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Exercise Imagery as a Health-Promoting Cognitive Strategy: Links to Physical Activity and Mental and Physical Health-Related Quality of Life

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ABSTRACT: Background: Physical activity is an important contributor to health-related quality of life, while exercise imagery may serve as a cognitive strategy that supports greater engagement in physical activity. **Objectives:** This study investigated how exercise imagery, physical activity, and the physical and mental components of health-related quality of life are structurally associated among community-dwelling adults. **Methods:** A total of 571 adults living in Nowon-gu, a district in northern Seoul, South Korea, participated in this study. Exercise imagery was measured using the Korean version of the Exercise Imagery Scale. Physical activity was assessed with metabolic equivalent task scores calculated from the Leisure-Time Exercise Questionnaire. Health-related quality of life was evaluated using items from the Korean Health Survey. Data were analyzed using descriptive statistics, Pearson's correlation analysis, and structural equation modeling to examine the proposed relationships among exercise imagery, physical activity, and the physical and mental dimensions of health-related quality of life. To explore moderation by sex, multi-group SEM was subsequently conducted. **Results:** Exercise imagery significantly predicted physical activity ($\beta = 0.36, p < 0.001$), physical health-related quality of life ($\beta = 0.42, p < 0.001$), and mental health-related quality of life ($\beta = 0.46, p < 0.001$). Physical activity significantly predicted physical health-related quality of life ($\beta = 0.27, p = 0.002$), but not mental health-related quality of life ($\beta = 0.11, p = 0.106$). The indirect effect of exercise imagery on physical health-related quality of life through physical activity was significant ($\beta = 0.10, 95\% \text{ CI } [0.04, 0.16]$). The model showed an overall acceptable fit based on multiple indices ($\chi^2/\text{df} = 3.37$, CFI = 0.93, GFI = 0.96, SRMR = 0.06, RMSEA = 0.06), and multi-group SEM supported overall invariance across sex. **Conclusions:** These outcomes underscore the value of exercise imagery as an effective cognitive strategy to boost physical activity participation and promote health-related quality of life in adult populations. Notably, the data indicates that the sheer volume of physical activity is insufficient for explaining variances in mental health-related quality of life. This highlights the critical requirement to integrate cognitive and emotional dimensions into current explanatory models.

KEYWORDS: Exercise imagery; health-related quality of life; physical activity; sex differences; structural equation modeling

1 Introduction

Contemporary society has experienced profound changes through advancements in information technology and industrial development, which have improved many aspects of daily life. However, these developments have also introduced new challenges that affect individuals' well-being. As people strive for a fulfilling and healthy life, interest in improving the quality of life has intensified. According to the World Health Organization (WHO) [1], quality of life is defined as an individual's perception of their position in life within the context of their cultural and value systems, in relation to their goals, expectations, and

concerns. Sanoff et al. [2] describe quality of life as the extent to which individuals perceive their lives as meaningful, their capacity to meet personal goals, and their ability to adapt to environmental challenges while maintaining social and emotional balance. Broadly, quality of life encompasses satisfaction across physical, psychological, and social dimensions. Among these, health plays a central role, often regarded as the foundation of overall life quality [3]. Consequently, governments across the globe have prioritized physical activity promotion to address health-related concerns.

Empirical studies have consistently demonstrated a causal—not merely correlational—relationship between physical activity and health [4]. Physical activity has been shown to enhance mental health and overall life satisfaction [5], while also being associated with improved self-esteem and health-related quality of life (HRQoL) in older adults [6]. In both Western and Korean populations, physical activity contributes to improved well-being, a sense of purpose, and enhanced quality of life [7–9]. At the same time, the relationship between physical activity and HRQoL may vary according to psychological and contextual conditions, suggesting the need to better understand cognitive mechanisms that support physical activity engagement and shape its broader well-being benefits [9].

Despite the well-established benefits of physical activity, global participation remains suboptimal. Less than half of Korean adults meet the recommended physical activity levels [10,11]. Alarming, approximately 50% of individuals who initiate an exercise routine discontinue it within three months [12], increasing the risk of health complications associated with inactivity [13]. In response, researchers have investigated the psychological and behavioral factors that influence physical activity adoption and maintenance [14]. In recent years, psychological constructs such as motivation, self-efficacy, intention, attitudes, and exercise imagery have been identified as key determinants of physical activity behavior [15–17]. Theoretical frameworks including self-determination theory, self-efficacy theory, the theory of planned behavior, and the transtheoretical model have offered explanatory power in this domain [18,19]. Among these, exercise imagery has attracted growing attention as an accessible and cost-effective cognitive strategy for enhancing physical activity engagement.

