Barreras a la actividad física en adultos con discapacidad visual: un análisis comparativo del estado visual y la etiología

Physical activity barriers among adults with visual impairment: a comparative analysis of visual status and aetiology

Autores

Kunjung Ashadi [1]
Laily Mita Andriana [1]
Muhammad Kharis Fajar [1]
Rizky Muhammad Sidik [1]
Rachman Widohardhono [1]
Tri Setyo Utami [1]
Riski Septa Jatmikanto [1]
Rokiah Omar [2]

[1] Universitas Negeri Surabaya (Indonesia)
[2] Universiti Kebangsaan Malaysia (Malaysia)

Corresponding author:
Kunjung Ashadi
kunjungashadi@unesa.ac.id

Recibido: 22-02-26
Aceptado: 26-05-26

Cómo citar en APA

Ashadi, K., Andriana, L. M., Fajar, M. K., Sidik, R. M., Widohardhono, R., Utami, T. S., Jatmikanto, R. S., & Omar, R. (2026). Barreras a la actividad física en adultos con discapacidad visual: un análisis comparativo del estado visual y la etiología. *Retos, 80*, 1374-1385. https://doi.org/10.47197/retos.v81.118861

Resumen

Introducción: La participación en actividad física entre adultos con discapacidad visual continúa siendo baja; en Indonesia, solo alrededor del 30 % realiza actividad física de intensidad moderada. Sin embargo, existe evidencia limitada sobre cómo el estado visual y la etiología influyen en la percepción de las barreras para la actividad física.
Objetivo: Analizar las diferencias en las barreras percibidas para la actividad física según el estado visual (baja visión y ceguera total) y la etiología (congénita y adquirida).
Metodología: Se realizó un estudio transversal con 60 adultos con discapacidad visual de Java Oriental, Indonesia, distribuidos en cuatro grupos. Las barreras se evaluaron mediante el Cuestionario de Barreras para la Actividad Física (PABQ). Los datos se analizaron mediante ANOVA de una vía y pruebas post-hoc de Bonferroni.
Resultados: Se encontraron diferencias significativas en las barreras sociales (p=0.033) y del entorno físico (p=0.001), mientras que las barreras personales no fueron significativas (p=0.103). Los participantes con ceguera total adquirida presentaron las puntuaciones más altas, especialmente en el entorno físico (M=32.93; DE=7.17). La mayor diferencia se observó entre los grupos de baja visión congénita y ceguera total adquirida (Diferencia Media=-20.07; IC95% [-25.53, -14.60]; p<0.001).
Conclusiones: La gravedad y el momento de aparición de la discapacidad visual influyen en la percepción de barreras. La ceguera total adquirida presenta los mayores desafíos, lo que respalda intervenciones específicas para cada perfil visual.

Palabras clave

Ceguera adquirida; ceguera congénita; barreras multidimensionales; participación en actividad física; discapacidad visual.

Abstract

Introduction: Physical activity participation among adults with visual impairment remains substantially lower than recommended levels. In Indonesia, only about 30% of individuals with visual impairment engage in moderate-intensity physical activity. Although physical inactivity is a recognized concern, limited research has explored how visual status and the onset of visual impairment influence perceived barriers to participation in physical activity.
Objective: To examine differences in perceived physical activity barriers among adults with visual impairment according to visual status (low vision and total blindness) and aetiology (congenital and acquired).
Methodology: A cross-sectional quantitative study was conducted in East Java, Indonesia, involving 60 adults with visual impairment. Participants were classified into four groups based on visual status and aetiology. Perceived barriers were assessed using the Physical Activity Barriers Questionnaire (PABQ), which evaluates personal, social, and physical environmental barriers. Data were analysed using one-way ANOVA followed by Bonferroni-adjusted post-hoc tests.
Results: Significant differences were found in the social (p=0.033) and physical environment domains (p=0.001), while the personal barriers were not significant (p=0.103). Adults with the acquired total blindness reported the highest barrier scores, particularly regarding the physical environment domain (M=32.93, SD=7.17). The most substantial difference was between the congenital low vision and the acquired total blindness groups (Mean Difference=-20.07; 95% CI [-25.53, -14.60]; p<0.001).
Discussion: The findings indicate that both the severity and timing of vision loss may influence how barriers to physical activity are perceived.
Conclusions: Adults with acquired total blindness experience the greatest perceived barriers. These findings support the development of targeted interventions and future longitudinal studies to promote physical activity participation among people with visual impairment.

