




# Discrete Choice Experiment in Evaluating Preferences for Physical Activity: A Mixed-Methods Study of Attributes and Their Levels

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## Abstract

**Background:** Discrete choice experiment (DCE) has become a leading method for evaluating health sector preferences. Despite its common use in evaluating physical activity (PA) preference, there is a lack of consensus on the optimal attribute and level, and this step often lacks rigorous documentation. This study aimed to identify suitable attributes and levels for a PA program for future application in DCE studies.

**Methods:** This study used a mixed-method approach. Initially, a rapid review was performed using databases and search engines. The findings were then used for a 2-stage semi-structured interview for attribute addition and scoring. Finally, top-scoring attributes were selected, and a small expert panel determined their associated levels.

**Results:** In our rapid review, from 8144 titles according to search strategy, 10 were selected for data extraction. After content analysis and integration of similar attributes, 12 were identified and 4 more were added from interviews. Using the opinions of the expert panel, the top 5 attributes were selected and a total of 22 levels were determined for these 5 attributes. The selected attributes included monthly cost, companions, distance, PA time, and PA type, with total scores of 150, 149, 147, 144, and 123, respectively.

**Conclusion:** Our study identified 5 attributes and 22 corresponding levels as effective tools for measuring PA preferences using a DCE approach. As this is a pioneering study, further comprehensive research is recommended for improved outcomes.

**Keywords:** Physical Activity, Exercise, Choice Behavior

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## Introduction

Non-communicable diseases (NCDs) are the leading global causes of death and illness, driven by lifestyle changes like unhealthy diets and reduced physical activity (PA) (1-3). Increasing PA levels can prevent and manage NCDs, improve mental health, enhance overall well-being, and potentially prevent at least 5 million deaths annually (4, 5). However, 1 in 4 adults globally do not meet recommended PA levels, leading to significant health and economic burdens (4). Understanding individual preferences

for PA is pivotal in promoting healthier lifestyles and combating the global rise of NCDs (6, 7). A study in Italy using DCE revealed that adolescents generally prefer walking as their PA preference, with women favoring cycling. Adolescents from lower-educated families tend to prefer motorized transport. Proximity to green areas encourages healthier choices while living near industrial or high-traffic areas leads to a preference for motorized vehicles (8). The research on PA preferences among 60-year-old individuals

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### ↑What is “already known” in this topic:

A discrete choice experiment (DCE) is a widely used method for evaluating health sector preferences. However, in the context of physical activity (PA) preference measurement, there is a lack of consensus on the optimal attributes and levels, and the initial attribute generation phase often lacks rigorous documentation.

### →What this article adds:

Our study identifies 5 key attributes and 22 corresponding levels for use in future studies that aimed to evaluate PA preferences using DCE models. Furthermore, our findings pave the way for more comprehensive research in this area, contributing to the development of personalized PA programs.

reveals distinct patterns between men and women. Women tend to prefer PA with the same sex, PA with friends or peers, PA under the guidance of a coach, and prefer a fixed, specific exercise schedule more than men. In addition, men show less preference for competitive activities, high-intensity and dynamic PA, skill-based PA, and outdoor activities compared to women (9). The motivation to start and sustain a PA program is significantly determined by preferences, which are influenced by various attributes and levels of the PA program (6, 10).

Due to their flexibility in accommodating diverse research objectives, DCE studies have become the leading method for evaluating health sector preferences over the past decade (11, 12). DCEs are particularly suitable for evaluating PA preferences because they allow for the estimation of the relative importance of different aspects of a PA program, the trade-offs between these aspects, and the total satisfaction or benefit respondents derive from such programs (8, 13). This method is advantageous in PA research, as it provides a clear stepwise method for selecting and tailoring strategies to unique settings, enhancing the precision with which strategies are tailored to the context (14). DCEs quantify trade-offs in PA programs, analyze participant behavior, assess program value for cost analyses, forecast program uptake, and offer insights for informed program design and policy decisions (15-17). However, there are challenges such as ensuring the robustness and validity of the method (18), the complexity of the design and implementation (19), the hypothetical nature of the scenarios (13), and difficulties in interpreting results (particularly in the presence of heterogeneous preferences) (20), when implementing the DCE approach to evaluate PA preferences. Despite these challenges, when carefully designed and implemented, DCEs remain a valuable tool for informing health policies and program design (21).

Although many studies in the past decade have used the DCE method to measure individual preferences in the field of PA, each study used multiple methods to find the attributes and levels associated with a PA program and there is still no specific study on the appropriate attributes and levels for this task (8, 22-24). The initial phase of a DCE design, which involves attribute generation, may appear simple but is often inadequately documented, raising questions about the rigor of this research component (25). The attributes and their levels should be related to the nature of the intervention and should effectively explain the characteristics of the desired intervention (26). The importance of attributes and levels in a DCE study cannot be overstated. They are fundamental to the design and implementation of DCEs, as they define the characteristics of the intervention being studied and the variations in these characteristics that respondents are asked to select (27). Misidentifying attributes and their levels can have significant negative implications, leading to erroneous DCE results and potentially misinforming policy implementation (28). Superficially selecting attributes and levels, and vaguely reporting the process, may result in misidentification, which can bias the study and misinform policy (29). Transparency in the calculations is crucial, as it clarifies which conclusions are sup-

ported by the results and enables more accurate and meaningful comparisons across subsamples (27). To the best of our knowledge, there has been no dedicated study with the specific objective of identifying the attributes and their respective levels for a PA program within a general population subgroup. Thus, this study aimed to gather a comprehensive set of attributes and levels related to PA from existing literature, and ultimately identify the most suitable attributes and levels for a PA program. These attributes and levels would then be used to measure PA preferences using the DCE method.