Exercise imagery involves the mental simulation of sensory experiences, including visual, kinesthetic, and emotional elements [20,21]. In the context of physical activity, exercise imagery refers to the cognitive visualization of scenarios such as performing correct technique, experiencing post-exercise confidence, or achieving health-related outcomes. Giacobbi et al. [22] developed the Exercise Imagery Scale to assess such experiences, identifying four domains: appearance and health, technique, self-efficacy, and emotional response. These dimensions have been linked to increased emotional engagement, motivation, and persistence in physical activity [23,24]. Beyond its role as a psychological technique, exercise imagery may also function as a self-regulatory cognitive resource. By mentally simulating successful exercise performance and desirable post-exercise states, imagery may strengthen self-efficacy, clarify goals, and enhance positive affective anticipation toward physical activity. In this sense, exercise imagery may operate as a cognitive-affective bridge between physical activity engagement and broader health-related well-being, rather than merely as a correlate of activity levels [15,25–27].

Prior research has documented the positive effects of exercise imagery on physical activity and associated psychological outcomes [28–30]. Nevertheless, most existing studies have focused on athletic populations, and few have explored exercise imagery in community-dwelling adults. Furthermore, the integrated structural relationship among exercise imagery, physical activity, and mental and physical health-related quality of life remains underexplored, particularly in Korean contexts. Accordingly, the present study extends prior work by examining exercise imagery as a latent cognitive resource linked not only to physical activity but also to physical and mental HRQoL in a community-based adult sample [6,31].

Beyond prior studies that have primarily examined the association between physical activity and HRQoL, the present study contributes to the literature in three ways. Theoretically, it incorporates exercise imagery as a motivational and self-regulatory cognitive resource that may help explain how behavioral engagement relates to broader health-related quality of life. Methodologically, it models exercise imagery as a latent construct with multiple subdimensions, thereby advancing understanding of health-promoting cognitive strategies beyond single-indicator or purely correlational approaches. Appliedly, by focusing on community-dwelling adults and examining the structural pattern across sex, the study provides additional insight into whether imagery-based health promotion processes are broadly comparable while still allowing for meaningful subgroup-specific tendencies in everyday contexts.

The present study aims to investigate the structural relationships among exercise imagery, physical activity, and mental and physical health-related quality of life in a community-based adult population. In line with this rationale, this study conceptualizes exercise imagery not simply as a correlate of physical activity, but as a theoretically meaningful motivational and self-regulatory resource that may connect behavioral engagement to broader perceptions of HRQoL. Additionally, this study explores sex differences in these relationships, building on evidence that psychological and behavioral patterns related to physical activity often differ by sex [32,33]. The conceptual framework is depicted in Fig. 1, and the following hypotheses were established:

Hypothesis 1: *Exercise imagery will positively predict physical activity, physical health-related quality of life, and mental health-related quality of life.*

Hypothesis 2: *Physical activity will be positively associated with health-related quality of life and will partially mediate the associations between exercise imagery and physical and mental health-related quality of life.*

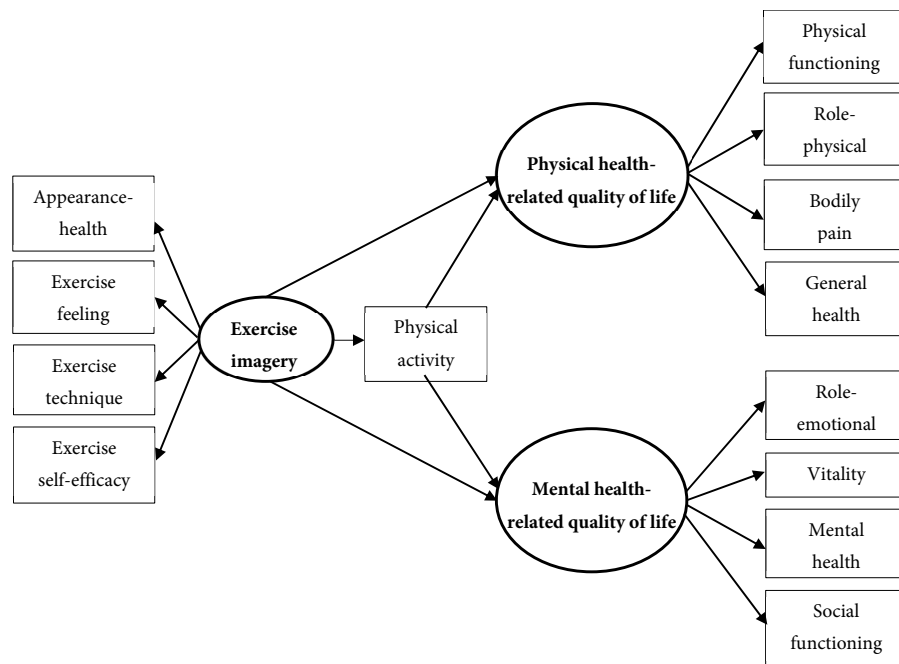


Figure 1: Hypothesized model for explaining the relationship between exercise imagery, physical activity, and mental and physical health-related quality of life.

