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From Awareness to Action: The Influence of Daily Physical Activity Awareness on Health Beliefs, Intentions, and Physical Activity Levels

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Abstract

Many people perceive physical activity solely as structured exercise, overlooking the benefits of daily activities like walking for transportation. This study explores office workers' perceptions of physical activity and assesses an intervention to broaden their understanding of physical activity to include non-leisure contexts, providing a foundation for future health promotion programs. Study 1 included 20 office workers (12 males, 8 females; M_{age} = 35.4) who participated in in-depth interviews to explore their perceptions of physical activity. Study 2 included 30 office workers (experimental group: 9 males, 6 females, M_{age} = 32.8; control group: 5 males, 10 females, M_{age} = 29.6), randomly assigned to either an experimental or control group. The experimental group received an intervention to enhance their awareness of physical activity across four domains. In Study 1, participants primarily perceived physical activity solely as leisure and failed to distinguish between exercise and physical activity. In Study 2, participants in the experimental group reported an increase in perceived benefits and a decrease in perceived barriersrelated to physical activity. Both groups showed significant improvement in physical activity levels compared to pre-intervention, with a larger effect size in the experimental group (Cohen's d = 0.62) compared to the control group (Cohen's d = 0.34), indicating that enhanced awareness contributed to greater behavior change. Broadening the perception of physical activity can promote both intentions to engage in physical activity and actual physical activity levels. The findings highlight the value of developing intervention programs that clarify the domains of physical activity, providing a foundation for strategies to foster healthier lifestyles.

Key words: physical activity, leisure-time physical activity, non-leisure-time physical activity, social cognitive theory, health belief model

Introduction

Physical activity impacts physical health and mental and social well-being across all age groups. Regular physical activity promotes body weight maintenance and functional capacity, and it plays a crucial role in preventing chronic diseases (Mendes et al., 2019). Physical activity enhances mental health by reducing depression and anxiety, improving quality of life and motivation, and providing social benefits by increasing participation in social activities and reducing healthcare costs (Mendes et al., 2019). Low physical activity levels

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are directly associated with obesity (Silveira et al., 2022) and are a leading cause of non-communicable diseases and mortality (World Health Organization [WHO], 2018).

Despite the numerous benefits, physical activity continues to decline due to advancements in transportation and digital communication (Woessner et al., 2021). The World Health Organization (WHO) recommends that adults engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week (WHO, 2018). However, many adults worldwide fail to meet these guidelines. As of 2022, approximately 31.3% of adults worldwide did not meet these recommendations (Strain et al., 2024). In South Korea, data from 2023 indicate that 47.5% of adults fail to achieve the recommended levels of physical activity, highlighting a growing concern regarding sedentary lifestyles (Korea Disease Control and Prevention Agency [KDCA], 2023).

Additionally, the COVID-19 pandemic accelerated the decline in physical activity, as social distancing measures—such as remote work, virtual meetings, and increased reliance on delivery services—further reduced opportunities for daily movement (Woods et al., 2020). Consequently, sedentary time has increased, while the time allocated to physical activity has decreased (Pinto et al., 2020). Modern lifestyle changes, combined with factors such as lack of time, motivation, energy, economic difficulties, and limited access to exercise facilities, make it increasingly difficult for many people to maintain consistent physical activity levels (Hunter et al., 2018).

Among the barriers to physical activity, “lack of time” is frequently cited as a key obstacle worldwide (Hoare et al., 2017). However, this perception likely arises from a narrow view of physical activity, limited to leisure activities such as sports and exercise requiring dedicated time. This view overlooks that physical activity includes both leisure-time exercise and daily activities at work or home. To change the perception that “lack of time” is a valid excuse for not engaging in physical activity, it is essential to clarify and differentiate the concepts of physical activity and exercise and explore the various contexts in which physical activity occurs.

Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure (Caspersen et al., 1985). It encompasses a wide range of movements performed throughout daily life, regardless of purpose or intensity. Physical activity and exercise are often used interchangeably, but they are distinct concepts. Exercise is a subset of physical activity that is planned, structured, and repetitive, intended to improve or maintain physical fitness (Piggin, 2020). To better classify different forms of physical activity, the International Physical Activity Questionnaire (IPAQ) further categorizes it into four domains: occupational, domestic, transportation-related, and leisure-time activities (Table 1), covering both non-leisure time physical activity (NLTPA) and leisure-time physical activity (LTPA) (Craig et al., 2003; Hagströmer et al., 2006). Exercise falls within the LTPA category, as it is typically performed voluntarily for health and fitness purposes rather than as part of daily responsibilities. This classification helps differentiate between activities performed as part of daily responsibilities and those undertaken voluntarily for recreation or fitness.

Although physical activity can occur in various contexts, many people still perceive physical activity solely as LTPA, such as sports and exercise. This narrow understanding might lead to the misconception

Table 1. Examples of the four domains of physical activity (Craig et al., 2003)

Domain	Example
Occupational	Walking within the workplace and moving boxes
Domestic	Childcare, carrying groceries, and cleaning
Transportation	Commuting by subway and cycling to work
Leisure-time	Sports and exercise

that NLTPA is merely a basic daily necessity rather than an activity that can also contribute to improving physical and mental health. In South Korea, cultural and environmental factors may further reinforce this perception. For example, increasing reliance on shared mobility services, such as electric scooters, has reduced opportunities for walking or cycling for short-distance travel. According to industry reports, the number of shared personal mobility devices in South Korea increased from approximately 70,000 in 2020 to nearly 290,000 in 2023, marking a fourfold increase in just three years (Oh, 2024). Similarly, the growing prevalence of app-based delivery services, such as Coupang and Market Kurly, has significantly minimized the need for individuals to engage in physically active tasks such as grocery shopping or running errands. As of August 2024, Coupang's monthly active users reached approximately 31.83 million, a 10% increase from the previous year, reflecting a continuous rise in consumer reliance on delivery services (Yeon, 2024). As a result, opportunities for NLTPA have diminished, and the importance of incidental daily physical activity may be overlooked. Consequently, this limited view may contribute to ongoing difficulties in engaging in and sustaining regular physical activity. However, daily physical activities can also provide considerable health benefits. In fact, NLTPA can reduce the incidence of cancer (Garcia et al., 2023), prevent diabetes and obesity (Barlin & Mercan, 2016; Bolin, 2018), and contribute to a significant reduction in mortality rates (Lee et al., 2022). Beyond physical health, engaging in regular physical activity in daily life improves mental health by helping individuals temporarily forget stressful events, thereby enhancing subjective well- being (Biddle et al., 2019). For example, walking to work instead of driving can elicit positive emotions and promote mental health (White et al., 2017).

