to PA in individuals with mobility impairments are multidimensional. According to the Ecological Model of Health Behaviour (Sallis et al., 2006), physical activity, which is part of health behaviour, is influenced by intrapersonal, interpersonal and structural factors. Intrapersonal factors include self-efficacy, knowledge, physical limitations, and emotional well-being. Interpersonal factors involve social support, encouragement, or resistance from family, friends, or caregivers. Structural factors include policies, the physical environment, transportation systems, and broader cultural attitudes toward disability. This comprehensive framework allows for a nuanced understanding of the interrelated barriers that PA influences behaviour, intending to improve participation and public health (Bethancourt et al., 2014).

Research on physical activity barriers has been conducted previously on subjects with intellectual disabilities in autistic children (Boucher et al., 2023), adolescents (McDermott et al., 2022; Yu et al., 2022), and adults (Dairo et al., 2016). Focus on the barriers students experience in school, children, and youth (Liu et al., 2025; Ma et al., 2024; Michalsen et al., 2024; Valle et al., 2022), and gender comparisons have also been observed (Ascondo et al., 2023). Furthermore, research on physical activity barriers in people with physical disabilities was also carried out on women (Olasagasti-Ibargoien et al., 2023), Sports and fitness club members (Declerck et al., 2021), and students with physical disabilities (Monforte et al., 2021), bank employees with disabilities (Moro et al, 2024), as well as from the perspective of family members, technical caregivers or project leaders (Jacinto et al., 2021). Based on these studies, it can be concluded that interpersonal, intrapersonal, and structural factors influence physical activity barriers. However, research on physical activity barriers that focus on people with disabilities who use wheelchairs and lower limb amputations is still limited, especially in developing countries that are home to 80% of the world's people with disabilities. This study specifically aims to: (1) analyse physical activity barriers in this population through a health ecology model approach, and (2) identify the main barriers experienced by wheelchair users and lower limb amputees in Indonesia.

This study addresses existing research gaps by examining specific ecological barriers to physical activity among individuals with mobility disabilities. It offers up-to-date empirical evidence on the types and extent of these barriers using validated measurement tools, while also considering how they intersect with gender and regional contexts. Ultimately, the study aims to strengthen the foundation for evidence-

based interventions and policymaking. A thorough understanding of these barriers is essential for promoting health equity for persons with disabilities, which aligns with the principles outlined in the UN Convention on the Rights of Persons with Disabilities (Prieto & Paramio-Salcines, 2018).

Method

Participants

This cross-sectional investigation recruited 81 participants with mobility disabilities from the registry of United Cerebral Palsy - Roda untuk Kemanusiaan (UCPRUK), an Indonesian non-profit organisation dedicated to advancing disability mobility rights since 2011 (UCPRUK, 2021). During August 2021, convenience sampling was employed to select wheelchair users and lower-limb prosthesis recipients aged ≥18 registered in UCPRUK's database. Meanwhile, the exclusion criteria: Age <18 years old and incomplete questionnaire data. After applying the exclusion criteria, 6 participants under 18 years old were excluded, so that the total final sample was 75 adults (wheelchair users (n=48) and amputees (n=27) with an age range of 18–71 years. Participants were stratified by using a primary mobility device through self-report verification. Those with lower-limb amputation predominantly utilising wheelchairs for ambulation were classified as wheelchair users per WHO GATE (2018) functional dependency standards. This approach ensured device-specific barrier analysis while acknowledging mobility complexity. The sample was spread across five provinces in Indonesia, including: Central Java: 22 participants (29.3%), West Java: 18 participants (24%), DKI Jakarta: 15 participants (20%), DIY Yogyakarta: 13 participants (17.3%) and East Java: 7 participants (9.3%). Urban-rural classification followed Indonesia's official framework (BPS, 2020), utilising three district-level (kecamatan) criteria: population density thresholds (>1,500 persons/km^2), agricultural workforce composition (<25%), and comprehensive infrastructure access. Districts meeting all benchmarks were designated urban, while those not meeting any criterion were classified rural.

Procedure

Data collection was conducted using the Barriers Physical Activity Questionnaire-Mobility Impairment (BPAQ-MI) questionnaire, which has a very high level of validity and reliability (Khani et al., 2023; Vasudevan et al., 2015a). The BPAQ-MI questionnaire consists of 63 questions using the Guttman scale (Yes/No), and each answer given by the participant is calculated using a value pattern of 1 = PA inhibitor, 0 = not PA inhibitor, with a minimum score of 0 and a maximum of 63.