2 Methods

2.1 Participants

Participants were voluntarily recruited from Nowon-gu, a district located in northern Seoul, South Korea, through community-based outreach, including notices posted in local community centers, sport facilities, and public spaces. Eligible participants were community-dwelling adults aged 20 years or older who resided in Nowon-gu, were able to complete the questionnaire independently, and provided informed consent to participate. Individuals were excluded if they submitted incomplete questionnaires, had missing data on the major study variables, or provided responses judged to be invalid because of substantial non-response patterns. Of the 600 questionnaires distributed, 571 were retained for analysis after removing 29 due to incomplete responses. The final sample included 289 males and 282 females, with a mean age of 49.21 years ($SD = 12.89$; range = 20–79). Accordingly, 95.2% of the distributed questionnaires were included in the final analysis, whereas 4.8% were excluded because of incomplete responses. In addition, a post hoc power analysis using G*Power indicated that the final sample size of 571 exceeded the minimum sample size required to ensure adequate statistical power for the present analyses.

The study protocol received ethical approval from the Institutional Review Board at Seoul National University of Science and Technology (IRB No. U2026-0099). All procedures were conducted in accordance with the Declaration of Helsinki, and written informed consent was provided by all participants before the commencement of the study.

2.2 Measures

To assess exercise imagery related to physical activity, we used the Korean version of the Exercise Imagery Scale, originally developed by Giacobbi et al. [22] and culturally adapted by Won et al. [34]. This instrument consists of 19 items grouped into four subdomains: appearance-health, exercise feeling, exercise technique, exercise self-efficacy. Items are rated on a 7-point Likert scale ranging from 1 (never) to 7 (often), with higher scores indicating more frequent use of imagery. In the present study, the overall scale demonstrated good internal consistency (Cronbach's $\alpha = 0.840$). Cronbach's α values for the subscales were 0.791 for appearance-health, 0.814 for exercise feeling, 0.786 for exercise technique, and 0.796 for exercise self-efficacy.

To measure habitual physical activity, we employed the Korean adaptation of the Leisure-Time Exercise Questionnaire (LTEQ), developed by Godin and Shephard [35]. Participants reported the weekly frequency of engaging in vigorous (e.g., running, vigorous cycling), moderate (e.g., brisk walking, swimming), and light (e.g., yoga, golf) physical activity lasting at least 15 min per session. A composite MET (Metabolic Equivalent of Task) score was calculated using the formula: $MET = (Vigorous \times 9) + (Moderate \times 5) + (Light \times 3)$. For descriptive purposes, the light-, moderate-, and vigorous-intensity values reported in Table 1 represent weighted MET scores for each activity category. Total physical activity was calculated as the sum of these three weighted category scores. Previous research supported the construct validity of the Korean version through correlations with accelerometer data (Spearman's $r = 0.77$). In the present study, the LTEQ demonstrated good internal consistency (Cronbach's $\alpha = 0.841$). Cronbach's α values for the subscales were 0.833 for light-intensity physical activity, 0.777 for moderate-intensity physical activity, and 0.822 for vigorous-intensity physical activity.

Health-related quality of life was assessed using the Korean version of the Short Form Health Survey (SF-36), originally developed by Ware and Sherbourne [36] and validated for Korean populations by Koh et al. [37]. While the original SF-36 includes 36 items across eight domains, the item related to changes

in health status over the past year was not included in this study, as it is typically treated as a separate health transition indicator rather than as part of the eight multi-item subscales used to derive physical and mental health-related quality of life. Accordingly, 35 items were analyzed, covering four domains of physical health (physical functioning, role limitations due to physical problems, bodily pain, and general health) and four domains of mental health (vitality, social functioning, role limitations due to emotional problems, and mental health). In the present study, the internal consistency of the physical health-related quality of life construct was 0.841 (physical functioning = 0.807; role physical = 0.809; bodily pain = 0.794; general health = 0.777), and that of the mental health-related quality of life construct was 0.828 (role emotional = 0.776; vitality = 0.784; mental health = 0.798; social functioning = 0.776).

Table 1: The study variables of the participants.

Variable	Male (n = 289)	Female (n = 282)	Total (N = 571)
Physical Activity (METs)			
Light-intensity	16.20 ± 4.90	15.65 ± 4.82	15.93 ± 4.87
Moderate-intensity	24.70 ± 7.20	23.51 ± 7.40	24.11 ± 7.33
Vigorous-intensity	21.40 ± 9.10	17.53 ± 9.05	19.49 ± 9.25
Total physical activity	62.30 ± 17.80	56.69 ± 17.40	59.53 ± 17.98
Exercise Imagery			
Appearance health	5.18 ± 1.14	5.32 ± 1.17	5.25 ± 1.16
Exercise feeling	4.66 ± 1.16	4.76 ± 1.19	4.71 ± 1.18
Exercise technique	4.34 ± 1.30	4.22 ± 1.35	4.28 ± 1.33
Exercise self-efficacy	5.15 ± 1.95	5.05 ± 2.00	5.10 ± 1.98
Physical Health-Related Quality of Life			
Physical functioning	59.10 ± 13.00	57.84 ± 13.20	58.48 ± 13.16
Role-physical	76.80 ± 7.40	75.32 ± 7.70	76.07 ± 7.59
Bodily pain	62.20 ± 12.10	60.44 ± 12.30	61.33 ± 12.26
General health	55.10 ± 14.20	53.58 ± 14.60	54.35 ± 14.47
Mental Health-Related Quality of Life			
Role-emotional	67.90 ± 10.20	66.69 ± 10.50	67.30 ± 10.37
Vitality	68.40 ± 10.00	67.35 ± 10.30	67.88 ± 10.18
Mental health	50.80 ± 15.50	48.49 ± 15.80	49.66 ± 15.74
Social functioning	52.60 ± 15.00	51.39 ± 15.30	52.00 ± 15.21