## Methods

To gain a comprehensive understanding of attributes and levels of PA for use in DCE studies, this study employed a mixed-methods approach, utilizing a combination of review analysis, interviews, and discussions with a small expert panel. The DCE is a technique commonly used to assess individual preferences for programs, interventions, or products. This method involves defining the attributes and their levels for different programs. Individuals then indicate their subjective preferences and assign value to each attribute and its levels. Typically, these studies involve several steps as follows: defining the attributes of the program, establishing the levels for each attribute, selecting and creating scenarios, conducting surveys, and collecting and analyzing the data from the study (30, 31). In DCE studies, individuals are presented with multiple sets of choices (choice tasks). Each choice task contains  $\geq 2$  scenarios. Individuals then select their priorities based on their subjective preferences (32, 33). To determine attributes and attribute levels in this context, methods such as literature reviews, interviews, expert opinions, or focus group discussions can be used (31, 32). In this study, we undertook several steps to identify suitable attributes and their levels for measuring preferences in the field of PA, adhering to the DCE study format. Initially, a rapid review study was conducted. Subsequently, interviews with experts were performed in 2 stages: (1) Identifying the attributes and (2) scoring of the attributes. Finally, through discussion and expert consensus, the levels for each attribute were determined. Our study aimed to identify the attributes and their respective levels for a PA program, with Iranian office workers serving as the focus group.

A combination of rapid review, content analysis, interviews, scoring, and expert panel discussions was chosen to ensure comprehensive and robust attributes and levels. Given the extensive range of studies and records in the field of PA and our objective to gather comprehensive information on the attributes and levels related to the nature of a PA program, we employed the rapid review method in the initial step. Rapid reviews are advantageous, as they provide a synthesized overview of the available evidence, allowing for timely decision-making while maintaining methodological rigor (34). Although rapid reviews may involve shortened steps compared with systematic reviews, they are still systematic and transparent, ensuring the validity of the findings (35). Second, content analysis was used to summarize the information obtained from the rapid review. Content analysis is a valuable tool for identifying the

presence of various concepts, themes, and patterns within qualitative data, providing systematic and objective insights (36). Third, interviews were conducted to complement the information gathered from the rapid review and content analysis. Interviews provide rich and in-depth data, allowing researchers to delve deeper into specific aspects of the study. They offer flexibility, immediate clarification, and the ability to probe further, ensuring a comprehensive understanding of the subject matter (37, 38). Fourth, the scoring step was included to quantitatively assess the importance of each attribute. Scoring systems are essential in research, as they provide a standardized method for evaluating and comparing different criteria. This step ensures that the selection of attributes is based on objective and quantifiable measures, enhancing the reliability and validity of the results (39). Finally, expert panel discussions were utilized to rate and select the most relevant attributes and levels. Expert panels are beneficial, as they provide evidence-based recommendations, synthesize existing knowledge, and offer multiple points of view. They facilitate a structured and transparent decision-making process, ensuring the credibility and applicability of the findings (40). By integrating these methods, we aimed to offset the limitations of each approach and maximize the strengths of both qualitative and quantitative data. This mixed-methods approach allowed us to gain a comprehensive understanding of attributes and levels for use to evaluate PA preferences according to a DCE approach, ensuring the robustness and validity of our findings.

#### **Finding the Attributes and Levels**

Various types of literature reviews can be utilized in DCE studies to identify attributes and their levels. To discover attributes and levels related to PA, we initially conducted a rapid review study. A rapid review, when compared with a systematic review, may have some steps that are shortened or even omitted, depending on the research needs and available time. In other words, rapid review is a type of knowledge synthesis that follows the systematic review process, but some parts may be simplified or even omitted (41, 42). Therefore, unlike a systematic review, there is no set of accepted standard methods for rapid review (43). However, to perform a rapid review, the following steps can be considered: (1) defining the research question, (2) searching for research evidence, (3) critical evaluation of information sources, and (4) combining the results (41).

In this study, we were looking for the best attributes and levels of attributes for PA programs. Therefore, the title of the rapid review specifically includes “suitable attributes and levels of attributes for PA programs”. After specifying the title, the study question is usually specified. In this study, the FINER criteria have been suggested as a comprehensive approach to tackle the considerations that need to be made when formulating research questions. Based on these criteria, the questions should be feasible, interesting, novel, ethical, and relevant (44). We were not interested in the numerical results of other studies. Instead, we were seeking suitable words for the attributes and their levels. Therefore, the research question was not limited at this stage (43). Specifically, studies focusing on the attributes

and levels of attributes of PA, types of PA, and individual preferences regarding PA were the targets of information collection in this study.