Keywords

Acquired blindness; congenital blindness; multidimensional barriers; physical activity participation; visual impairment.

Introducción

Vision is a fundamental sensory system that provides critical information to support motor performance, spatial orientation, and visual-motor coordination (Omar et al, 2017). Consequently, visual impairment is more than a sensory limitation; it serves as a critical determinant of both mobility and functional independence (Miyata et al, 2021). Current clinical classifications differentiate between low vision and total blindness based on visual acuity and field of view (Omar et al, 2025), However, these classifications may also reflect differences in how individuals perceive and respond to challenges related to physical activity participation (dos Santos et al, 2022; Chu, 2024; Keene and Zhu, 2024).

Participation in consistent physical activity plays an essential role in enhancing well-being and mitigating the onset of non-communicable diseases among visually impaired adults (Fitri et al, 2022). However, participation rates remain disproportionately low (Rif'Ati et al, 2021). In Indonesia, for instance, only 30% of adults with visual impairment engage in moderate-intensity physical activity, and less than 10% participate in structured exercise programs (Fitri et al, 2022; Rif'Ati et al, 2021; Puspitasai et al, 2021; Barasche-Berdah et al, 2023). This suggests that significant multidimensional barriers prevent this population from achieving an active lifestyle (Ma et al, 2024; Alcaraz-Rodríguez et al, 2021; Lanza et al, 2024).

To understand these barriers, researchers increasingly employ the Social Ecological Model (SEM) (Lee et al, 2014). The SEM provides a robust conceptual framework on analysing health states through theoretical interpretations by categorizing obstacles into personal, social, and physical environment domains (Armstrong et al, 2020; Cain et al, 2024). Although prior studies have documented general environmental obstacles—including a lack of inclusive facilities and inadequate transportation options, these studies often treat adults with visual impairment as a homogeneous group (Keene and Zhu, 2024; Haegele et al, 2024). However, many of these studies have examined adults with visual impairment as a relatively homogeneous population, with limited attention given to differences in visual status or aetiology of impairment. Recent studies have shown that geographical context (urban vs. rural) significantly influences physical activity levels (Pelletier et al, 2022; Ashadi et al, 2022; Desai et al, 2023; Ashadi et al, 2025). However, it remains unclear how individual characteristics, specifically visual status (low vision vs. total blindness) and aetiology (congenital vs. acquired), interact with these barriers. In contrast, fewer studies have specifically compared perceived physical activity barriers between individuals with low vision and those with total blindness, or between congenital and acquired visual impairment. Moreover, studies simultaneously examining both visual status and aetiology in relation to perceived barriers remain limited.

A critical research gap exists: most studies do not distinguish how the origin and degree of vision loss shape an individual's adaptive capacity and psychosocial response. For example, individuals with congenital total blindness may develop different navigation strategies from an early age, whereas those with acquired total blindness may face sudden psychosocial disorientation and higher environmental barriers. Without understanding these nuances, public health interventions and adaptive sports programs remain too general to be effective. This study offers a novel contribution by analysing the variation in perceived physical activity barriers through a stratified approach based on visual status and aetiology. Utilizing the Physical Activity Barriers Questionnaire (PABQ), a validated instrument grounded in the SEM, we aim to identify specific domain-based challenges across four distinct visual profiles. The findings are intended to provide a scientific basis for developing inclusive sports policies and adaptive physical education curricula that are tailored to the unique requirements of individuals with varying degrees of visual impairment in Indonesia and globally.