Note: Values are presented as mean ± standard deviation (SD). Values for light-, moderate-, and vigorous-intensity physical activity represent weighted MET scores. Total physical activity was calculated as the sum of these three weighted scores.

2.3 Data Analysis

Descriptive statistics, including means and standard deviations (SDs), were computed for all variables. Pearson correlation analysis was performed to examine associations among exercise imagery, physical activity, and mental and physical health-related quality of life. To examine the potential influence of common method variance due to the use of self-report measures collected at a single time point, Harman's single-factor test was conducted. Structural equation modeling (SEM) was conducted to test the hypothesized relationships among the constructs. The directional paths specified in the SEM were based on the theoretical positioning of exercise imagery as a motivational and self-regulatory cognitive resource, physical activity as a health-related behavioral indicator, and mental and physical health-related quality of life as a health consequence construct [6,15,25,31]. Prior to SEM, normality was assessed by examining the skewness and kurtosis of the observed variables, as well as multivariate kurtosis. Given the potential limitation

of multivariate normality, bootstrapping was additionally applied to obtain more robust estimates of the structural paths and indirect effects.

In the SEM model, observed items were loaded onto their respective latent variables, and error terms were assumed to be uncorrelated. One factor loading per latent construct was fixed at 1.0 for model identification. Model fit was evaluated using multiple indices ($\chi^2/\text{df} < 3$, CFI > 0.90 , GFI > 0.90 , SRMR = 0.05–0.08, and RMSEA < 0.08). Given the sensitivity of the chi-square statistic to sample size, the χ^2/df ratio was evaluated in conjunction with other global fit indices rather than being used as the sole criterion for model fit assessment.

Based on previous findings regarding sex-based differences in psychological and behavioral outcomes [32,33], multi-group SEM was additionally conducted to examine measurement and structural invariance across sex through comparisons between unconstrained and constrained models. Physical activity was represented as a single observed variable (MET score), whereas exercise imagery and health-related quality of life were modeled as latent constructs using their respective subdomains. This modeling decision was made because the LTEQ is designed to yield a composite MET index summarizing leisure-time physical activity across intensity levels. Whereas exercise imagery and health-related quality of life were specified as multidimensional latent constructs with theoretically differentiated subdomains, physical activity was represented as an aggregate behavioral measure to preserve model parsimony and avoid overparameterization. As such, this operationalization predominantly reflects activity volume and may not adequately capture qualitative characteristics of physical activity that could contribute to mental health–related quality of life.

3 Results

3.1 Descriptive Statistics

Table 1 shows the descriptive statistics (i.e., Mean, SD) for the study variables of the participants. Prior to model testing, univariate and multivariate normality were examined. The skewness values of the observed variables ranged from -0.176 to 0.103 , and the kurtosis values ranged from -0.892 to -0.299 , indicating that univariate normality was generally acceptable. Multivariate normality was assessed using the multivariate kurtosis index, and the critical ratio for multivariate kurtosis was -2.480 , suggesting that multivariate normality may not have been fully satisfied. Therefore, bootstrapping was applied in the subsequent SEM analysis to obtain more robust estimates. Harman's single-factor test further indicated that common method variance was unlikely to be a serious concern, as the first unrotated factor accounted for 34.82% of the total variance.

3.2 Correlational Analysis

The results of the correlation analysis regarding exercise imagery, physical activity, and components of health-related quality of life (mental and physical) are presented in Table 2. The findings revealed that physical activity was positively associated with most subdomains of exercise imagery and several indicators of mental and physical health-related quality of life. Overall, the exercise imagery subcomponents showed generally positive associations with indicators of both physical and mental health-related quality of life, although not all correlations reached statistical significance. These results suggest a consistent pattern wherein individuals who frequently use exercise imagery related to exercise and wellness report higher levels of physical activity and better perceived health. In addition, the square roots of the average variance extracted (AVE) exceeded the corresponding inter-construct correlations, supporting discriminant validity among the latent constructs.