The BPAQ-MI instrument was mapped to the Ecological Model of Health Behaviour three core domains: Intrapersonal Barriers (15 items; Q1-Q15; maximum score of 15) biological and psychological factors including 1) health limitations (Items 1-7: fatigue, pain, injury fear) and 2) attitudinal PA beliefs (Items 8-15: motivation, confidence, enjoyment). Interpersonal Barriers (11 items; Q16-26; maximum score of 11) focus on social network influences captured through 1) peer dynamics (Items 16-21: friend support, role models) and 2) family systems (Items 22-26: cultural priorities, encouragement). Structural barriers (37 items; Q27-63; maximum score of 37) consist of 1) physical infrastructure: fitness center accessibility (Items 27-37), 2) policy/programmatic: financial systems (Items 38-39), 3) inclusive programming (Items 40-47), 4) community design (Items 48-57) and 5) safety systems: neighborhood security (Items 58-63). This classification aligns with Vasudevan et al.'s (2015) original validation and Bronfenbrenner's ecological systems theory.

The data collection period is one month, and the participants fill out Google Forms. UCPRUK distributed the link form through WhatsApp to 102 prospective respondents in its database. UCPRUK also conveyed confirmation of approval to fill out the questionnaire via WhatsApp text message to the prospective respondents in the UCPRUK database. A total of 81 respondents completed the questionnaire, with a questionnaire response rate of 70%. After being excluded, 75 respondents were further analysed.

Data analysis

The data obtained was then analysed using SPSS 25 with the following steps: 1) Descriptive Analysis to calculate the prevalence of barriers and demographic characteristics. 2) Exploratory Factor Analysis

(EFA) was conducted to identify latent constructs within barrier dimensions, retaining factors with eigenvalues >1.0 and items exhibiting factor loadings >0.5. The solution's adequacy was confirmed by Kaiser-Meyer-Olkin (KMO) sampling adequacy (0.79) and Bartlett's sphericity test (*p* < 0.001), indicating sufficient intercorrelations for factorability. Spearman Correlation test to test the relationship between accessibility scores (scale 0=No, 1=Yes) and frequency of physical activity (days per week). 4) Furthermore, Binary logistic regression is used to predict the influence of residential areas (urban vs. rural) on physical activity barriers.

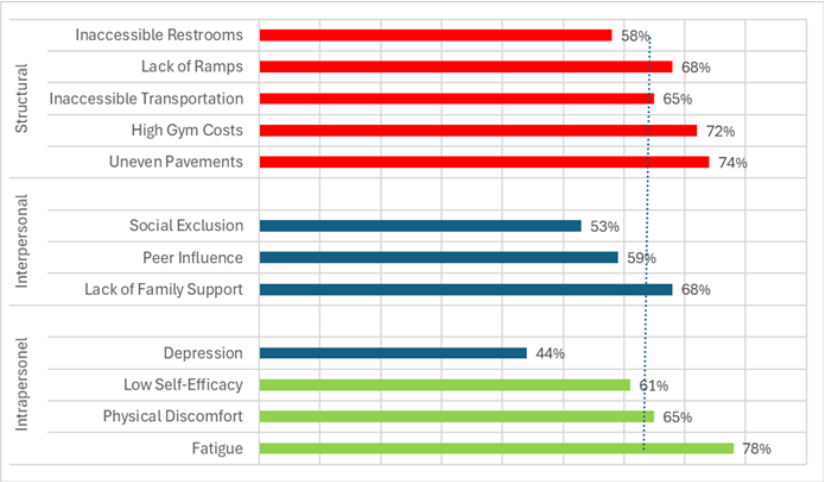
Results

Table 1 presents participant demographics. Wheelchair users predominated (64%), with 36% amputees. Males slightly outnumbered females (53.3% vs. 46.7%), and urban residents comprised 62.7% of the sample. These distributions underscore the heterogeneity of Indonesia's mobility-impaired population.

Table 1. Participant Characteristics (n = 75).

Variable	n (%)
Types of Disabilities	
Wheelchair users	48 (64%)
Lower limb amputation	27 (36%)
Gender	
Man	40 (53.3%)
Woman	35 (46.7%)
Region	
Urban	47 (62.7%)
Rural	28 (37.3%)

Figure 1. Prevalence of Physical Activity Barriers Based on Ecological Models.