Differences in the degree and origin of visual impairment may be associated with variations in psychosocial adjustment, mobility experiences, and environmental interaction, which could influence perceptions of barriers to physical activity participation. For instance, individuals with congenital visual impairment may develop adaptive mobility strategies over time, whereas individuals with acquired visual impairment might experience different adjustment processes following vision loss. However, these potential differences remain insufficiently explored within the context of physical activity barriers. To our knowledge, limited studies have simultaneously examined perceived physical activity barriers based on both visual status and aetiology among adults with visual impairment. Therefore, this study aims to analyse variations in perceived physical activity barriers across four visual impairment profiles: low vision congenital, low vision acquired, total blindness congenital, and total blindness acquired. Using the Physical Activity Barriers Questionnaire (PABQ), a validated instrument grounded in the SEM framework, this study seeks to identify domain-specific barriers among adults with visual impairment. The findings are expected to contribute to the development of evidence-based inclusive sports policies and adaptive physical education programs tailored to the diverse needs of individuals with visual impairment in Indonesia and broader contexts.

Método

This research was designed as a quantitative, cross-sectional design to analyse perceptions of physical activity barriers among visually impaired adults. To ensure scientific rigor and sufficient statistical power, the sample size was determined using G*Power 3.1 software. Based on an assumed large effect size ($f=0.40$), a significance level (α) of 0.05, and a power of 80% ($1-\beta=0.80$), the calculation required no fewer than 60 individuals. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to enhance transparency and reporting quality.

Participants

In total, 60 participants were recruited and proportionally stratified into four distinct groups (n=15 each) to allow for comparative analysis: (1) congenital low vision, (2) acquired low vision, (3) congenital total blindness, and (4) acquired total blindness. Participants were recruited using convenience sampling from the Indonesian Association of the Blind (PERTUNI), East Java branch. Recruitment through a single disability association may limit the generalizability of the findings to the broader visually impaired population in Indonesia. Inclusion criteria required participants to be Indonesian citizens residing in East Java, aged ≥25 years, and active members of the Indonesian Association of the Blind (PERTUNI). Group allocation was determined through a screening process based on participants' self-reported visual status and medical history regarding the onset of visual impairment. The proportional distribution across groups was intentionally maintained to support balanced subgroup comparisons. Exclusion criteria were applied to individuals with multiple or intellectual disabilities to ensure the focus remained on visual impairment-related barriers. Although demographic characteristics were collected, several potentially relevant variables including previous physical activity participation, duration since onset of visual impairment, comorbid medical conditions, and use of assistive devices were not controlled in the present study and may have influenced participants' perceptions of physical activity barriers.

Procedure

Data collection was conducted via an accessible online survey platform (Google Forms) from April 1 to May 1, 2025, with assistance from PERTUNI facilitators and family members where necessary to ensure independent and accurate completion. To improve accessibility and response accuracy, participants were allowed to receive technical assistance from trained PERTUNI facilitators or family members when necessary; however, responses were completed independently by the participants themselves. Ethical approval was obtained from the Research Ethics Commission for this protocol at the Universitas Negeri Surabaya (Reference No. 006/UN38. III.1/DL.01.02/2024). The study strictly adhered to the World Medical Association Declaration of Helsinki and CIOMS guidelines. Participants provided informed verbal consent before engagement, and the informed consent process explicitly outlined their right to withdraw at any time without consequence. Privacy was protected by excluding identifying information such as social security numbers or dates of birth.

Instrument

The primary tool utilized was the Physical Activity Barriers Questionnaire (PABQ) is summarised in Table 1 which is a validated instrument grounded in the Social Ecological Model (SEM). The PABQ was selected because it is conceptually grounded in the Social Ecological Model (SEM), allowing the assessment of multidimensional barriers to physical activity across personal, social, and environmental domains. This framework was considered particularly relevant for individuals with visual impairment, whose participation in physical activity may be influenced by both individual and contextual factors. The PABQ consists of 24 items across three key domains:

1. Personal Barriers – internal factors such as low motivation, health concerns, fear of injury, and lack of confidence;
2. Social Environment Barriers – barriers related to insufficient support from peers, family, or the surrounding social environment;
3. Physical Environment Barriers – structural and environmental obstacles including inaccessible facilities, transportation difficulties, and unsafe surroundings.