Table 2: Correlations between the study variables and square root of AVE.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1													
2	0.21**	<i>0.814</i>											
3	0.25***	0.37***	<i>0.805</i>										
4	0.30***	0.47***	0.63***	<i>0.722</i>									
5	0.21***	0.60***	0.60***	0.53***	<i>0.748</i>								
6	0.23**	0.26***	0.21**	0.29***	0.29***	<i>0.740</i>							
7	0.05	0.13*	0.02	0.04	0.36***	0.29***	<i>0.818</i>						
8	0.01	0.13*	0.04	0.11*	0.31***	0.22**	0.41***	<i>0.742</i>					
9	0.25***	0.26***	0.29***	0.27***	0.30***	0.45***	0.26***	0.34***	<i>0.802</i>				
10	0.08	−0.01	0.02	0.03	0.31***	0.10*	0.43***	0.32***	0.19**	<i>0.782</i>			
11	−0.02	−0.05	−0.02	0.04	0.33***	0.08	0.20**	0.30***	0.24***	0.32***	<i>0.714</i>		
12	0.21**	0.27***	0.32***	0.32***	0.31***	0.36***	0.24***	0.29***	0.50***	0.21**	0.17**	<i>0.753</i>	
13	0.11*	0.13*	0.17*	0.14*	0.32***	0.10*	0.23***	0.12***	0.19**	0.13*	0.15*	0.19**	<i>0.775</i>
Mean ±	59.53 ±	5.25 ±	4.28 ±	4.71 ±	5.10 ±	58.48 ±	76.07 ±	61.33 ±	54.35 ±	67.30 ±	49.66 ±	67.88 ±	52.00 ±
SD	17.98	1.16	1.33	1.18	1.98	13.16	7.59	12.26	14.47	10.37	15.74	10.18	15.21

Note: 1: physical activity (METs value); 2: appearance-health; 3: exercise technique; 4: exercise feeling; 5: exercise self-efficacy; 6: physical functioning; 7: role-physical; 8: bodily pain; 9: general health; 10: role-emotional; 11: mental health; 12: vitality; 13: social functioning; *Italicized* values indicate the square roots of the average variance extracted (AVE). AVE was not estimated for total physical activity because it was specified as a single observed variable rather than a latent construct. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

3.3 Structural Equation Modeling

Structural equation modeling was conducted to examine the hypothesized relationships among exercise imagery, physical activity, and physical and mental health-related quality of life. As shown in Table 3 and Fig. 2, exercise imagery was a significant positive predictor of physical activity ($\beta = 0.36$, $p < 0.001$), physical health-related quality of life ($\beta = 0.42$, $p < 0.001$), and mental health-related quality of life ($\beta = 0.46$, $p < 0.001$), indicating moderate to relatively strong associations. Physical activity also significantly predicted physical health-related quality of life ($\beta = 0.27$, $p = 0.002$), suggesting a modest-to-moderate effect, whereas its association with mental health-related quality of life was small and not statistically significant ($\beta = 0.11$, $p = 0.106$). The proposed model showed an overall acceptable fit to the data based on multiple fit indices ($\chi^2/\text{df} = 3.37$, CFI = 0.93, GFI = 0.96, SRMR = 0.06, RMSEA = 0.06), although the χ^2/df value was slightly above the conventional guideline of 3. Furthermore, bootstrap analyses evaluated whether physical activity mediated the relationship between exercise imagery and health-related quality of life. Results revealed a significant indirect effect on physical health-related quality of life (0.10 (95% CI [0.04, 0.16])), whereas the mediating effect on mental health-related quality of life was 0.04 (95% CI [-0.01, 0.10]).

Table 3: Structural relationships and bootstrap indirect effects among exercise imagery, physical activity, and physical and mental health-related quality of life.

Path		SRW	C.R. (<i>p</i> -Value)		
Exercise imagery → Physical activity		0.36	7.84 (<0.001)		
Exercise imagery → Physical health-related quality of life		0.42	6.81 (<0.001)		
Exercise imagery → Mental health-related quality of life		0.46	5.04 (<0.001)		
Physical activity → Physical health-related quality of life		0.27	3.22 (0.002)		
Physical activity → Mental health-related quality of life		0.11	1.61 (0.106)		
Indirect Path	Standardized Indirect Effect	Bootstrap SE	95% Bootstrap CI	Result	
EI → PA → Physical HRQoL	0.10	0.03	[0.04, 0.16]	Significant	
EI → PA → Mental HRQoL	0.04	0.03	[-0.01, 0.10]	Not significant	
Model fit	χ^2/df	CFI	GFI	SRMR	RMSEA
	3.37	0.93	0.96	0.06	0.06

Note: SRW, standardized regression weight; C.R., critical ratio; CI, confidence interval; df, degree of freedom; EI, exercise imagery; PA, physical activity; HRQoL, health-related quality of life; CFI, comparative fit index; GFI, goodness-of-fit index; SRMR, standardized root mean square residual; RMSEA, root mean square error of approximation.