Using the BPAQ-MI instrument with Guttman scaling (Yes/No responses, where 'Yes' indicates a barrier), this study identified physical activity barriers across the three levels of the Health Ecology Model. The prevalence of each barrier is expressed as a percentage in Figure 1. The blue vertical dotted line indicates the average percentage of physical activity barriers. Examining this line can distinguish which barriers are dominant (above average) and which are less dominant (below average). Crucial findings found that structural barriers were more dominant than personal/interpersonal barriers. There are four inhibiting factors in the structural domain whose values are above average, more than in the other two domains. Data shows that structural barriers have the highest prevalence, especially uneven sidewalks (74%) and expensive gym costs (72%). While fitness centre costs impact the broader population, the burden borne by individuals with mobility disabilities is disproportionately due to potential disabi-

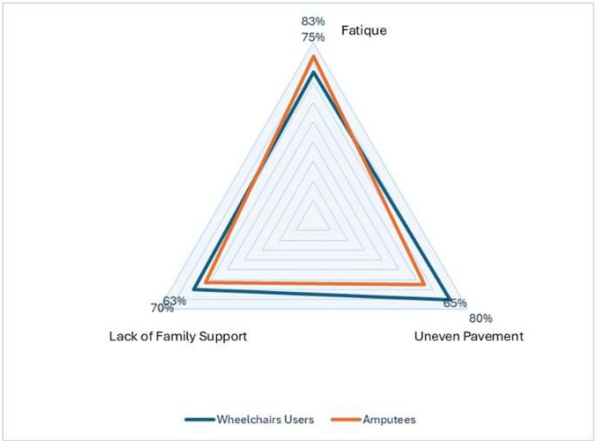
lity-specific dynamics: limited inclusive facilities force them to rely on speciality fitness centres at premium prices, coupled with typically lower incomes and higher overhead costs, making costs prohibitive for 72% of participants. Intrapersonal barriers are dominated by fatigue (78%), while interpersonal barriers are most prominent in the lack of family support (68%).

Structural barriers are environmental and community barriers. Inaccessible infrastructure such as Uneven Sidewalks: 74% (Q49: "uneven or crooked sidewalks"), Narrow/obstacles sidewalks: 68% (Q28: "Walkways/aisles were too narrow or had obstacles") and No Accessible Toilets: 58% (Q33: "Bathrooms are not accessible at fitness centre"). Women may be more sensitive to the lack of accessible toilets (63% vs 52% of men). The reported community barriers were inaccessible transportation: 65% mentioned fitness-specific transportation gaps (Q56: "Lack of accessible transportation to the gym"), and Financial Constraints: 72% could not afford gym membership (Q38: "Gym membership fees were too expensive"). Men are more hampered by expensive gym costs (75% vs 68% of women). The demographic analysis showed that rural residents faced a 3.1x higher risk of transportation barriers to the gym (OR=3.1; *p*=0.008). In contrast, from Q38, urban participants reported 1.9x higher risk associated with gym costs (OR=1.9; *p*=0.03).

Interpersonal Barriers relate to the social and relational challenges experienced by participants. Lack of Family Support: 16% stated that families do not prioritise physical activity (Q22: "Family culture does not prioritise physical activity") as well as Peer Influence: 59% reported friends not being physically active (Q18: "My friends are not physically active"), 53% felt excluded from social exercise groups (Q17: "Friends are not helping enough"). Women are higher in family culture regarding physical activity (Q22: 72% vs 63% of men), whereas men are more influenced by peers (61% vs 56% of women). Interestingly, rural participants faced a 2.8x higher risk of lack of peer support than urban participants (OR=2.8; *p*=0.01). A further noteworthy fact is that participants with family support (Q22: "No") showed 2.3x higher levels of activity despite structural barriers (*p*=0.02).