If we could begin to consciously consider the various physical activities we perform unconsciously in daily life as forms of exercise, it could motivate individuals to incorporate more physical activity into their routines, even in situation when time is limited owing to busy work schedules or household responsibilities. For instance, taking the stairs instead of the elevator could become a more common practice. However, there remains a lack of clear understanding regarding the distinction between exercise and physical activity (Lee, 2011). It is thus necessary to empirically explore how people perceive physical activity, and how well they understand the various domains and contexts in which it occurs.

This study explores the perceptions of physical activity among office workers, who typically lead sedentary lifestyles with low physical activity levels. Further, this study assesses the impact of an intervention designed to change these perceptions. Study 1 involved in-depth interviews using semi-structured questionnaires to investigate people's perceptions of physical activity, their awareness of different physical activity domains, and whether they can distinguish between exercise and physical activity. Study 2, building on the results of Study 1, implemented an integrative approach by introducing an intervention program to change participants' perceptions by emphasizing the significance of light physical activities performed unconsciously in daily life. The effectiveness of this intervention was then evaluated.

This study is expected to promote active workplace environments by expanding awareness of NLTPA and encouraging practical applications in office settings. Many employees spend most of their workday in sedentary positions, often perceiving physical activity as requiring dedicated time and effort. This research may support a shift toward more movement-friendly workplaces by helping individuals recognize the value of everyday movements, such as standing while working, walking short distances, or taking the stairs. Additionally, the study findings could inform corporate wellness initiatives, encouraging companies to explore strategies that integrate opportunities for movement into daily work routines. While awareness alone may not be sufficient to drive behavior change, fostering a culture that acknowledges the benefits of NLTPA could serve as a foundation for future workplace interventions aimed at improving employee well-being.

Study 1: Exploration of perceptions regarding the concept and domains of physical activity

In Study 1, in-depth interviews were conducted with office workers to explore their understanding of what constitutes physical activity, their awareness of the four domains of physical activity as defined by the IPAQ—workplace, household, transportation, and leisure-time—and whether they recognize the distinction between leisure-related physical activities and those that occur in daily life.

To date, no studies have directly examined people's perceptions of the concept and domains of physical activity. The prevailing tendency to attribute the inability to engage in physical activity to environmental or external factors, such as "lack of time," may be rooted in a limited understanding of physical activity. Specifically, this tendency might stem from the misconception that physical activity is confined solely to leisure activities, neglecting the broader spectrum of activities that occur daily. Therefore, this study aims to preliminarily explore office workers' perceptions of the concept and domains of physical activity.

Materials and Methods

Participants

Participants in this study were selected using purposive sampling, targeting office workers in companies located in the Seoul and Gyeonggi regions of South Korea who engage in minimal physical activity. A total of 20 participants were included in the study, with 12 males (60%) and 8 females (40%). The age distribution was as follows: 2 participants in their 20s (10%), 16 in their 30s (80%), and 2 in their 40s (10%), and the average age was recorded as 35.4 years.

Data Collection

Data collection occurred over approximately one month, and individual in-depth interviews were performed. Each interview lasted between 60 and 100 minutes and was conducted using a semi-structured questionnaire. An initial set of semi-structured interview questions was developed to explore how participants perceive and understand physical activity. A pilot interview was conducted to assess the suitability of these questions. The post-interview questions were refined based on feedback from the pilot interview and incorporating the opinions of one sports psychology professor and two Ph.D. holders in sports psychology. The final semi-structured interviews included questions about participants' awareness of physical activity, their physical activity levels, mood related to their activity levels, and the perceived necessity of physical activity (see Appendix A).

As all participants were office workers, the interviews were conducted remotely. The semi-structured questionnaire guided the interviews, with the researcher adjusting or adding questions based on participants' responses. The interview content was audio-recorded with participants' consent, and the raw data were transcribed into written documents. Following the initial interviews, additional interviews were conducted if necessary to supplement and verify the collected data.

Data Analysis and Ensuring Trustworthiness

The inductive categorical system method was used to analyze interviews, which involves categorizing recurring themes and patterns identified in the interviews, allowing for the integration of participants' experiences and the derivation of general concepts from the data.

To enhance the validity and ensure trustworthiness, the recorded interview content was transcribed digitally. The transcribed text was then thoroughly reviewed multiple times to identify key themes and relevant content. An initial coding process was conducted to identify recurring words and content within the data. These initial codes were then grouped into broader themes through thematic analysis, focusing on similarities and relationships among the identified patterns. Based on these relationships, higher-order categories were established to reflect the underlying structure of the data, and the data were categorized accordingly. The final categories were determined through discussions among peers and consultations with experts.

To ensure the trustworthiness of the data, advice was sought from a sports psychology professor with extensive experience in qualitative research and a doctoral candidate throughout the entire research process. Their advice included guidance on the development of interview questions, assistance in the categorization process, and feedback on data interpretation to enhance the accuracy and reliability of the findings. Additionally, peer debriefing was employed to prevent errors arising from researcher bias during the data analysis and interpretation phases. To further ensure the accuracy and reliability of the analysis, member checking was conducted, wherein the participants reviewed the derived analyses and interpretations to identify and correct any potential errors or distortions that could have occurred during the analysis process.

Results

Awareness Toward Physical Activity

Participants primarily perceived physical activity as leisure-related, overlooking the first three IPAQ domains. Most participants struggled to distinguish between exercise and physical activity. Although the concepts of physical activity and exercise are distinctly different, most participants understood physical activity broadly as “exercise.” While some could differentiate between exercise and physical activity, they still held misconceptions.

> “When you say physical activity, do you mean exercise? I am not exactly sure what the difference is. Isn't it the same thing?” (Participant F)

> “Difference between physical activity and exercise? Well…I am not really sure what the difference is…” (Participant J)

> “Since activities that involve the use of the body are considered exercise, I think they are the same thing.” (Participant B)

> “I think the difference between physical activity and exercise depends on the number of calories burned. I believe that exercise generally involves more intense activities that burn more calories compared to physical activity.” (Participant T)

Owing to a lack of awareness regarding physical activity, no participants consciously engaged in it as an intentional effort, like exercise, within their daily routines. Most engaged in physical activity unconsciously, primarily through structured routines centered around commuting.

> “Physical activity? I have never consciously thought about doing it. After all, the only movement I do every day is commuting to work. Even when I go somewhere far, I drive, so I wouldn’t really consider it physical activity.” (Participant F)

> “I have never consciously thought about doing physical activity. It might differ slightly depending on my work pattern, but it is hard to say that I do it consciously. It is just something I do because I have to, not something I would consider exercise.” (Participant A)

Awareness of the Necessity of Physical Activity

Most participants saw physical activity as leisure and used the term interchangeably with exercise. However, they were acutely aware of its necessity.