DCE studies typically search for keywords related to attributes and levels during the literature review. Therefore, the evaluation of the records is usually based on the likelihood of the occurrence of words related to the attributes and levels. In this study, there were no restrictions on finding related words, and the review was conducted without any critical appraisal limitations. All studies and documents that potentially included the attribute or level of PA were incorporated into this study. After clarifying the main review question, in the second stage, search strategies were designed using the following keywords: “physical activity,” “intervention,” “program,” “attributes,” “preference,” “discrete choice experiment,” “conjoint analysis,” “choice-based models,” et cetera. The next step involved searching the PubMed, Scopus, and Web of Science databases using 2 specific search strategies for each of the databases according to related keywords. Subsequently, these keywords were used for a free search in the Google search engine and Google Scholar, and titles that potentially contained useful information were examined. Literature searches for this study were completed between March 29, 2023, and May 15, 2023.

The studies identified in each database based on our search strategies were imported into EndNote software for further processing. In the next steps, title screening, abstract screening, and full-text screening were conducted respectively. In each step, the screening criterion was the potential presence of attributes and levels related to the nature of a PA program. After conducting full-text screening in accordance with the review’s objectives, several studies were selected to advance to the final phase (data extraction). In the final step of the rapid review, information such as the author’s name, year of publication, sample size, and key findings—including attributes and levels associated with each attribute—was extracted.

In the next step, the attributes and levels extracted from the rapid review study were summarized using content analysis. This involved systematically coding the data to identify recurring themes and patterns. Attributes and levels that were conceptually similar were merged. Specifically, we integrated the extracted attributes and levels according to their meaning and concept, ensuring that items with similar content were grouped. Then, through the summarized attributes and levels of attributes, a tool was designed for interviewing experts. This tool included attributes and levels of attributes related to PA programs. The tool was disseminated among a select group of experts, identified through a purposeful sampling strategy known as the snowball method. The snowball sampling method, a nonprobability sampling technique, operates on the principle of recruiting new units to the sample through referrals from existing units. The process commences with a small group of initial respondents, often referred to as “seeds.” These seeds play a crucial role as they refer the researcher to other potential respondents within the target population whom they are acquainted with. This referral chain contin-

ues, progressively expanding the sample size until the desired number is reached. Because of its distinctive approach, the snowball sampling method is highly effective for exploratory and qualitative research (45).

The selection process began by identifying individuals who had made significant contributions to the field of PA, particularly in areas such as PA intervention, development of PA plans or programs, and studies on factors influencing participation in PA programs. These individuals were identified through a comprehensive review of scientific literature. Our selection criteria went beyond academic discipline, aiming to find individuals who could enhance our understanding of attributes and levels in PA programs. Therefore, for the interviews, we selected those who had a history of projects or research plans in the field of PA or who had authored at least 3 articles in the specified fields. Following this process, we were able to engage 13 individuals who accepted our invitation for an interview. Nine of them were men, 4 were women, and all held PhD degrees. Mainly, but not necessarily, their discipline was one of the branches of PA. The initial instrument was shared with these experts. During a semi-structured face-to-face interview, they were encouraged to suggest any additional attributes or levels that they believed were not represented in the initial instrument. During the interview process, experts were asked to add only attributes that are directly related to the nature of a PA program. To minimize interviewer bias, we ensured that the interview questions were standardized and that the interviewers were trained to follow a consistent approach. Additionally, the results of the interviews were summarized and integrated through content analysis, which involved systematically coding the data to identify recurring themes and patterns.

#### *Determining the Final Attributes and Levels*

With the assistance of individuals interviewed in the previous stage, the final tool—comprising attributes extracted from both the rapid review and interview stages—was sent to 32 experts (selected according to the criteria from the previous stage) for scoring. Seventeen, including 10 men and 7 women, accepted the invitation to participate in the interview to score the attributes on a scale of 0 to 10. Next, we asked participants the following question for each attribute: “In your opinion, how effective is attribute X, compared with other attributes, in influencing people’s participation in a PA program?” Please rate each attribute from 0 (no effect) to 10 (maximum effect). During the interview, the main levels associated with each attribute were presented to facilitate more accurate scoring by the experts. In this step of the study, the purpose was to select the most important attributes for use in DCE studies in the field of PA. Scoring based on the Likert scale could have led to the selection of the “medium” option in several cases. This made it difficult to choose the final attributes. Therefore, a scale of 0 to 10 was used to address this issue. Scoring from 0 to 10, due to its wider range, improves the ability to summarize points and select the most important attributes. “10-point” rating scales are widely used in survey research as a measurement tool. They have been successfully applied to various constructs, including items that ask respondents to

rate their experiences or opinions (46). Comparing Likert scales with 4, 5, 6, and 11 points found that the 11-point scale (ranging from 0 to 10) exhibited the least skewness and most closely approximated a normal distribution. Therefore, it is recommended to use an 11-point scale, as it enhances sensitivity and more accurately reflects interval-level measurement (47).