Table 1. Domain and Item Structure in the Physical Activity Barriers Questionnaire

Domain	Statement Items	Number of items
A. Personal Barriers	Too tired to exercise Not having enough time Lack of confidence Fear of injury Unpleasant activities Not feeling important Health issues Not knowing how to get started	8
B. Social Barriers	No friends exercising Family not supportive Shy of exercising in front of others Friends inactive Not feeling accepted No supportive community Prefer social time	7
C. Physical Environmental Barriers	No affordable sports facilities Unsafe environment Unfavourable weather Cost too expensive Unfavourable roads/sidewalks Inadequate facilities Transportation difficult Not knowing the location of facilities No suitable programs	9

Each item is scored on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), resulting in a total score range of 24–120. Higher scores indicate greater perceived barriers, categorized as low (24–47), medium (48–71), high (72–95), or very high (96–120). Prior to data collection, the questionnaire underwent linguistic adaptation into Indonesian through a forward–backward translation procedure to improve semantic clarity and contextual appropriateness for Indonesian participants with visual impairment. Internal consistency in the present study demonstrated good reliability, with a Cronbach's alpha coefficient of 0.86. Although the PABQ has demonstrated acceptable psychometric properties, evidence regarding its specific application among adults with visual impairment remains limited. Therefore, interpretation of the findings should consider the contextual adaptation and population-specific characteristics of the present study sample.

Data analysis

Data were analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated to summarize participant characteristics and perceived barrier scores. Data normality was assessed using the Shapiro–Wilk test. Given that the study was conceptually structured around two independent factors—visual status (low vision vs. total blindness) and aetiology (congenital vs. acquired)—a two-way ANOVA was employed to examine both the main effects and interaction effects of these variables on perceived physical activity barriers across domains.

Where statistically significant effects were identified, post-hoc pairwise comparisons were conducted using Bonferroni adjustment. In addition to p-values, effect sizes (partial eta squared, $\eta^2 p$) and 95% confidence intervals were reported to provide greater interpretative precision and practical significance of the findings. The alpha level for statistical significance was set at $p < 0.05$.

Resultados

Participant Characteristics

The study included 60 participants equally distributed across four visual status and aetiology groups (n = 15 per group). The sample consisted of 31 men (52%) and 29 women (48%), with an overall mean age of 33.8 ± 5.8 years. Across groups, the mean age ranged from 32.9 ± 6.0 years in the congenital total blindness group to 34.7 ± 5.8 years in the acquired total blindness group. Regarding occupational status, most participants were employed as masseurs (60%), while the remaining participants were categorized as unemployed (20%), government/private officials (10%), or business owners (10%). Occupational distribution was relatively comparable across groups. Detailed demographic characteristics are presented in Table 2.

Table 2. Demographic Characteristics of Participants According to Visual Status and Aetiology

Variable	Congenital Low Vision (n = 15)	Acquired Low Vision (n = 15)	Congenital Total Blind (n = 15)	Acquired Total Blind (n = 15)	Total (N = 60)
Gender					
Man	8 (53%)	7 (46.7%)	7 (47%)	9 (60%)	31 (52%)
Woman	7 (47%)	8 (53.3%)	8 (53%)	6 (40%)	29 (48%)
Age(years)					
Mean ± SD	33.5±6.1	34.2±5.4	32.9±6.0	34.7±5.8	33.8±5.8
Work					
Masseurs	9 (60%)	9 (60%)	9 (60%)	9 (60%)	36 (60%)
Not working	3 (20%)	3 (20%)	3 (20%)	3 (20%)	12 (20%)
Official	2 (13%)	1 (7%)	1 (7%)	2 (13%)	6 (10%)
Businessman	1 (7%)	2 (13%)	2 (13%)	1 (7%)	6 (10%)

Domain-Specific Perceived Barriers

Table 3 presents the mean scores and standard deviations of perceived physical activity barriers across the three domains of the Physical Activity Barriers Questionnaire (PABQ), namely personal barriers, social barriers, and physical environmental barriers. For the personal barriers domain, no statistically significant differences were observed between groups (p = 0.103, η^2p = 0.11). Mean scores ranged from 20.3 ± 4.6 in the congenital low vision group to 25.1 ± 6.4 in the acquired total blindness group. In the social barriers domain, statistically significant between-group differences were identified (p = 0.033, η^2p = 0.15). The acquired total blindness group reported the highest mean score (25.2 ± 2.1), whereas the congenital low vision group demonstrated the lowest score (20.5 ± 5.6). The physical environmental barriers domain demonstrated the largest between-group variation (p = 0.001, η^2p = 0.29). Participants in the acquired total blindness group reported the highest environmental barrier scores (32.9 ± 7.2), while the congenital low vision group demonstrated the lowest scores (22.4 ± 5.4).