> “Well…it is important because physical activity makes me healthier and less prone to diseases.” (Participant D)

> “While there are health benefits to physical activity, I think it also plays a crucial role in enabling me to fulfill my responsibilities at work and home. In that sense, physical activity seems to be directly related to my survival.” (Participant H)

Participants' perceived necessity of physical activity varied slightly, but it could generally be categorized into physical and psychological needs. Most participants noted that physical activity is crucial in maintaining health and preventing diseases. Many viewed it as a minimum measure or essential for health maintenance.

> "I have a family history of certain conditions. Physical activity helps me manage my blood pressure and blood sugar, so I try to do it regularly. Engaging in physical activity also makes me feel psychologically healthier." (Participant J)

> "I have a straight neck, so when I work late or sit for long periods, the pain becomes worse. When I went to the hospital, the doctor recommended physical activities like walking and stretching as part of my treatment. That made me realize how beneficial physical activity can be." (Participant K)

Further, they noted that physical activity offers psychological benefits in addition to its physical effects. Participants noted that physical activity enhanced their mood and vitality.

> "When I do not exercise, I feel less efficient at work, gain weight, and suffer from poor digestion, which really puts me in a bad mood. I definitely feel better when I exercise regularly." (Participant C)

> "When I engage in physical activity, I feel much better compared to just staying at home. How should I describe it? It feels like a refreshing change, as if both my body and mind are recharged from the weariness of daily life." (Participant L)

Participants mainly considered physical activity as sports and exercise, which correspond to the fourth IPAQ category. This suggests that participants mainly identified physical activity as leisure, making it difficult for them to differentiate between physical activity and exercise. Despite the lack of a clear distinction between physical activity and exercise, participants recognized the necessity of physical activity.

Study 2: Exploration of changes in health beliefs, intentions, and physical activity levels based on perceptions of daily physical activity

Based on the findings from Study 1 and the clear conceptual distinctions regarding the domains of physical activity, Study 2 examined how changes and increases in the perception of daily physical activity influence health beliefs related to physical activity, particularly perceived benefits and barriers. Further, this study investigated how these perceptions affect intentions and the actual practice of physical activity.

The social cognitive approach emphasizes the "cognitive/conscious" aspects of physical activity perceptions (Rhodes et al., 2019). The health belief model, a representative theory following this approach is widely used for understanding and predicting individual health behaviors (Rosenstock et al., 1994). According to this model, people's health-related behaviors are determined by a complex interplay of perceptions regarding how valuable the behavior is and the likelihood of achieving it (Champion & Skinner, 2008). Among various health-related beliefs, perceived benefits and barriers are the most powerful predictors of diverse health-related behaviors (Carpenter, 2010). This suggests that if people perceive that physical activity provides them with numerous benefits and that engaging in physical activity can help overcome the barriers that previously hindered their physical activity, it can contribute to improving their physical activity beyond just the evaluative dimension of this health behavior. Therefore, efforts to instill the perception that naturally occurring physical activity can be as valuable as exercise could reduce the barriers people feel toward physical activity and serve as a foundational academic resource for designing intervention strategies and policies to enhance actual physical activity levels.

Materials and Methods

Participants

Participants were purposively sampled from 30 office workers in the Seoul and Gyeonggi regions of South Korea who typically engage in little to no physical activity. Recruitment was conducted by posting advertisements in online communities for Korean office workers. Participants' physical activity levels were assessed through self-reported measures during the recruitment process. The criteria for physical activity levels were based on the WHO's recommended guidelines for adults, which suggest at least 150 minutes of moderate-intensity or 75 minutes of vigorous-

intensity physical activity per week. Individuals who did not meet these criteria were selected as the final participants. Fifteen participants were randomly assigned to the experimental group, and the remaining fifteen were assigned to the control group. To prevent any interaction between the experimental and control groups, participants were recruited individually, ensuring no opportunities for cross-group communication. The average age of the experimental group was 32.8 years (M = 9, F = 6), while the average age of the control group was 29.6 years (M = 5, F = 10). Detailed demographic characteristics of the sample are presented in Table 2.

Research Design and Procedure

This study employed a mixed-methods approach, combining a quasi-experimental design with qualitative interviews, to explore how perceptions of daily physical activity influence participants' health beliefs and intentions regarding physical activity. The integration of qualitative and quantitative methods was crucial in addressing both cognitive and behavioral aspects of physical activity engagement. Specifically, qualitative interviews allowed for an in-depth exploration of participants' perceptions, beliefs, and intentions, while step count data provided an empirical measure of actual behavioral change. This approach aligns with established theoretical frameworks such as the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB), which emphasize that understanding health beliefs and intentions alone is insufficient without examining their actual influence on behavior. By integrating these methods, this study sought to provide a comprehensive perspective on how changes in perception translate into measurable increases in daily physical activity. The experiment was conducted over four weeks. Before the study began, a preliminary survey was conducted using structured questionnaires through telephone interviews. After the first two weeks, a mid-point interview was conducted. For the experimental group, additional information was provided on the concept and domains of physical activity, to raise awareness of non-leisure contexts of physical activity. Following the mid-point interview, participants in the experimental group received additional, structured information aimed at

Table 2. Participants' demographic characteristics

Characteristic	Category	Experimental group (A)		Control group (B)	
		n	%	n	%
Gender	Male	9	60	5	33
	Female	6	40	10	67
Age	20s	6	40	8	53
	30s	9	60	7	47
Type of residence	Apartment	10	67	5	33
	Multi-family housing	3	20	4	27
	Studio	2	13	6	40
Marital status	Married	9	60	7	47
	Single	6	40	8	53
Living arrangement	Alone	3	20	4	27
	With parents	3	20	4	27
	With parents and siblings	0	0	0	0
	With spouse	3	20	5	33
	With spouse and children	6	40	2	13
Commuting method	Personal vehicle	6	40	1	7
	Public transportation	7	47	13	87
	Personal vehicle/public transportation	1	7	0	0
	Walking	1	7	1	7
Total		15	100	15	100

enhancing their understanding of the health benefits of daily physical activity. This intervention included the distribution of carefully selected articles and summaries of recent research findings highlighting the positive impacts of regular physical activity on both physical and mental health (see Appendix C). Specifically, materials covered topics such as the role of physical activity in preventing chronic diseases like cardiovascular disease and diabetes, improving mental well-being by reducing stress and anxiety, and enhancing overall life satisfaction and quality of life. To reinforce the relevance of NLTPA, examples were provided on how routine activities—such as commuting on foot, taking the stairs, and completing household chores—can contribute to daily physical activity goals. Participants were encouraged to reflect on how these activities align with exercise, emphasizing that NLTPA can also yield significant health benefits. Additionally, the importance of consistency in incorporating movement into daily routines was underscored, and practical tips for increasing physical activity in manageable ways were shared. This approach aimed to help participants build a more comprehensive view of physical activity, fostering a sustained intention to stay active beyond traditional exercise contexts. A post-interview was conducted after all experimental activities. The timing, specific content, and methods of the experiment are detailed in Table 3.