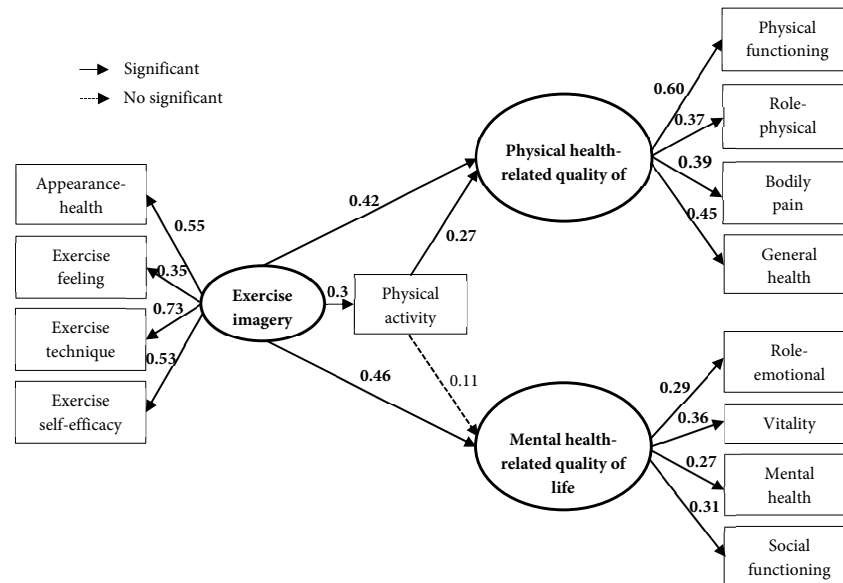


Figure 2: Relationship between exercise imagery, physical activity, and mental and physical health-related quality of life. Note: Values presented on the single-headed arrows represent standardized path coefficients (for the structural model) and standardized factor loadings (for the measurement model). Solid arrows indicate statistically significant paths ($p < 0.01$), whereas the dashed arrow indicates a non-significant path.

Accordingly, Hypothesis 1 was supported, whereas Hypothesis 2 was only partially supported, because physical activity was significantly associated with physical health-related quality of life but not with mental health-related quality of life, and only the indirect effect on physical health-related quality of life was statistically significant.

3.4 Multi-Group Structural Equation Modeling across Sex

To examine whether the hypothesized model was equivalent across sex, multi-group structural equation modeling was conducted using a series of nested models (Table 4). The unconstrained model showed a good fit to the data ($\chi^2 = 142.140$, $df = 122$, $\chi^2/df = 1.165$, CFI = 0.996, RMSEA = 0.014). To evaluate measurement and structural invariance across sex, a series of progressively restrictive nested models was examined. Constraining the measurement weights, structural weights, covariances, and residuals (both structural and measurement) to equality resulted in no substantial decrement in model fit. The incremental changes in chi-square values across these nested configurations were negligible ($\Delta\chi^2 = 1.380$ – 5.850), and the variations in the Comparative Fit Index remained well within acceptable thresholds ($\Delta CFI \leq 0.004$). These robust metrics collectively confirm that both the measurement and structural properties of the model are invariant across male and female groups.

When the group-specific parameter estimates were inspected descriptively, some paths appeared to differ in statistical significance between males and females. In males, exercise imagery significantly predicted physical activity, physical health-related quality of life, and mental health-related quality of life, and physical activity significantly predicted both physical and mental health-related quality of life. In females, exercise imagery significantly predicted physical activity and physical health-related quality of life, whereas the path from exercise imagery to mental health-related quality of life was not statistically significant. Likewise, the paths from physical activity to physical and mental health-related quality of life were not statistically significant in females. These findings suggest that, although the overall measurement

and structural models were largely comparable across sex, some group-specific patterns may warrant cautious interpretation in future research.

Table 4: Multi-group structural equation modeling across sex.

Invariance Testing across Sex								
Model	χ^2	df	χ^2/df	CFI	RMSEA	$\Delta\chi^2$	Δdf	ΔCFI
Unconstrained	142.140	122	1.165	0.996	0.014	-	-	-
Measurement weights	143.520	132	1.087	0.998	0.010	1.380	10	0.002
Structural weights	143.940	136	1.058	0.998	0.008	1.800	14	0.002
Structural covariances	143.958	137	1.051	0.999	0.008	1.818	15	0.003
Structural residuals	144.343	139	1.038	0.999	0.007	2.203	17	0.003
Measurement residuals	147.990	151	0.980	1.000	0.000	5.850	29	0.004
Group-Specific Structural Path Estimates								
Path	Male SRW	Male C.R. (<i>p</i>-Value)		Female SRW	Female C.R. (<i>p</i>-Value)			
Exercise imagery → Physical activity	0.38	5.65 (<0.001)		0.33	3.96 (<0.001)			
Exercise imagery → Physical HRQoL	0.38	4.31 (<0.001)		0.53	4.35 (<0.001)			
Exercise imagery → Mental HRQoL	0.43	3.25 (0.001)		0.39	1.20 (0.232)			
Physical activity → Physical HRQoL	0.21	2.99 (0.003)		0.08	0.82 (0.412)			
Physical activity → Mental HRQoL	0.24	2.48 (0.013)		-0.06	-0.66 (0.508)			

Note: SRW, standardized regression weight; C.R., critical ratio; df, degree of freedom; HRQoL, health-related quality of life; CFI, comparative fit index; GFI, goodness-of-fit index; SRMR, standardized root mean square residual; RMSEA, root mean square error of approximation.