Upon completing the interviews, the scores assigned by each interviewee to each attribute were aggregated, resulting in a final score for each attribute. Finally, to select and reach a consensus on the levels of the highest-scoring attributes, a small expert panel was assembled. This panel consisted of experts who have sufficient experience or studies in the field of DCE (to consider the limitations associated with these studies), PA (for the comprehensiveness of most attributes and levels), and health education (to ensure the final combination of words was as simple and comprehensible as possible). During this meeting, the number of attributes that had the highest score and could be included in the study, considering the DCE limitations, was determined. Subsequently, suitable levels were selected for each of these attributes. These levels were chosen based on the opinions of the experts and all the information gathered from the previous steps. Consensus methodologies are systematic approaches used to summarize expert opinions, establish agreements, and construct recommendations (48). In our study, we employed the Consensus Development Panel method to select appropriate attributes and levels. This method involves a group of experts who meet in person to discuss a specific issue and reach a consensus. The experts present their viewpoints, discuss them, and then make a collective decision (49). Small expert panels are beneficial, as they allow for in-depth discussions and consensus-building among experts. To address potential biases in scoring, we ensured that the scoring process was anonymous and that experts were provided with clear guidelines. The representativeness of the expert panel was considered by selecting individuals with diverse backgrounds and extensive experience in PA, DCE, and health education. The consensus process was carefully managed to ensure that all expert opinions were considered and that the final decisions were based on a thorough discussion and agreement among the panel members.

The validity of choice sets and the reliability of the results derived from them depend on the independence of attribute levels. These levels should also be equally represented within the choice sets. Moreover, the estimated parameters should exhibit minimal variance to ensure efficiency. After the selection of attributes and their respective levels, fractional factorial designs can be utilized. These designs facilitate the creation of valid and reliable choice sets with an optimal combination of attributes and attribute levels (50). In the final step of attribute selection, experts can evaluate the attributes for semantic and formal affinity during their discussions. Thus, in the concluding stage involving a small expert panel, this evaluation was carried out for attributes and the levels of each attribute. For the optimal combination and equal repetition of attribute levels, as well as the efficiency of structures, either SAS software or the “dcreate” module in STATA software can be implemented. This

is executed with the D efficiency analysis. As an example, we aimed for each respondent to be presented with 8 binary choice sets. To achieve this, we designed 40 choice sets, which were organized into 5 blocks. These were constructed using a fractional factorial design from all possible scenarios through STATA 17 software. All these scenarios were within the accepted and valid range of D efficiency. This step was undertaken only to provide a sample of the final choice sets, which were designed using the attributes and levels selected in our study. It is important to note that this is just one possible configuration. In general, there is the potential to create other combinations of choice sets with varying numbers. This flexibility allows for a wide range of scenarios to be explored in future studies.

## Results

Our search strategy identified 8144 titles. These titles were obtained from 3 databases: PubMed (2,147), Web of Science (2,498), and Scopus (3,499). After removing duplicates using Endnote software, 5329 unique titles remained. All these titles underwent initial screening. Subsequently,

273 titles were selected for abstract screening. After the abstract screening, 41 titles were chosen for full-text screening. The title and abstract screening for results from free search in search engines were conducted online through the web pages of each paper. In this step, 7 titles were selected for full-text screening. Therefore, following these steps, 48 titles advanced to the final full-text screening stage. Ultimately, 10 of these were selected for data extraction. The studies originated from various countries: Australia (4), USA (2), Canada (1), Philippines (1), Germany (1), and Sweden (1). All 10 studies explored attributes and levels associated with PA programs (Table 1).

We extracted attributes and levels from the final studies and then coded them. Based on content analysis and conceptual similarity, these elements were integrated into a framework of 12 distinct attributes and relevant levels. Motivators, framework of PA, place of PA, companion/companions, duration of PA, intensity of PA, monthly fee, convenience, PA time, coach, type of PA, and PA period were the final extracted attributes (Table 2).

The initial tool comprised 12 attributes and levels. Experts were provided with these to suggest additional items that they believed would accurately describe the nature of

**Table 1.** The Results of Studies: Attributes and Level of Attributes for Evaluating PA Preferences

id	Author and Year	Country	Samples	Attributes: Levels of Attributes
1	G. Z. van Uffelen (51), 2017 Burton(52), 2012	Australia Australia	1845 7873	Motivating factors: Prevent health problems- Make me feel good- Lose or manage weight Help manage stress- Improve appearance- Spend time with others- Meet new friends Format: Little or no cost- Are not just about exercise- Have a set routine or format- Done at a fixed time- Require skill and practice- Are vigorous- Involve competition Location: Close to home- Done outdoors Social setting: Can do on my own- Done with people my age- Done with people my sex- Involve supervision- Are team-based Time per PA occasion: 90 minutes or more, 45-89 minutes, 10-44 minutes PA effort: High: you can't say more than a few words without pausing for breath, Medium: you can talk but can't sing during the activity, Low: you can sing during the activity Monthly cost including equipment or coaching: \$80 per month- \$50 per month- \$20 per month Convenience, how well the activity fits into your schedule: With difficulty- and large need for modification- With some need for modification- With ease- and minimal need for modification Enjoyment: High – you are happy and very engaged in the activity, Moderate – you are somewhat engaged in the activity, Low – you are bored and not engaged in the activity Benefits for my health: Large relief in discomfort, a large increase in strength and ability to move- Moderate relief in discomfort, a moderate increase in strength and ability to relief in discomfort, a small increase in strength and ability to move Intensity: Light intensity- Moderate intensity- High intensity -Varying intensities- No preference Duration: < 15 minutes- 30 minutes- 45 minutes- 1 hour- 2 hours - > 2 hours Location: At home- Sporting facilities- Community centers- Structure with Medical Surveillance- Outside (park- forest- street- etc.) - No preference PA companion: In a Group- Alone- With family- With friends- With a Pet- No preference Time of day: Morning- Middy- Afternoon- Evening- No preference Supervision: Only no supervision- Only supervised by a professional- Both- No preference Scheduling: Only a set schedule- Only when desired- Both- No preference
2	Pinto(22), 2017	USA	41	
3	Hussien (53) 2020	Canada	44	