Intrapersonal Barriers relate to individual factors that affect motivation, perception, and physical capacity. Fatigue and Physical Discomfort are prominent intrapersonal barriers: 78% reported fatigue inhibiting physical activity (Q1: "I feel tired/tired/tired") and 65% mentioned physical discomfort during activity (Q5: "Body discomfort when active"). Low Self-Efficacy: 61% do not believe in their physical abilities (Q9: "Lack of confidence in abilities"). Depression: 44% reported mental health challenges (Q7: "I feel depressed/mentally weak"). Women are more likely to report fatigue (82% vs. 74% of men) and depression (51% vs. 37%). On the other hand, men complain more about a lack of confidence (65% vs 56% of women). Interestingly, all participants aged >50 years had a 2.1x higher risk for low self-efficacy (OR=2.1; 95% CI:1.1–4.0). Subsequent important findings showed that higher severity of intrapersonal and structural barriers correlates with participants with amputations reporting higher levels of fatigue than wheelchair users (83%Vs75%), with 89% lower frequency of physical activity (ρ=-0.71; *p*<0.001).

Figure 2. Comparison of Barriers by Type of Disability.



Based on the previous data in Figure 1, it is known that fatigue, lack of family support, and uneven pavement have the highest percentage of obstacles compared to other factors in their respective obstacle domains: intrapersonal, interpersonal, and structural, furthermore, by taking a comparative perspective based on the type of disability (wheelchair users vs. amputees) by displaying the highest barrier factors in each domain in the Health Ecology Model which appear at the corners of the triangle in Figure 2. It showed that participants with amputations report higher levels of fatigue than wheelchair users (83% vs 75%). Conversely, the lack of family support and uneven sidewalks were higher barriers for wheelchair users than for participants with amputations. Key quote from the open response delivered by participants: "I want to exercise, but broken sidewalks keep my wheelchair stuck a lot." (Male, 45 years old, Central Java), on the other hand "The cost of the gym is expensive, and my family does not support me to exercise." (Female, 38 years old, DKI Jakarta). The findings further confirm that the physical activity barriers the participants face are related to structural, interpersonal and intrapersonal dimensions that require comprehensive problem-solving.

Discussion

Using the Health Ecology Model approach, this research investigates the multifaceted physical activity barriers encountered by Indonesians with mobility impairments. Our findings establish structural barriers as the predominant obstacle to physical activity participation, where inaccessible infrastructure—notably uneven pavements and prohibitively expensive gym memberships—emerges as the primary constraint. It aligns with global evidence demonstrating how built environments facilitate or restrict activity engagement across developed and developing nations (Vasudevan et al., 2015a; Wildekamp et al., 2024). Urban accessibility challenges confirm infrastructure design's pivotal role in determining activity opportunities for mobility-impaired individuals (Barreno et al., 2021). Gender dimensions further complicate this landscape: women reported significantly more emotional barriers than men. In this study, women reported higher emotional barriers with the largest gaps in motivation, embarrassment about appearance and lack of enjoyment.

Furthermore, Prior research substantiates socioeconomic factors as critical impediments, with women facing compounded challenges involving safety concerns and specific gyms for women (Ascondo et al., 2023; Mayo et al., 2019; Olasagasti-Ibargoien et al., 2023). Such gendered divergence necessitates tailored interventions addressing distinct needs. Geographical disparities also proved pronounced. Respondents in rural areas faced greater transportation limitations. In contrast, participants in urban areas explained financial constraints due to expensive sports facilities—reflecting how environmental differences impact different factors that inhibit physical activity (Garcia et al., 2021; Vasudevan et al., 2015b). This urban-rural gym cost gap likely stems from the premium fees charged by specialised urban-based facilities, compounded by higher urban living costs that limit disposable income. Cross-regional policy formulation must therefore account for these structural differences.

The interaction between barriers at the structural and intrapersonal levels shows a combined effect that can drastically reduce the frequency of physical activity. Nevertheless, family support emerged as a significant protective factor. Those who received support from family tended to show increased involvement in physical activity. These findings corroborate the literature showing that social networks, particularly families, play an important role in determining patterns of physical activity participation in populations with disabilities (Fagher et al., 2022; McKenzie et al., 2021). This kind of social support is crucial social capital, especially in the face of complex physical and emotional barriers. A comparison of the results of this study with the international literature shows a convergence of findings and important contextual variations. Structural barriers are a major barrier consistent with studies in various developing countries that face a shortage of disability-friendly public facilities. Gender issues, such as women's sensitivity to the lack of accessible toilet facilities, are reflected in global reports on gender-specific safety needs (Carmichael et al., 2023). Meanwhile, the financial constraints experienced by men refer to broader socioeconomic patterns. However, regional comparators such as the study from Vietnam (Sakalidis et al., 2023) have not explicitly confirmed these findings, suggesting further exploration.