Table 3. Comparison of Mean Physical Activity Barrier Scores Across PABQ Domains According to Visual Status and Aetiology

Domain	Total Score Each Domain (Mean & SD)				One Way ANOVA p-value	Partial Eta Squared (η^2p)
	Congenital Low Vision (n=15)	Acquired Low Vision (n=15)	Congenital Total Blind (n=15)	Acquired Total Blind (n=15)		
Personal Barriers	20.3 ± 4.6	23.7 ± 6.4	23.3 ± 2.9	25.1 ± 6.4	0.103	0.11
Social Barriers	20.5 ± 5.6	21.6 ± 5.6	21.1 ± 4.1	25.2 ± 2.1	0.033	0.15
Obstacles Physical Environment	22.4 ± 5.4	27.7 ± 5.2	27.1 ± 7.8	32.9 ± 7.2	0.001	0.29

For the physical environment barriers domain, the results showed the most substantial variation (p=0.001). The acquired total blindness group faced the highest environmental hurdles 32.9 ± 7.2, whereas the congenital low vision group perceived significantly fewer obstacles 22.4 ± 5.4 indicating that obstacles including limited sports facility access, environmental insecurity, and limited public transportation are major challenges for this group. These findings emphasise the importance of environment-based interventions to reduce the structural barriers faced by people with visual impairments, especially those who experience total blindness due to accidents.

Intensity of Barriers by Visual Status

The distribution of perceived physical activity barrier intensity according to visual status and aetiology is summarized in Table 4. Most participants in the congenital low vision group were categorized within the moderate barrier category (93.3%), whereas most participants in the acquired total blindness group were categorized within the high barrier category (93.3%). The acquired low vision group demonstrated a relatively balanced distribution between moderate barriers (46.7%) and high barriers (53.3%). Meanwhile, participants in the congenital total blindness group were predominantly categorized within the moderate barrier category (66.7%). Statistically significant differences in barrier intensity were identified between groups (p = 0.001, $\eta^2 p$ = 0.31).

Table 4. Distribution of Physical Activity Barrier Levels According to Visual Status and Aetiology

Disability Groups	Moderate Resistance n/(%)	High Resistance n/(%)	One Way ANOVA p value	Partial Eta Squared ($\eta^2 p$)
Congenital Low Vision(n =15)	14 (93%)	1 (7%)	0.001	0.31
Acquired Low Vision(n =15)	7 (47%)	8 (53%)		
Congenital Total Blind(n =15)	10 (67%)	5 (33%)		
Acquired Total Blind(n =15)	1 (8%)	14 (93%)		

Post-hoc pairwise comparisons with Bonferroni adjustment and 95% confidence intervals are presented in Table 5. Participants in the congenital low vision group demonstrated significantly lower total barrier scores than participants in the acquired low vision group (Mean Difference = -9.87; 95% CI [-15.33, -4.40]; *p* = 0.001; Cohen's *d* = 1.21), congenital total blindness group (Mean Difference = -8.47; 95% CI [-13.93, -3.00]; *p* = 0.003; Cohen's *d* = 1.04), and acquired total blindness group (Mean Difference = -20.07; 95% CI [-25.53, -14.60]; *p* = 0.001; Cohen's *d* = 2.36). No statistically significant difference was identified between the acquired low vision and congenital total blindness groups (Mean Difference = 1.40; 95% CI [-4.06, 6.86]; *p* = 0.610). Participants in the acquired total blindness group demonstrated significantly higher total barrier scores than participants in the acquired low vision group (Mean Difference = -10.20; 95% CI [-15.66, -4.74]; *p* = 0.001; Cohen's *d* = 1.29) and congenital total blindness group (Mean Difference = -11.60; 95% CI [-17.06, -6.14]; *p* = 0.001; Cohen's *d* = 1.46). The largest mean difference was observed between the congenital low vision and acquired total blindness groups.