Table 2. Continued

id	Author and Year	Country	Samples	Attributes: Levels of Attributes
4	Doyle (54) 2018	Australia	628	How: Include a fun element- I can choose the intensity- are done at a fixed time, i.e.- scheduled sessions- involve little or no cost- are structured with a set routine or format- Are vigorous- Are supervised- e.g.- by a leader- Include a social aspect- Involve competition- Require skill and practice Where: Are done in my neighborhood/local area- Are done outdoors- Are done at the university- Are done at home- Are done at my workplace With whom: my own- Are done with people of my gender- Are done with an exercise partner/buddy- Are done with people who have the same health condition as I do- Are done with people at my level of ability- Are done with people my age- Are done in a small group (e.g.- 3-6 people)- Are team-based Type: Walking - Swimming - Jogging - Cycling - Fitness/weights - Aerobics - Yoga - Football - Martial arts - Basketball - Squash - Volleyball - Table tennis - Tennis Time of day: AM - PM Duration: Less than 30 minutes - More than 30 minutes Frequency: Every day - Twice a week - Thrice a week Venue: Indoor - Outdoor Company: Alone - With companion Type of PA: Light PA - Moderate PA - Vigorous PA
5	B. de Guzman (55) 2015	Philippines	300	Activity: Walking and jogging - Bicycling - Walking and weight training on alternate days - Playing tennis Group: Alone - With one partner - In a group of 8-12 - In a group of 25 Frequency: (Three - Four - Five) times per week Time: Morning - Midday - Evening - Varying times of the day Coaching: None - Weekly - Monthly - As desired Intentions: None - Within 6 months - Within 1 month Planning behavior: None - Rough - Detailed Frequency: ≤ twice a week - 3 or 4 times a week - 5 or 6 times a week - Once a day Duration: < 30 min - 45 min - 1 h - > 1.5 h Type: House/yard work - Gym/home fitness - Slower paced - Fast paced Sessions: Multiple short - One longer - No preference Time of day: Early morning - Midday/afternoon - Night - No preference Season: Summer - Winter - Spring/Autumn - All year - No preference Active with others: Alone - With others - No preference Social support: Family - Friends - Organized group/professional Location: Outdoor public space - Home Indoor sport facility
6	Chatfield (56) 2018	USA	53	Type of training: Strength training - Cardiovascular training - Mindfulness-based training Design: Individual with supervision - Individual without supervision - Group with supervision - Group without supervision Intensity: Low - Medium - High Frequency: Once a week - Two times per week - Three times per week Proximity: 10 minutes - 20 minutes - 30 minutes Incentives: None - Discount coupon for sports goods - Wellness subsidies - Exercise during working hours (1 hour per week)
7	J. Alley (57) 2017	Australia	1217	Social situation: Participating alone - With a partner - In a group with healthy people - In a group with patients that have similar health issues Location: Participating at home - Local offer outside home Type of exercise: Endurance - Muscular strength - Neuromuscular and flexibility - Mixed program Intensity: Light activity - Moderate activity - Vigorous activity Frequency: 1-2 sessions per week - 3 sessions per week - 4-5 sessions per week Duration: 20-30 minutes per session - 45-60 minutes per session
8	Aboagye (58) 2017	Sweden	112	
9	Wolfgang (59) 2018	Germany	103	

a PA program but were not already included in the tool. At this stage, 4 items were added to the tool based on their content and meaning similarities with the items mentioned in the interviews. These items were as follows: distance

from the PA location, PA program considering health problems, progression of PA intensity, and specificity of the PA program. In the subsequent step, each of these 16 attributes was rated by the experts. Because of the limitation in the