The disparity in transportation between rural and urban areas is striking. Our data reveals rural-dwelling individuals with disabilities face 3.1 times greater transportation barriers than their urban counterparts. Regional comparison with Thailand (Ashadi et al., 2024) showed a different odds ratio (OR=1.8),

suggesting that Indonesia's transportation infrastructure constraints may exacerbate accessibility challenges—although further validation is needed. Interestingly, family support emerged as a strong facilitator of physical activity (OR=2.3), which contrasts with the findings of Smith & Monforte (2021), who prioritised peer influence in individualistic societies (Bailie et al., 2023). This difference in perspective is in line with Asian cultural theories that emphasise the influence of family behaviour in collectivistic contexts such as Indonesia.

Barriers to physical activity are multidimensional phenomena arising from complex individual-social-environmental interactions. The ecological model appropriately frames health behaviour in a broader context. At the individual level, self-doubt, exposure to stigma, and decreased motivation are key barriers (Boucher et al., 2023; Jacinto et al., 2021; Liu et al., 2025), while increased self-efficacy has been shown to overcome injury concerns and self-confidence deficits (Botagariyev et al., 2023). Socially, inadequate support, cultural stigma, and exclusionary norms hinder participation (Ascondo et al., 2023; Luarte-Rocha et al., 2023; Sakalidis et al., 2023). Furthermore, based on the environment, accessibility of inclusive facilities and infrastructure is decisive (Declerck et al., 2021; Smith & Monforte, 2021).

These findings substantively strengthen the Ecology of Health Model, particularly explaining the relationship between intrapersonal and environmental barriers. Physical discomfort drives avoidance of hostile environments (Sutherland et al., 2021; Yu et al., 2022), potentially triggering a sedentary lifestyle that is detrimental to mental health (McKenzie et al., 2021). Community-level analysis revealed that low rural social support was 2.8 times more frequent than urban, underscoring the significance of community dynamics based on area. Bronfenbrenner's mesosystem theory precisely frames the microenvironmental (family-community) interactions that shape individual behaviour (Bronfenbrenner, U. 1977), especially where infrastructure and health service access are limited (Mayo et al., 2019). Gender also influences barriers through socioeconomic role differentiation, underscoring the adaptation of the intersectional Ecological Model of Health Behaviour for policy formulation (Ma et al., 2024; McKenzie et al., 2021).

Consequently, multilayered solutions integrating infrastructure development, gender-responsive strategies, and rural inclusivity are imperative. Infrastructure priorities include accelerated implementation of Indonesia's accessibility standards (SNI 032-2023) through safer pedestrian pathways and subsidised inclusive gym memberships via private partnerships—mirroring effective Malaysian approaches (Ascondo et al., 2023). Gender-specific interventions should prioritise well-lit facilities and secure sanitation for women (Olasagasti-Ibargoien et al., 2023), while establishing accessible low-cost community sports centres that address male financial constraints (Ma et al., 2024; Monforte et al., 2021). Rural mobility requires adaptive minibus services (Bailie et al., 2023; Garcia et al., 2021), supplemented by telerehabilitation technologies reaching remote populations (Shady et al., 2024).

This study thus enriches theoretical-practical comprehension of mobility disability barriers in Indonesia. Cross-level interventions addressing structural, interpersonal, and cultural dimensions remain essential for sustainable inclusivity. Future research should strengthen empirical foundations regarding familial and community dynamics' activity-enhancing roles across diverse geographical-cultural settings.

Conclusions

This study has identified physical activity barriers in people with mobility disabilities in Indonesia through the Health Ecology Model approach by placing structural barriers as the main barriers, exceeding intrapersonal and interpersonal barriers. These barriers are interrelated and demonstrate the weakness of support systems for disability inclusion in physical activity. Therefore, providing disability-friendly physical activity infrastructure and policies and increasing family support are important steps to increase participation in physical activity among people with mobility disabilities. Although a quantitative approach has been taken, this study has limitations in generalising findings and potential bias from self-reported data. Further research is recommended using mixed methods and cross-regional comparative studies with large numbers of participants to strengthen external validity and understand the influence of broader socio-cultural factors. Longitudinal design is also required to observe long-term

changes and the impact of policies or environmental interventions on AF participation in these populations.

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