Table 5. Post-hoc Pairwise Comparisons of Total Physical Activity Barrier Scores

Groups Compared	Mean Difference	*p*-value	95% Confidence Interval	Cohen's *d*
Congenital Low Vision vs. Acquired Low Vision	-9.87	0.001*	[-15.33, -4.40]	1.21
Congenital Low Vision vs. Congenital Total Blindness	-8.47	0.003*	[-13.93, -3.00]	1.04
Congenital Low Vision vs. Acquired Total Blindness	-20.07	0.001*	[-25.53, -14.60]	2.36
Acquired Low Vision vs. Congenital Total Blindness	1.40	0.610	[-4.06, 6.86]	0.17
Acquired Low Vision vs. Acquired Total Blindness	-10.20	0.001*	[-15.66, -4.74]	1.29
Acquired Total Blindness vs. Congenital Total Blindness	-11.60	0.001*	[-17.06, -6.14]	1.46

Analysis for acquired low vision and acquired total blindness groups showed those with total blindness faced significantly higher total barriers than those with low vision (Mean Difference = -10.20; 95% CI [-15.66, -4.74]; p=0.001). This comparison indicates that total blindness represents a much more disruptive life event than losing only partial vision. Those with acquired total blindness face "complex challenges in psychosocial adjustment" and the highest levels of environmental resistance found in the study. This group lacks the "motor literacy" of those born with the condition and the "visual cues" of those with low vision, resulting in a profoundly higher sense of inhibition regarding independent mobility and physical activity

Additionally, individuals with acquired total blindness experienced significantly higher barriers than those with congenital total blindness (Mean Difference = -11.60; 95% CI [-17.06, -6.14]; p = 0.001), suggesting that the sudden loss of vision (aetiology) is a critical determinant of perceived barriers. Hence, history of the disability is just as important as the severity of the disability.

The Post-hoc analysis also yielded no statistically significant difference in perceived barriers between these two groups acquired low vision and congenital total blindness (Mean Difference = 1.40; 95% CI [-4.06, 6.86]; p = 0.610). This findings suggest that the challenges of adapting to acquired low vision may be comparable in intensity to those faced by individuals who have been totally blind since birth.

Discusión

This study provides a novel analysis of physical activity barriers among adults with visual impairments by stratifying participants according to both visual status (low vision vs. total blindness) and aetiology (congenital vs. acquired). By moving beyond the broad categorization of "visual impairment" commonly used in previous studies, the findings demonstrate that differences in visual status and onset of impairment may be associated with variations in perceived physical activity barriers among adults with visual impairment.

The most prominent finding of this study was that individuals with acquired total blindness reported the highest barrier scores across several domains. Specifically, this group demonstrated significantly higher social (p = 0.033) and physical environment (p = 0.001) barriers compared with the other groups. Rather than indicating a direct causal relationship, these findings may reflect potential psychosocial adjustment challenges among individuals who experience vision loss later in life. These findings align with the "trauma of transition" hypothesis suggested by Pan et al. (2022) and Clements et al. (2024), which posits that sudden vision loss in adulthood precipitates acute psychological disorientation. Unlike congenital groups who develop their identity alongside their disability, the acquired total blindness group must grapple with the loss of a previously sighted identity, leading to higher inhibition, fear of injury, and social withdrawal (Choi and Pionke, 2024; Choi, 2024; Hanna et al, 2024; Bonsaksen et al, 2025). However, it is important to note that psychological adaptation variables were not directly measured in the present study; therefore, these interpretations should be considered exploratory rather than confirmatory.

Our findings regarding the Social Domain (p = 0.033) specifically align with Haegele et al. (2024), who found that social isolation is exacerbated in adults who lose vision later in life due to a disruption in established social networks. The acquired total blindness group lacks the "blindness skills" (e.g., braille, cane travel) that congenital groups learn during developmental years, making social interaction feel more dependent and burdensome. However, our results nuance the findings of Shah et al. (2020). While Shah suggested that social participation generally declines with vision loss, our post-hoc analysis indicates this decline is not uniform; the congenital low vision group reported social barrier scores comparable to the norm, suggesting that long-term habituation effectively mitigates social inhibition. Interestingly, the congenital low vision group reported relatively lower social barriers. This finding might indicate that long-term adaptation and familiarity with visual limitations could contribute to greater confidence in social participation. However, caution is warranted because this study did not directly assess coping strategies, social competence, or psychological resilience.