**Table 3.** Synthesized and Summarized Attributes and Levels of Attributes

Attributes: Levels of Attributes
Motivators: Disease prevention - being healthy - weight management - stress management - improving appearance - discount coupon for sports equipment - exercise during working hours - relieving discomfort
Framework of PA: specific format or routine - sports combined with other programs - need to skill and practice - including competition-- Includes a fun component - includes a social aspect
Place of PA: At home - at work - at the gym - outside (park - forest - street, etc.) - structures under the supervision of the health department
Companion/companions: Alone - with the same age - with the same sex - with friends - with a pet - with people of the same ability level as me - in a team - in a group - with family - in One group With Healthy Persons
Duration of PA: Each session 25 to 30 minutes - Each session 30 to 45 minutes - Each session 45 to 60 minutes - Each session 60 to 90 minutes - Each session 90 to 120 minutes
The Intensity of PA: High: you can't say more than a few words without taking a breath - Medium: you can talk but you can't read - Low: you can read during PA
Monthly fee: \$80 per month- \$50 per month- \$20 per month
Convenience - the degree to which it fits your schedule: Hard and needs a lot of correction - needs some correction - good and needs minimal correction
PA Time: Morning - afternoon - evening - night
The Coach: With a face-to-face trainer - with an online trainer - without a trainer - sometimes with a trainer - sometimes without a trainer
Type of PA: Aerobic - endurance - muscular strength - flexibility and muscular - combination
PA Period: Every day - twice a week - three times a week - (three - four - five) times the door week

combination of attributes and levels, the 5 attributes with the highest scores were selected during a discussion through the small expert panel. These attributes were as follows: the monthly cost of the program (score: 150), companions (score: 149), distance from the PA location (score: 147), time of PA (score:144), and type of PA (Figure 1).

In the final analysis, a total of 22 levels were selected for the specified attributes, based on feedback from a small expert panel and a pilot study. Specifically, 5 levels were defined to represent various types of PA. Three levels were used to denote different distances to the PA location. Six levels were designed to reflect the spectrum of monthly costs associated with the program. Four levels were set to indicate the companions present during PA, and another 4

levels were established to account for the timing of PA. The “Alone” level was used to denote participation in PA programs either with individuals other than friends, colleagues, and family members or engaging in PA alone (Table 3).

The following figure illustrates how program attributes and levels are integrated. We use STATA software and its *decreat* module to formulate an optimal mix of attributes and levels (From all possible scenarios, we created 40 binary choice sets using a fractional factorial design. Figure 2 shows one example). It showcases 2 sample PA programs (Program 1 and Program 2). To assess individual preferences, participants were asked to choose one program based on their priorities (Figure 2).

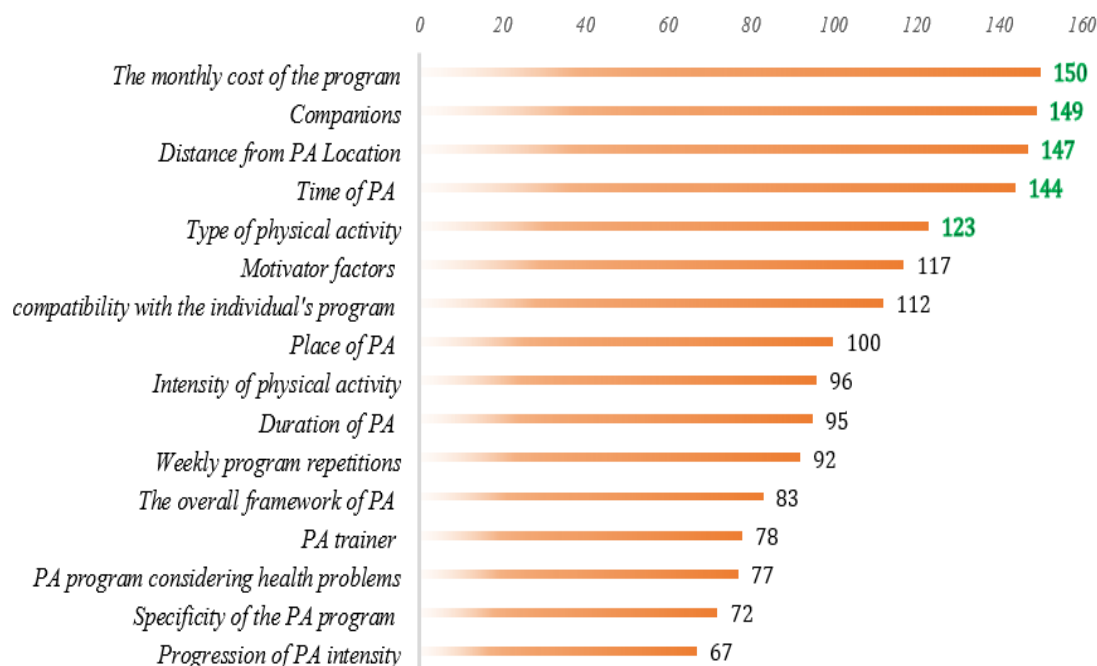
**Figure 1.** Final selected attributes by scores extracted from expert interviews.