Participants' physical activity levels were tracked alongside shifts in their perceptions. This was measured by daily step counts, a basic unit of human movement and a commonly used metric for measuring physical activity (Basset et al., 2017). Step count data were collected daily via text message for the four weeks

Table 3. Research content and specific implementation method

Content	Method	
Pre-interview & Introduction to the experiment	• The demographic characteristics, perceptions toward physical activity, intentions, and health beliefs were investigated using a pre-interview questionnaire. • An overview of the study's purpose, method, duration, and other details is provided to ensure clarity and understanding.	
Installing the application	• The instructions for installing the mobile application for smartwatch and smartphone synchronization were provided.	
Recording and reporting daily step counts	• Participants were asked to record their daily step counts during the week for two weeks. • Participants were asked to report the recorded number of steps each day to the researcher. • Perceptions toward physical activity, intentions, and health beliefs were investigated using a mid-study interview questionnaire.	
Mid-interview & Intervention	Experimental group	Control group
	• Participants were provided with information on physical activity and the four domains covered in the IPAQ. • Information was provided to participants on how daily physical activity in IPAQ domains 1, 2, and 3—which represent non-leisure time physical activities—can have similar effects as exercise.	• Participants were requested to diligently continue with the experiment for the remaining two weeks without any additional interventions.
Recording and reporting daily step counts & Intervention	Experimental group	
	• Participants were asked to record and report their daily step counts for two weeks. • Information such as articles or research findings related to the benefits of practicing daily physical activity was provided to participants.	
Post-interview	• Participants' awareness of physical activity levels, experiences and reflections after four weeks of experiment participation, future plans related to physical activity, and changes in health beliefs based on awareness of daily physical activity were investigated through a post-interview.	

Note. Specific interview questions are provided in the appendix

starting from the beginning of the experiment. Each morning, step count data from the previous day was collected via text message. During this process, participants were reminded to wear their smartwatch and record their step count for the day. Weekend data were excluded as travel and personal hobbies could significantly affect step counts. If participants did not wear the smartwatch or failed to record their step count on certain days accurately, additional step count data was collected on weekdays after the scheduled end date of the experiment. Before starting the study, participants were informed about the purpose, methods, duration, and potential use of the results. Their consent to participate was obtained before proceeding with the research. We transcribed all recorded materials from the interview process and stored them as Word documents.

Measurement

Physical activity level. The number of steps per day was set as an indicator of physical activity, and a smartwatch (Polar Pacer; Polar Electro Oy, Finland) was used to measure this. The experimental and control groups were asked to wear a smartwatch at all times except for sleeping or showering. Participants reported their daily step count to the researcher via "Polar Flow."

Interview questionnaire. Three interviews (pre-, mid-, and post-intervention) were conducted to explore participants' experiences. The interview questionnaire was structured based on previous research to measure participants' perceptions of physical activity and its changes. The common questions in the interview were consistently asked across the pre-interview, mid-interview, and post-interview to track changes over time. (see Appendix B).

a. Pre-interview

The pre-interview questionnaire comprised common questions and background questions to understand participants' initial perceptions and demographic characteristics before the study began. The common questions explored participants' general perceptions of physical activity, including their understanding of physical activity, distinctions between exercise and physical activity, and related health beliefs. The background questions collected demographic information, such as name, age, gender, cohabitation details, and commuting methods, providing a baseline for comparing responses in later stages of the study.

b. Mid-interview

The mid-intervention interview used only the common questions, focusing on participants' perceptions of physical activity, health beliefs, and intentions to engage in physical activity.

c. Post-interview

After the end of the four-week study period, a post-interview was conducted. This interview included common questions to track change across all interviews and additional questions specifically designed for the post-interview. These additional questions explored the effects of participating in the experiment, participants' reflections on the study, the impact of external compensation, and plans for physical activity. Specifically, they were encouraged to share their experiences with physical activity and their intentions for incorporating it into their future routines.

Data Analysis

Quantitative data. Quantitative data were analyzed using IBM SPSS (Statistics 25.0, IBM Corp., Armonk, NY, USA). First, a frequency analysis was conducted to identify participants' general characteristics. The number of steps before transformation showed right-skewed skewness and positive kurtosis, making it difficult to assume normality. Therefore, the number of steps was log-transformed to adjust the skewness and meet the assumption of normality. An independent samples t-test was conducted using the transformed step data to test the homogeneity of pre- and post-intervention steps between the experimental and control groups. Additionally, a paired t-test was performed to

examine the effect of changes in perception of physical activity. The significance level for all statistical analyses was set at .05. Lastly, effect size (ES) statistics were computed for all t-ratios that reached statistical significance to better understand the step count differences between the experimental and control groups. These calculations followed Cohen's guidelines, which define a small effect size as $0.2 \leq d < 0.5$, a moderate effect size as $0.5 \leq d < 0.8$, and a large effect size as $d \geq 0.8$ (Cohen, 2013). Understanding the effect size allowed us to estimate each significant analysis's power (%).

Qualitative data. The inductive categorical system method was used to analyze interviews. Throughout the entire research process, consultations were sought from one professor of sports psychology with extensive experience in qualitative research and one doctoral student. Peer debriefing was employed to analyze and interpret the research data. This approach was used to prevent errors owing to researcher bias and to ensure objectivity.

Results

Quantitative Data

Descriptive statistics. The means of the number of steps for each group pre- and post-intervention are shown in Table 4. The Shapiro–Wilk p-value for the pre-intervention mean number of steps in the control group was .020, indicating that the normality assumption was not met. Therefore, the step data were log-transformed, and all data met the normality assumption.

Change in physical activity level. To examine the homogeneity of the number of steps pre- and post-intervention between the experimental and control groups, an independent samples t-test was conducted (Table 5). The results showed no significant difference in the number of steps between the experimental and control groups pre-intervention ($t = 1.590$, $p = .123$).