Regarding physical environment domain, the significant gap between the acquired total blindness group and the congenital groups supports the theory of 'environmental literacy'. Fitri et al. (2022) and Puspitasari et al. (2021) noted that individuals with acquired blindness often lack the "safe routes" and cognitive maps that those born with visual impairments develop during childhood. However, the present findings should not be interpreted as evidence that congenital blindness inherently results in superior mobility abilities. Studies by Zarei and Norasteh (2022) and Bakke et al. (2019) argue that children with congenital blindness suffer from significant motor delays due to a lack of visual imitation, implying they should face higher physical barriers. However, our adult data contradicts this expectation regarding perceived barriers. The congenital total blindness group reported significantly fewer barriers than the acquired total blindness group (Mean Difference = -11.60). This suggests that while congenital groups may have developmental motor delays, they possess superior orientation and mobility (O & M) self-efficacy. They perceive the environment as less hostile because they have never relied on vision to navigate it, whereas the acquired total blindness group constantly compares their current mobility to their past sighted performance, resulting in a higher perception of difficulty. In addition, participants with acquired total blindness may compare their current functional mobility with their previous sighted experiences, which could contribute to higher perceptions of environmental difficulty. Nevertheless, this interpretation remains hypothetical because comparative self-perception and psychological adjustment were not directly evaluated in this study.

The study identified congenital low vision as the ‘best-case scenario’ for physical activity engagement, reporting the lowest barriers across the board. The massive mean difference of -20.07 between the congenital low vision and acquired total blindness groups quantifies the ‘adaptation gap.—the statistical cost of losing vision later in life. This corresponds with Omar et al. (2017) and Hwang et al. (2020), who emphasize that residual vision combined with early-life adaptation creates stable adaptive capacities. The congenital low vision group benefits from habituation. They do not experience the "shock" of vision loss, and their residual vision acts as a powerful facilitator for spatial orientation. This rejects the notion that all "visually impaired" individuals need the same level of support; the congenital low vision group is functionally distinct from the total blindness group. This finding strongly rejects a ‘one-size-fits-all’ policy approach and supports Choi and Pionke’s (2024) call for interventions that are specific to the timeline of disability. Nevertheless, the current study cannot determine which factors most strongly contribute to the observed differences because of its cross-sectional nature.

Demographically, 60% of our participants worked as masseurs. This concentration in a sedentary profession may compound physical activity barriers. This occupational concentration may have influenced physical activity patterns and perceived barriers, particularly because massage-related work is often performed indoors and may involve prolonged sedentary periods between clients. While Ma et al. (2024) suggest employment generally improves quality of life, the specific nature of this work often performed indoors with limited movement, may reinforce the "sedentary cycle" identified in our Personal Barriers domain, although that specific domain were not statistically significant ($p = 0.103$).

Several limitations should be acknowledged. First, the cross-sectional design prevents causal interpretation of the findings. The observed differences between groups only indicate associations and cannot determine whether visual status or aetiology directly caused higher perceived barriers. While this study offers critical insights, the following recommendations are made for future work. Longitudinal Trajectory Analysis; this study captures a snapshot, but adaptation is a process. Future research should use a longitudinal design by tracking participants at 1, 3 and 5 years post-vision loss to determine if the high barriers in the acquired total blindness group naturally decrease over time or require intervention to mitigate a longitudinal trajectory analysis to track adaptation phases over 1–5 years post-vision loss. This study relied on self-reported perceptions. The study relied exclusively on self-reported questionnaire data, which may be affected by recall bias, subjective interpretation, and social desirability bias. Hence for future studies should integrate accelerometer data as suggested by Tama & Astutik (2022) to correlate perceived barriers with actual physical activity intensity. The relatively small sample size and association-based recruitment approach may limit statistical power and generalizability. Participants recruited through disability associations may have greater access to social networks, rehabilitation resources, or organized activities compared with the broader visually impaired population. Several potentially important confounding variables were not assessed, including socioeconomic status, educational level, environmental accessibility, rehabilitation history, mental health status, social support, and assistive technology use. These factors may partially explain the observed differences between groups.