4 Discussion

Exercise imagery has garnered increasing interest as a psychological technique for enhancing motivation, self-efficacy, behavioral intention, emotional engagement, and physical activity participation [29,38]. While much of the previous literature has focused on athletes, the current study extends these findings to community-dwelling adults. The structural model demonstrated that exercise imagery significantly influences both physical activity levels and health-related quality of life (mental and physical), with further distinctions observed by sex.

The first major finding confirms that exercise imagery is positively associated with physical activity and with both physical and mental health-related quality of life. These findings are consistent with prior studies highlighting the benefits of mental simulation in supporting exercise motivation and adherence [30,39]. Specifically, participants who frequently imagined exercise-related experiences—such as improvements in appearance, technique execution, or feelings of competence and well-being—tended to engage more in physical activity and report higher quality of life. This supports the notion that exercise imagery serves not only as a cognitive rehearsal tool but also as a psychological amplifier that enhances goal-directed behavior and emotional regulation [15,26]. At the same time, the present findings may be understood more fully by considering the distinct functions of the imagery subdimensions. In particular, exercise feeling imagery

may be more closely linked to positive affect and anticipated enjoyment, whereas appearance-health imagery may operate in a more complex manner, strengthening motivation in some individuals but also evoking self-evaluative concerns in others. Likewise, exercise technique and exercise self-efficacy imagery may support perceived competence and persistence in exercise behavior, although their links to mental well-being may be more indirect. These patterns suggest that exercise imagery may not function as a uniformly adaptive construct across all individuals and contexts, even when its overall association with health-related outcomes is positive [23,24].

Second, although physical activity significantly predicted physical health-related quality of life, it did not exhibit a statistically significant effect on mental health-related quality of life in the overall sample. Rather than being viewed primarily as a limitation, this finding may be interpreted as theoretically informative, suggesting that the mental health relevance of physical activity is not fully captured by activity volume alone. While this partially aligns with past research that demonstrated consistent associations between regular physical activity and psychological well-being [8,40], the absence of a direct effect in this model may be due to mediating or moderating variables not included in the current study, such as perceived stress, sleep quality, or baseline mental health conditions. In this respect, the benefits of physical activity for mental health-related quality of life may be more indirect, operating through cognitive, affective, and psychosocial pathways rather than through movement quantity alone. Prior research has shown, for example, that the relationship between physical activity and health-related quality of life may be mediated by depression and shaped by broader psychological processes [6].

Furthermore, these findings indicate that the mental health implications of physical activity are not only merely a function of total amount of physical activity, but also its qualitative attributes and contextual features. Recent studies have indicated that the relationship between physical activity and mental health is shaped not merely by activity volume alone, but also by various mediating and moderating factors. In particular, prior reviews have suggested that psychological benefits may be greater when physical activity is undertaken within a social context and experienced as enjoyable and self-directed [41]. From this perspective, the leisure-time MET index used in the present study may have captured the quantitative level of physical activity relatively well, while failing to fully reflect the affective or social qualities through which physical activity contributes to mental well-being. In essence, the current data suggest that physical movement in isolation may not suffice to enhance mental health-related quality of life; rather, its efficacy appears to rely on concurrent cognitive or emotional processes that convert mere activity into a psychologically enriching experience.

Further, gender-specific evaluations uncovered contrasting patterns. Among male participants, exercise imagery demonstrated a meaningful connection with both health domains, while physical activity served as a positive predictor for both physical and psychological health-related quality of life. In contrast, for female participants, exercise imagery correlated significantly with exercise levels and physical health-related quality of life; however, neither imagery nor physical activity levels yielded a statistically significant impact on mental well-being. These disparities align with prior research indicating that women frequently report poorer perceived health and lower exercise participation than men [32,33,42]. Psychological constructs—including self-efficacy, stages of change, and exercise attitudes—might function differently across genders regarding behavior maintenance [43,44]. Furthermore, women could be subject to distinct social and contextual pressures that diminish the psychological rewards of exercise. Because the current study did not explicitly test these underlying pathways, these assumptions must be treated as speculative and approached with caution.

In this context, the non-significant path from exercise imagery to mental health-related quality of life in females also suggests that exercise imagery may not operate as an equivalent psychological resource across groups. For some women, particularly those facing multiple role demands, exercise-related imagery may be experienced less as a restorative resource and more as an additional demand. This interpretation is also consistent with the possibility that the psychological meaning of exercise differs across groups depending on activity motives, perceived autonomy, and the extent to which exercise is integrated into daily routines as a self-directed versus role-constrained practice.

Even though this interpretation warrants caution since contextual variables were not explicitly quantified, these insights underscore a critical avenue for prospective research to investigate how extraneous demands, such as caregiving burden and time scarcity, might attenuate or shape the psychological benefits derived from exercise imagery.