To investigate changes in physical activity levels, a paired samples t-test was conducted using the collected step data (Table 6). The analysis revealed

Table 4. Descriptive statistics of step counts before and after log transformation

		Group	M	SD	Shapiro–Wilk	
					W	*p*
before	Pre	EG	8914.20	2753.75	.901	.098
		CG	7579.54	3004.72	.854	.020
	Post	EG	10705.21	2963.39	.924	.222
		CG	8431.68	2824.26	.921	.196
after	Pre	EG	8.997	.302	.896	.083
		CG	8.786	.419	.949	.515
	Post	EG	9.197	.281	.934	.312
		CG	8.912	.375	.955	.599

Note. EG = experimental group; CG = control group

Table 5. Results of the homogeneity test for the step counts before treatment

	EG	CG	Shapiro–Wilk		Levene's test		t	*p*
	Mean (SD)	Mean (SD)	W	*p*	F	*p*		
Pre	8.997 (.302)	8.786 (.419)	.968	.497	3.078	.090	1.590	.123

Note. EG = experimental group; CG = control group

Table 6. Results of the test for differences in the step counts and effect size of the intervention

	Pre	Post	Shapiro–Wilk		t	*p*	Cohen's *d*	95% CI
	Mean (SD)	Mean (SD)	W	*p*				
EG	8.997 (.302)	9.197 (.281)	.972	.888	6.48	< .001	0.62	[0.42, 0.83]
CG	8.786 (.419)	8.912 (.375)	.922	.208	2.21	.044	0.34	[0.03, 0.63]

Note. EG = experimental group; CG = control group

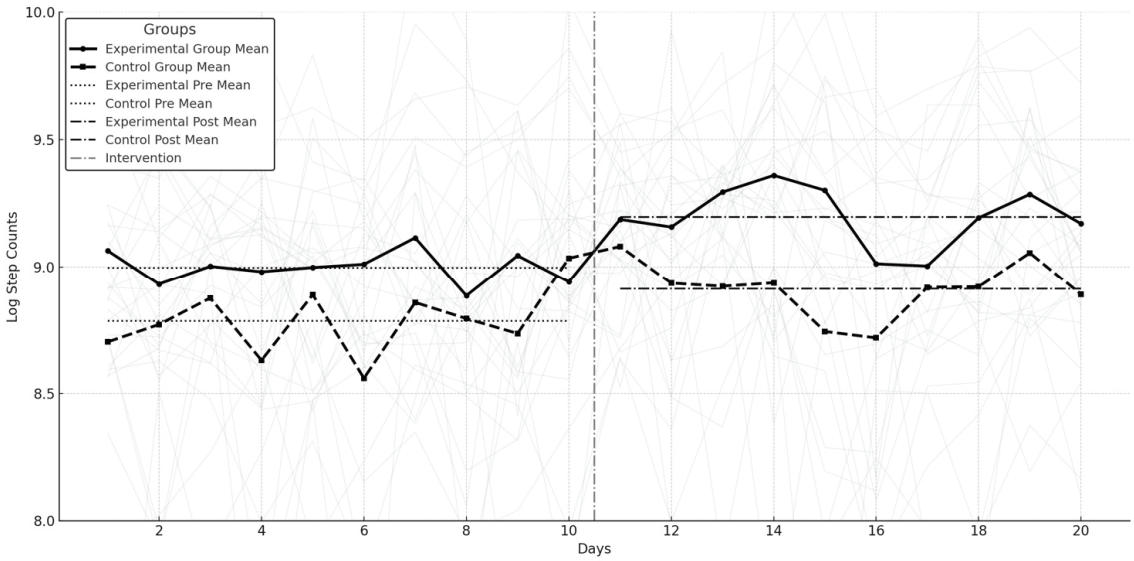

Figure 1. Trends in Average Step Counts for the Experimental and Control Groups.

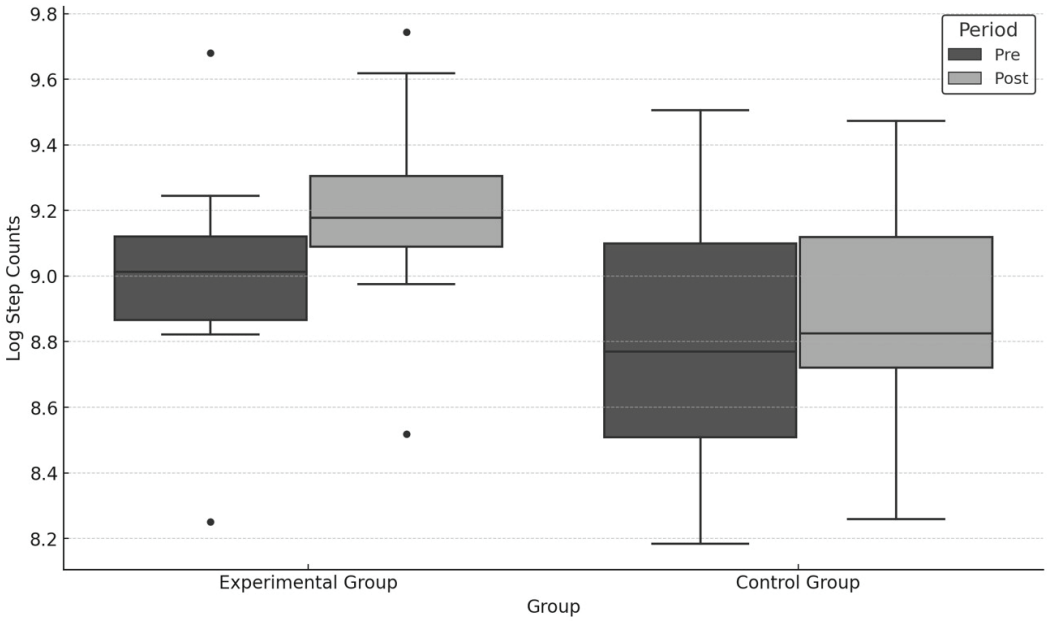

Figure 2. Box Plot of Pre and Post Intervention Step Counts by Group.

that the difference in the number of steps pre- and post-intervention in the experimental group was significant (t = 6.18, $p < .001$), with a medium effect size (Cohen's d = 0.62, 95% CI [0.42, 0.83]). The control group also showed a significant difference in steps pre- and post-intervention (t = 2.21, $p = .044$), but relatively with a small effect size (Cohen's d = 0.34, 95% CI [0.03, 0.63]).

Qualitative Data

Change in perception of physical activity. The control group (Group B) showed no significant change in their perception of physical activity and exercise. All participants felt that physical activity was necessary for health management, but they primarily recognized only the part of physical activity related to leisure, which corresponds to the fourth category of the IPAQ. No significant differences were found between the pre-interview and the post-interview.