To better understand the non-significant difference between the Acquired Low Vision and Congenital Total Blindness groups ($p = 0.610$), future research should utilize qualitative interviews or focus groups. This would help untangle whether the barriers are numerically similar due to shared functional limitations or different underlying psychological stressors. Given the rapid advancement of assistive technology, future models should include tech-literacy as a moderating variable. As noted by Khan et al. (2023), access to smart mobility aids could significantly lower environmental barriers for the acquired blindness group, potentially narrowing the gap with congenital groups. By addressing these areas, future research can move from identifying barriers to designing precision interventions specifically, psychosocial rehabilitation for acquired blindness and infrastructure improvements for congenital low vision. that respect the unique developmental histories of adults with visual impairment.

Future research should therefore adopt longitudinal designs to examine adaptation trajectories over time following vision loss. Tracking individuals at multiple time points following acquired visual impairment may help clarify whether perceived barriers naturally decrease through adaptation or whether targeted interventions are required. In addition, qualitative approaches such as in-depth interviews or focus groups may provide deeper insight into why some groups demonstrate similar quantitative scores despite potentially different lived experiences. Finally, given recent advances in assistive technology, future studies should examine technology literacy and access to mobility aids as potential moderating variables. As suggested by Khan et al., assistive technologies may contribute to reduced environmental barriers and improved independence among adults with visual impairment.

Conclusiones

This study suggests that perceived barriers to physical activity participation among adults with visual impairment may differ according to visual status (low vision vs. total blindness) and aetiology (congenital vs. acquired). By differentiating these subgroups, the findings appear to indicate a potential "adaptation gap" between individuals with congenital and acquired visual impairment. Participants with acquired total blindness reported higher perceived barriers across several domains, which may reflect possible challenges related to psychosocial adjustment, environmental adaptation, and mobility confidence. However, these variables were not directly assessed in the present study and therefore should be interpreted cautiously.

In contrast, participants with congenital low vision reported relatively lower perceived barriers, which might be associated with long-term habituation processes and the presence of residual visual function. Nevertheless, alternative explanations such as differences in environmental accessibility, rehabilitation exposure, socioeconomic conditions, social support, and access to assistive technology may also have contributed to the observed findings.

The present findings highlight the importance of considering heterogeneity within the visually impaired population rather than applying a uniform approach to physical activity interventions. Interventions for individuals with acquired total blindness may benefit from emphasizing orientation and mobility (O & M) training, psychosocial support, and confidence-building strategies, whereas individuals with congenital low vision may particularly benefit from improved environmental accessibility and inclusive infrastructure. However, these recommendations should be interpreted as preliminary implications rather than definitive intervention guidelines.

Future studies should employ longitudinal and mixed-method approaches to better understand adaptation trajectories following vision loss and to identify factors influencing physical activity participation over time. In addition, further investigation into the role of assistive technology, family support systems, rehabilitation access, and environmental factors may contribute to the development of more comprehensive evidence-based strategies for promoting active living among adults with visual impairment.

Finally, the findings should be interpreted within the context of several study limitations, including the cross-sectional design, reliance on self-reported data, relatively small sample size, and limited generalizability of the study population.

Agradecimientos

We wish to express our sincere gratitude to all study participants for their time and valuable insights. We also extend our thanks to the Indonesian Association of the Blind (PERTUNI) for their collaboration and unwavering support.

Financiación

The authors wish to thank Universitas Negeri Surabaya (UNESA) for their generous support through non-APBN research funding, which made this study possible.

Declaration of AI Use

During the preparation of this work, the authors used NotebookLM and DeepSeek in order to improve readability and language in the writing process. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Conflicts of Interest

No potential conflict of interest was reported by the authors.

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Datos de los/as autores/as y traductor/a:

Kunjung Ashadi	kunjungashadi@unesa.ac.id	Author/translator
Laily Mita Andriana	lailyandriana@unesa.ac.id	Author
Muhammad Kharis Fajar	muhammadfajar@unesa.ac.id	Author
Rizky Muhammad Sidik	rizkysidik@unesa.ac.id	Author
Rachman Widohardhono	rachmanwidohardhono@unesa.ac.id	Author
Tri Setyo Utami	triutami@unesa.ac.id	Author
Riski Septa Jatmikanto	riskijatmikanto@unesa.ac.id	Author
Rokiah Omar	r_omar@ukm.edu.my	Author/translator