Table 4. Final Selected Attributes and Levels of Attributes

Attributes	Levels of Attributes
Type	1. Ball-based Physical Activities 2. Aquatic Exercise (Swimming) 3. Strength Training (Resistance Training) 4. Walking or Running (Mountain, Park, Treadmill, etc.) 5. Cycling or Similar Exercise
proximity	1. At home or workplace 2. close to home or workplace 3. Away from home or work
Monthly cost	1. Free 2. 1M IRR 3. 2.5M IRR 4. 3.5M IRR 5. 5M IRR 6. 7.5M IRR
Companions	1. Alone 2. Friend(s) (Non-Colleagues) 3. Colleagues 4. family members
Time	1. Morning 2. Evening 3. Night 4. Weekends

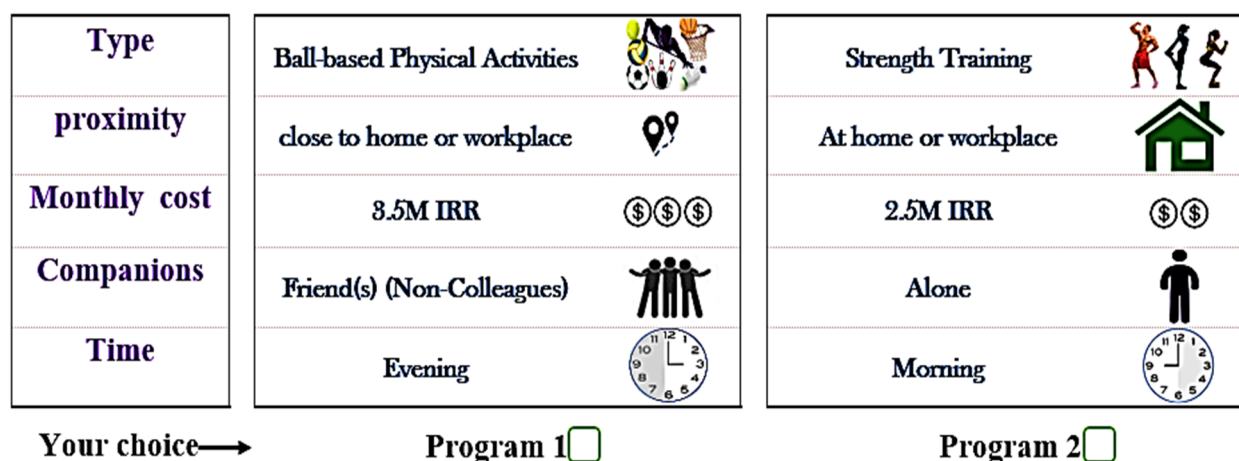


Figure 2. An example of a DCE choice set for PA programs

### Discussion

This study represents the first attempt to investigate the specific attributes and the levels of attributes that are suitable for evaluating individuals' preferences regarding PA using the DCE method in a general subgroup. While DCE methods are commonly used to evaluate PA program preferences (8, 22-24), identifying the most suitable attributes and levels remains an open question. It is important to note that while these attributes and the levels of attributes may not be regarded as the ultimate or ideal choice for describing PA programs, the insights gained from this research can provide valuable guidance. Selecting the right attributes and their corresponding levels is fundamental for a well-designed DCE (60). Inadequate selection can lead to invalid results. To achieve this, a recommended approach involves a literature review, refining attributes and levels by discarding and merging items, conducting qualitative research, and selecting attributes and levels through expert consultations (60). Therefore, in our study, a rapid review

identified 12 general attributes for PA programs, with multiple levels established for each attribute. Following 2 rounds of interviews and small expert panel discussions, a final selection was made, resulting in the identification of 5 attributes associated with PA programs. These attributes include the type of activity, proximity to the location of activity, monthly cost, companions, and time of PA. As the number of attributes and levels increases, the information gained from each response decreases, thus a balance between specification and efficiency is needed (61). A limited selection is advised to avoid confusing respondents. In the final step of selecting attributes and levels, we balanced the number to avoid cognitive overload by considering the complexity of PA preferences, ensuring the selected attributes were comprehensive yet not oversimplified. Additionally, we followed the guideline that most existing DCEs (70%) use between 3 to 7 attributes, which helps in maintaining a manageable cognitive load for respondents (61).

A study on participation in types of PA among American

adults suggests that PA engagement varies across different types of activities and demographic characteristics (62). It highlights the importance of considering types of PA when designing intervention strategies for PA promotion programs (62). An assessment of the PA program preferences among university students in the United Arab Emirates revealed that the majority favored walking and swimming in terms of the type of PA (54). It was also observed that male students were more inclined toward competitive activities and showed a significant preference for activities such as football, fitness, and jogging (54). According to a conjoint analysis conducted in the Philippines, the most significant factor in terms of PA preference was the type of PA (55). There is substantial evidence that highlights the importance of PA type in individual preferences and participation in PA programs (54-59). Thus, it is suggested that the type of PA should be included as one of the attributes to measure preferences about PA programs using DCE (57, 58). However, the levels to consider for this attribute may vary depending on different communities and subgroups, and these levels must be understandable to the research group (54, 55).