> "There was no significant change in perception regarding the difference between physical activity and exercise. I do have the desire to set aside time to exercise, but I don't have a concrete plan on how to start yet." (Participant K from Group B)

Participants in the experimental group (Group A) initially tended to think of physical activity in the same way as LTPA, corresponding to the fourth category of the IPAQ, just like the control group. However, through participation in the experiment, they began to newly recognize the difference between physical activity and exercise, clearly distinguishing between the two.

> "When I think of exercise, it feels like something that requires significant preparation, which made it hard to start. But physical activity, like brisk walking or walking for a long time, can be done without any preparation and feels lighter, which I found to be enjoyable." (Participant B from Group A)

> "I realized that by perceiving physical activity as exercise and making an effort, I could achieve much more activity. During the experiment, I even walked distances that I would usually take a taxi for, and I felt like I was exercising through physical activity." (Participant Y from Group A)

Additionally, the final interviews revealed that the change in perception regarding physical activity extended to efforts to increase physical movement in daily activities. This revealed a difference between participants who viewed physical activity solely as leisure and those who recognized the other domains.

> "At first, I was just going through the motions without much thought, but after the mid-interview, I realized that physical activity doesn't just mean exercise-it also includes everyday activities. This realization deepened my understanding of physical activity. After setting a goal of around 20,000 steps, I started walking more, and as I found it enjoyable, I lost weight and noticed an increase in calorie consumption, which may be due to an increase in my basal metabolic rate. This motivated me to continue consistently." (Participant B from Group A)

> "I never really considered walking to be exercise. But after participating in the experiment, I realized that walking and even unconscious movements in daily life are physical activities that can have the benefits of exercise. So I started to count my walks as part of my exercise routine." (Participant K from Group A)

Change in health beliefs. As the scope of perception regarding physical activity expanded, participants in the experimental group experienced changes in their health beliefs. All participants in this group reported that their perception of physical activity had changed, and they recognized that consciously and consistently engaging in physical activity, just like exercise, could have the same benefits for disease prevention and maintaining a physically and psychologically healthy life. They stated that the time and space barriers they previously associated with exercise had diminished.

a. Perceived benefits

First, all participants in the experimental group

evaluated physical activity as beneficial for disease prevention.

> "I believe that consistently engaging in physical activity is beneficial for disease prevention, as it helps improve basic physical fitness and prevents muscle loss."

> "As I engage in physical activity, I feel that my body becomes healthier, and the continued activity seems to lead to weight loss. Since there is a connection between disease and obesity, I believe that consciously and consistently doing physical activity helps in preventing diseases, as well." (Participant P from Group A)

They also responded that consciously and consistently engaging in physical activity, just like exercise, helps maintain a physically healthy life.

> "When I intentionally took the stairs after work, I felt that moving more than usual was beneficial to my physical health, and I actually started to feel much healthier." (Participant S from Group A)

Participants in the experimental group also noted that intentionally planning and performing daily physical activities, just like exercise, helps maintain a psychologically healthy life.

> "Just as the saying goes, 'A healthy body leads to a healthy mind,' I believe that putting this idea into action has greatly helped me maintain not only physical health but also a psychologically healthy life." (Participant B from Group A)

> "I believe that consistently engaging in even a little physical activity helps not only with physical health but also with mental well-being and stress relief." (Participant H from Group A)

b. Perceived barriers

Realizing that daily physical activity can have the same benefits as exercise can help individuals overcome barriers like time and space constraints, lack of physical fitness, and lack of motivation.

> "Physical activity is something I can do with a relatively light mind, which makes it easier to carry out. Instead of setting aside specific time to exercise, I find it helpful to do things like take a walk around the block before going home or get off the subway a stop early and walk. It feels like physical activity lowers the barriers to exercise significantly." (Participant B from Group A)

Change in intentions toward physical activity. In the control group, in which changes in perception were relatively minimal, the post-interviews revealed that participants did not recognize the benefits of physical activity. There was also no notable change in their intentions toward engaging in physical activity.

> "My level of physical activity hasn't increased compared to before, and since I don't know how much I need to walk to see physical or psychological benefits, I didn't have much motivation. I plan to maintain my current level of physical activity without any significant changes in the future." (Participant S from Group B)

In the experimental group, changes in perception of physical activity and health beliefs were observed, and an improvement in intentions toward future physical activity was also evident after participating in the experiment.

> "I found it really encouraging that I could achieve the benefits of exercise without setting aside extra time or spending money. Moving forward, I plan to maintain my fitness through physical activity as I've been doing, and I've also developed an interest in exercise, so I'm planning to explore it more." (Participant C from Group A)

General Discussion

Global research trends show distinctions between LTPA and non-LTPA (NLTPA). For instance, Lin et al. (2011) examined the relationship between NLTPA and longevity, and Chen et al. (2012) examined the association between LTPA, NLTPA, and depression, demonstrating that physical activity is not confined merely to exercise or sports engaged in during leisure

time. Particularly in the United States, there has been extensive research on the levels of LTPA and NLTPA across various ethnicities and age groups (Afable-Munsuz et al., 2010; Kandula & Lauderdale, 2005; Wen et al., 2013; Zan & Fan, 2018), along with efforts to develop corresponding physical activity guidelines (Martinez et al., 2011). This indicates that research in the various domains of physical activity is being actively pursued. By contrast, in South Korea, most studies have been conducted either without clearly distinguishing between different domains of physical activity or have been predominantly focused on leisure-time physical activities such as exercise or sports. This suggests that domestic researchers' perceptions of physical activity are still largely focused on LTPA, such as exercise or sports. Therefore, this study approached physical activity by distinguishing it into LTPA and NLTPA. To achieve the study objectives, Study 1 explored the perceptions of sedentary office workers regarding the overall concept of physical activity and its various domains. Study 2 then examined how the expansion and changes in perceptions of physical activity influenced health beliefs, intentions regarding physical activity, and the actual physical activity levels.

Study 1: Exploration of perceptions regarding the concept and domains of physical activity

In Study 1, the aim was to investigate how individuals generally perceive physical activity. First, an examination of participants' perceptions of the domains of physical activity revealed that all participants recognized only leisure-time physical activities, which correspond to the fourth domain of the IPAQ, as physical activity. Although a considerable portion of modern people's physical activity is conducted through NLTPA such as household chores, walking, or commuting via public transportation (Bates et al., 2005), most participants did not consider these activities as physical activity. This implies the possibility that participants may not have fully considered the potential benefits that could be gained from increasing or utilizing NLTPA. This study also revealed that participants, who primarily recognize physical activity in the context of leisure, struggle to differentiate between physical activity and exercise. This finding aligns with previous research, which indicates that people often do not clearly distinguish between the concepts of physical activity and exercise (Lee, 2011). These findings suggest that most domestic research is still predominantly focused on LTPA, which may have contributed to the incomplete or unclear understanding of physical activity among the general population.