At the same time, the more direct pattern observed in males may suggest that exercise imagery is more readily translated into mental health-related quality of life when it is linked to self-regulatory routines, competence-related motives, or psychologically meaningful forms of activity engagement. Although this interpretation remains tentative, explicit integration with gender and health psychology literature helps situate the present findings within broader evidence suggesting that the psychological effects of exercise may vary according to the reasons for participation and their relevance to quality of life across sexes [33].

Given these nuanced findings, future research should further explore mediating mechanisms—such as perceived competence, body image satisfaction, or emotion regulation—that might explain the differential associations between exercise imagery and health-related outcomes by sex. Additionally, longitudinal or experimental designs would offer clearer causal inferences regarding how exercise imagery interventions might alter behavioral and health trajectories over time. This study underscores the critical role of exercise imagery in promoting physical activity and enhancing health-related quality of life among community-dwelling adults. The results support a structural model in which exercise imagery exerts direct effects on both physical activity and health outcomes, with variations observed by sex. These findings highlight the value of integrating cognitive techniques such as exercise imagery into public health strategies aimed at improving physical and psychological well-being.

In particular, the use of exercise imagery may serve as a cost-effective, scalable intervention to enhance motivation and adherence to physical activity. Given the observed gender differences, tailored approaches may be warranted to optimize the effectiveness of exercise imagery-based interventions for different populations. Future research should further investigate the psychological pathways through which exercise imagery affects health and explore its utility in clinical and community health promotion contexts.

5 Limitations and Implications

5.1 Methodological Limitations

This study contributes significantly by empirically validating how exercise imagery, physical activity, and physical/mental health-related quality of life interconnect within a community-dwelling adult population; however, several limitations merit attention. First, because the data collection relied on a cross-sectional design, establishing clear cause-and-effect relationships or determining the direction of influence remains impossible. Although exercise imagery significantly predicted physical activity and health-related quality of life, future research should clarify how these associations unfold over time and whether reciprocal effects are present. Accordingly, the structural associations identified in the present SEM should be interpreted as theory-consistent patterns of association rather than as evidence of causal pathways.

Second, all measures were self-reported, which may introduce common method and recall biases. Physical activity was operationalized as a single MET score derived from a weekly leisure-time exercise questionnaire and may not align with objectively assessed activity (e.g., accelerometry). Health-related quality of life was modeled using the SF-36 physical and mental components; however, because the health transition item was excluded and analyses were based on 35 items, replication using alternative health-related quality of life measures or operationalizations is warranted.

5.2 Theoretical and Interpretive Limitations

First, the sample was limited to adults residing in northern Seoul (Nowon-gu), restricting generalizability. Moreover, the adult population is inherently heterogeneous, and the structural pathways observed in this study may differ across age-specific and baseline health-related subgroups. Although the present study accounted for sex-based differences, future research should move beyond binary sex-based comparisons and employ more deeply stratified or moderated models to better capture heterogeneity within adult populations.

Second, although multi-group structural equation modeling indicated sex-based differences in structural paths, potential mechanisms were not directly assessed. Ultimately, the lack of a prominent physical activity–mental health-related quality of life pathway within the global sample, contrasted with its sex-specific manifestation among males, strongly points toward the involvement of unaddressed mediating or moderating mechanisms (e.g., stress, sleep quality, baseline psychological status, caregiving responsibilities, and sociocultural expectations). Expanded models incorporating psychological and contextual factors (e.g., perceived competence, body image satisfaction, emotion regulation, social support, and exercise barriers) are needed to explain these differences.

5.3 Practical Implications

Notwithstanding these limitations, the findings offer practical implications for health promotion. Because exercise imagery was directly associated with physical activity and both health-related quality of life domains, integrating brief imagery training into community-based programs may be beneficial. Short scripts (2–5 min) or mobile audio/video guidance aligned with key exercise imagery domains (appearance–health, exercise feeling, exercise technique, exercise self-efficacy) could be delivered before, during, and after exercise to support motivation and adherence. Given the observed sex differences, interventions may also require tailoring; for females, combining imagery with components targeting stress, sleep, emotion regulation, and social support may strengthen mental health benefits, alongside formats that accommodate time constraints and caregiving demands.

6 Conclusions

The present study examined the structural relationships among exercise imagery, physical activity, and mental and physical health-related quality of life in community-dwelling adults. The findings showed that exercise imagery significantly predicted physical activity and was also a significant predictor of both physical and mental health-related quality of life. Physical activity, in turn, significantly explained physical health-related quality of life; however, its direct effect on mental health-related quality of life was not statistically significant in the overall sample. Multigroup analyses further suggested some group-specific differences in structural path patterns, highlighting the importance of examining possible sex-related variation in health promotion research and intervention design.

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Ethics Approval: The study protocol was approved by the Institutional Review Board of the Seoul National University of Science and Technology (IRB No. U2026-0099) and adhered to the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants prior to their participation.

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