Nevertheless, people recognized the necessity of physical activity in various aspects. They recognized that physical activity helps maintain health and prevent diseases by regulating blood pressure and blood sugar levels. They also understood that it plays an important role in improving mood. Thus, even if they are not consciously or deliberately engaging in physical activity, they still recognize its importance.

Study 2: Exploration of changes in health beliefs, intentions, and physical activity levels based on perceptions of daily physical activity

Study 2 examined whether changes in individuals' perceptions of daily physical activity could lead to shifts in health beliefs, intention toward physical activity, and improvements in activity levels. First, regarding changes in health beliefs, most participants in the experimental group responded that a shift in their perception of physical activity led them to believe that engaging in daily physical activities could be sufficient to prevent diseases and support a physically and psychologically healthy life. This finding highlights participants' recognition of the perceived benefits factor within their health beliefs related to physical activity. Additionally, several participants responded that they felt they could overcome various barriers that they previously perceived as obstacles to exercising, such as lack of time and limited access to facilities, by engaging in daily physical activities. This suggests that knowing that daily physical activities can be as structured and systematic as traditional exercise

significantly helped reduce the psychological distance previously felt toward exercise. Particularly, since perceived barriers are a key predictor of health behaviors (Carpenter, 2010; Harrison et al., 1992), expanding the understanding of physical activity to encompass daily activities can help address spatial and temporal obstacles that were previously seen as major barriers to exercise and contribute to increasing overall physical activity level.

Second, the expansion of perceptions regarding physical activity positively influenced both the intention to engage in future physical activity and the actual level of physical activity. Initially, participants in the control group who did not recognize daily physical activities, corresponding to domains 1, 2, and 3 of the IPAQ, as physical activity, perceived the need for physical activity to maintain a healthy life. However, they viewed physical activity as requiring specific time and place, and as demanding in terms of physical effort, making it seem like an insurmountable barrier. Consequently, this perception prevented them from forming intentions to engage in physical activity. By contrast, participants in the experimental group expanded their perception of physical activity beyond just sports and exercise to include daily movements such as those at home, during transportation, and at work. This shift in understanding also led to changes in health beliefs and the formation of positive intentions toward future physical activity participation. Specifically, the recognition that daily physical activities can provide benefits similar to those of structured exercise helped reduce perceived barriers and enhanced the awareness of perceived benefits. This change in perception ultimately contributed to an increase in the intention to engage in physical activity. Considering prior research that suggests the likelihood of initiating and maintaining health-promoting behaviors, such as physical activity, increases when perceived benefits are high and perceived barriers are low (Rosenstock, 1974), it is anticipated that the changes in health beliefs related to physical activity observed in the experimental group will positively influence their actual engagement in physical activity as well (Conner, 2020; Janz & Becker, 1984; Rosenstock, 1974).

Third, both the experimental and control groups showed significant improvement in step count compared to pre-intervention; however, the effect size differed between groups. The experimental group demonstrated a moderate effect size, indicating a meaningful increase in physical activity that suggests the intervention effectively raised awareness and intention toward daily physical activity. In contrast, the control group showed a small effect size, implying a more limited change in physical activity levels. This result indicates that the improvement in physical activity intentions led to actual behavior changes, highlighting the importance of enhancing perceptions of physical activity. However, when interpreting the results of the increased step counts, it is difficult to completely rule out the possibility that factors other than the intervention may have influenced the outcomes. In particular, while both the experimental and control groups showed improvements in step counts, the significant increase observed in the control group, which did not receive any intervention, suggests the potential involvement of uncontrolled factors. One possible factor to consider is the effect of self-monitoring. The process of recording and reporting step counts tracked by the smartwatch may have influenced the step counts in both groups. The self-monitoring effect may have helped participants increase their awareness of progress and behavioral patterns, facilitating behavior change (Butryn et al., 2020). The smartwatch used in this study to measure physical activity allowed for real-time, continuous monitoring of physiological indicators such as physical activity and heart rate, and also provided personalized feedback based on set activity level goals (Reeder & David, 2016). As participants wore the smartwatch throughout the experimental period, both the experimental and control groups commonly reflected on their physical activity levels and expressed a greater commitment to increasing their activity. This aligns with previous studies suggesting that smartwatches significantly help enhance users' awareness of their physical activity status, thereby contributing to increased physical activity levels (Lee & Kwon, 2019; Chun et al., 2018).

Academic & Practical Implication

This study's integration of qualitative and quantitative findings highlights the value of a mixed-methods approach in understanding physical activity behavior. While step count data provide an objective measure of behavior change, qualitative findings offer insight into the cognitive and motivational processes underlying these changes. This approach allows for a more comprehensive examination of how individuals not only engage in physical activity but also interpret and integrate it into their daily lives. A key contribution of this study is its emphasis on perceptual expansion as a potential mechanism for behavioral engagement. The findings suggest that broadening the conceptualization of physical activity beyond structured exercise to include daily movement may encourage more consistent engagement in physical activity. Traditional interventions often focus solely on increasing physical activity levels through structured exercise programs, yet this study demonstrates that shaping individuals' perceptions and intentions can also influence engagement. By integrating subjective experiences with objective measures, this study underscores the importance of addressing both cognitive and behavioral dimensions in physical activity interventions.

Furthermore, this mixed-methods approach provides a deeper understanding of why and how participants modify their activity patterns. The step count data confirm that behavioral engagement increased, while the qualitative data reveal the psychological shifts that may have contributed to this change.This aligns with previous research suggesting that a strong intention and belief in the benefits of physical activity are essential precursors to sustained behavior change (Conner, 2020; Janz & Becker, 1984; Rosenstock, 1974).

Encouraging physical activity is a key public health priority worldwide, yet engagement patterns vary across cultural and societal contexts. Despite growing awareness of its benefits in South Korea, participation in structured exercise remains low, while sedentary time continues to rise (KDCA, 2021; WHO, 2018). A major challenge is the strong emphasis on high-intensity exercise over incidental movement, with cultural perceptions associating physical activity primarily with intentional workouts or sports participation. Moreover, technological advancements and urban infrastructure—including efficient public transportation and widespread delivery services—have further reduced opportunities for NLTPA, reinforcing sedentary behaviors. These factors create barriers that limit engagement in movement outside of structured exercise. To address these challenges, this study sought to expand perceptions of physical activity domains through a structured intervention. The findings highlight the importance of raising awareness of NLTPA alongside structural support in workplace settings. Recognizing the value of NLTPA helps individuals integrate everyday movements—such as walking during commutes, standing while working, or taking the stairs—into their perception of health-promoting behaviors. However, awareness alone is insufficient; companies must also cultivate environments that encourage movement throughout the workday.

The study suggests that combining education with workplace modifications is particularly effective in promoting NLTPA. Employee programs, such as workshops and informational sessions, can help reframe physical activity beyond structured exercise, while workplace-wide communication strategies—including newsletters, posters, and digital prompts—can reinforce the importance of daily movement. Additionally, workplace design changes—such as sit-stand desks, positioning shared resources farther from desks, and integrating standing or walking meetings—can help mitigate prolonged sedentary behavior.

By demonstrating the impact of expanding physical activity perceptions and reducing perceived barriers, this study provides actionable insights for corporate wellness programs and workplace health policies. A combined approach—raising awareness and fostering a movement-friendly environment—can make physical activity a natural and sustainable part of employees' daily lives, contributing to broader efforts to reduce sedentary behavior and improve long-term health outcomes.

Conclusion and Recommendation

When participants were asked about the concept and domains of physical activity, their responses generally focused on leisure-time physical activities such as exercise and sports. Consequently, unlike the control group, participants in the experimental group expanded their understanding of physical activity beyond the narrow scope of LTPA to include physical movements that naturally occur in non-leisure contexts like at work, during commuting, and at home. This broader perception of daily physical activities increased perceived benefits, reduced perceived barriers, positively impacted the intention to participate in physical activity, and improved physical activity levels.

Based on the insights gained from conducting this study, the limitations and suggestions for future research are as follows. First, this study relied primarily on qualitative data to examine the impact of daily physical activity perception on health beliefs and intentions, with step count as the only quantitative measure. The absence of additional objective physiological and behavioral indicators, such as heart rate, the Global Physical Activity Questionnaire (GPAQ), or the International Physical Activity Questionnaire (IPAQ), limits the ability to draw more robust conclusions about these effects. Therefore, future research should incorporate a wider range of quantitative assessments to enhance the reliability of findings and provide stronger empirical support for the relationship between physical activity perceptions and behavioral outcomes.

Second, the study was conducted with a relatively small sample size and within a limited age range (20s–40s), which may affect the broader applicability of the findings. A larger and more diverse sample would allow for more statistically robust analyses and better representation of different demographic groups. Additionally, physical activity patterns and perceptions may vary across developmental stages and environmental contexts, meaning that findings from this study may not fully apply to adolescents or older adults. Future research should include a wider range of age groups and larger participant pools to explore how NLTPA perceptions and behavioral responses differ across populations.

Third, both the experimental and control groups may have naturally experienced the effects of self-monitoring by using smartwatches to record their physical activity levels during the study. This potential self-monitoring effect could have contributed to the significant increases in step count observed in both groups in the quantitative data. Therefore, future research should consider methods to control for the effects of self-monitoring to ensure that changes in step count can be more clearly attributed to shifts in physical activity awareness within the experimental design.

Fourth, the short duration of the study may have influenced the stability of the observed effects. While the findings indicate that expanding perceptions of NLTPA positively impact health beliefs and physical activity levels, it remains unclear whether these changes persist over time. A longer intervention period would help assess the sustainability of perception shifts and behavioral adaptations, reducing the potential for short-term fluctuations. Future studies should implement extended observation periods to evaluate the long-term impact of NLTPA awareness expansion and ensure that behavioral changes are maintained beyond the study period.

Lastly, this study demonstrates that raising awareness of daily physical activity positively affects health beliefs, intentions, and actual engagement in physical activity. To build upon these findings, future research should focus on implementing structured educational programs to enhance individuals' recognition of NLTPA and assess their long-term impact. This approach could provide practical foundations for interventions promoting sustainable increases in physical activity levels across diverse populations.

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The author(s) report there are no competing interests to declare.

Data Availability Statement

The author(s) agree to make data and materials supporting the results or analyses presented in their paper available upon reasonable request.

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Conflict of Interest

The authors declare no conflict of interest.

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Appendix A

Interview questionnaire for Study 1

Introduction

Thank you for taking the time to participate in our study.

Participation in this study is entirely voluntary. You are free to withdraw from the interview at any time without any consequences.

Your responses will be kept confidential, and any identifying information will be removed to protect your privacy. If you have any questions or concerns about the study or your participation, please feel free to reach out to the researcher at any time.

Questions

Awareness toward Physical Activity

1. What do you think physical activity is?
2. Do you think there is difference between physical activity and exercise?
3. (After reflecting on your daily life) What activities do you consider to be exercise, and what activities do you consider to be physical activity?

Inquiries regarding Physical Activity

4. How would you rate your usual level of physical activity? On a scale of 1 to 10, what score would you give yourself?
5. Do you engage in physical activity consciously or unconsciously?
6. Is your daily pattern of physical activity consistent? Does it vary by day of the week, or between weekdays and weekends?
7. Is there any type of physical activity you do more than others?
8. How do you feel after engaging in a lot of physical activity?
9. How do you feel when you engage in little physical activity?
10. Why do you think physical activity is necessary, or unnecessary?
11. What do you think is needed to increase your usual amount of physical activity?

Appendix B

Interview questionnaire for Study 2

Introduction

Thank you for taking the time to participate in our study.

The interview process for this research will consist of three sessions. The following interview will take place 2 weeks after this initial one, and the final interview will be conducted after the completion of the study.

You are free to withdraw from the interview at any time, and if you have any questions or concerns, please feel free to reach out to the researcher.

Common Questions

These are the questions that will be asked consistently across the pre-interview, mid-interview, and post-interview

Perception toward Physical Activity

1. What do you think physical activity is?

2. Do you think there is difference between physical activity and exercise?

3. (After reflecting on your daily life) What activities do you consider to be exercise, and what activities do you consider to be physical activity?

Health Beliefs

4. Do you think consciously and consistently practicing physical activity in daily life, as you would with exercise, is beneficial for preventing disease?

5. Do you think consciously and consistently practicing physical activity in daily life, as you would with exercise, helps you maintain a physically healthy life?

6. Do you think consciously and consistently practicing physical activity in daily life, as you would with exercise, helps you maintain a psychologically healthy life?

7. Do you think the fact that physical activity in daily life can have similar effects to exercise has helped you overcome limitations to exercise (such as lack of time and motivation or accessibility of locations, etc.)?

Intention toward Physical Activity

8. Have you ever intentionally made time to engage in physical activity?
8-1. (If yes) How many times per week do you intend to make time for physical activity?

Appendix C

Figure 1. Example of Intervention materials.

Kim, Y. (2023, November 3). Is Walking Enough? What About Changes in Leg Muscles? Komedi. https://n.news.naver.com/article/296/0000071101?cds=news_my