According to the CDC, the proximity of an individual's residence to a park and their perception of safety within the park are positively correlated with the likelihood of walking or biking to the park and engaging in PA there (63). A research paper in BMC Public Health revealed a correlation between the availability of PA facilities and engagement in PA. Specifically, it was found that individuals living closer to these facilities tend to have higher levels of PA (64). Proximity to activity-inducing facilities has generally been associated with greater participation in PA for the general population (65). The location or distance of PA opportunities has been a key factor in influencing individual participation or preferences, according to most of the studies that we reviewed to examine the attributes and level of attributes of PA (51-59). Therefore, based on the evidence, it is clear that proximity is an important factor in determining preferences for PA programs using the DCE approach. DCEs rely on attributes and their corresponding levels to describe hypothetical interventions. Therefore, it is essential to have a comprehensive mix of attributes and their levels, considering the constraints of DCEs (28, 29). We considered 3 levels of proximity: at home or workplace, close to home or workplace, and away from home or workplace. However, it is possible to have multiple and different levels of this attribute. For example, an alternative approach could involve using the following levels: PA in the neighborhood/local area, PA outdoors, PA at home, or PA at the workplace (54). Alternatively, the varying times required to reach the PA location could be considered as levels of the proximity attribute (58).

Our study identified the monthly cost of the PA program as a key attribute, and according to expert opinion, it received the highest score for evaluating PA preferences using a DCE framework. From an economic perspective, the cost and price of a program can play a pivotal role in shaping the demand and choices of individuals when opting for a program (66, 67). Given that both expert insights and fundamental economic principles affirm the significant role of

cost in the selection of a PA program, the decision to include cost as an attribute in this study appears to be thoroughly justified. Also, cost has been used as an important attribute in the studies conducted in the field of measuring individual preferences for PA programs (22, 51, 52). In a population-based study, it was found that cost was a significant factor in the trade-off between scenarios, with both sexes showing a preference for PA scenarios with lower costs (51). In a study where participants were categorized based on age, income, and body mass index, it was observed that over 75% of respondents from each category showed a preference for activities that are free or low cost (52). Another significant aspect of the cost attribute in a DCE model is that it enables the estimation of willingness to pay (WTP) (68). WTP is a key concept in health economics, revealing how much individuals value a program or different aspects of a program (69).

Companion/companions and time of PA are the other 2 attributes that have been selected according to high scores and expert opinions. In many studies related to measuring the preference of individuals in the field of PA, the companion/companions attribute has been used with the titles of social setting (51, 52), Social situation (59), PA companion (53), With whom (54), company (55), group (56), active with others (57), and design (58). The time of PA attribute is prevalent in PA preference studies, often referred to as time of the day or simply time (53, 55-57). In other studies, the time of PA was categorized into various levels such as morning, midday, afternoon, and Evening; No preference: morning, midday, evening, varying times of the day, and AM, PM (53, 55-57). However, in our study, 4 distinct time levels—including morning, evening, night, and weekend—were selected. In our study, the levels of attributes were chosen based on their relevance and significance to the target population, as well as their clarity and ability to be traded off against each other in a DCE (70). The selected levels were informed by a comprehensive literature review and expert consultations to ensure they were meaningful and understandable to the respondents (71). It is important to note that DCEs have inherent limitations in the number of attributes and levels that can be included. Including too many attributes or levels can lead to cognitive overload for respondents, reducing the reliability and validity of the results (72). Therefore, a balance must be struck between comprehensiveness and simplicity to ensure the DCE remains manageable and interpretable (73). We developed the attributes and levels with a focus on office workers. However, given the comprehensiveness of these attributes, they appear to apply to studying PA preferences in the general public using DCEs. This claim is well supported by the fact that the selected attributes and levels are frequently found in a multitude of studies that assess individual preferences for PA programs in several subgroups (51-59). However, to improve the validity and make the tool more specialized for other subgroups, it is suggested to leverage the review section and the overall findings of the current study, along with the supplementary literature review and the opinions of experts (60). Although several steps have been implemented in this study to mitigate potential biases, it is important to acknowledge methodological limitations.

Potential biases in the data extraction process could influence the findings, as the selection and interpretation of data are inherently subjective. Additionally, the qualitative nature of the analysis may introduce subjectivity, which could affect the reliability of the results. Although cultural factors, such as traditional gender roles, social norms, and socioeconomic status significantly influence PA preferences and PA program participation rates (74, 75), it appears that many attributes and levels—such as cost, time, type, companion, and proximity—are general. However, the selected levels may differ significantly in some cases, especially regarding the type of PA.

### Conclusion

We conducted several stages, including rapid review, 2-stage interviews, and discussion through a small expert panel to select the appropriate attributes and levels of a PA program to be used in measuring preferences in a DCE approach. In general, 5 attributes—including the type of PA, proximity to activity location, monthly cost, companions, and time of PA—and 22 levels were selected. Although this study was conducted with a focus on office workers, the overall body of our review suggests that the selected attributes and levels are suitable for use in different population subgroups to measure PA preferences using the DCE method. Our study appears to be the first to identify appropriate attributes and levels for measuring preferences in a general subgroup; therefore, before the application of these attributes, an additional literature review and obtaining expert opinions is recommended. Although the current study has collected almost complete information in the field under investigation, it has some limitations. Instead of a rapid review, a systematic review or scoping review can be used. On the other hand, the expert panel can be done with the presence of a large number of experts for more reliable results and to reduce possible biases. The present study has collected the attributes and levels related to the nature of a PA program according to the framework of a DCE study. It is recommended to apply the methods of the present study to identify and select attributes and levels in the field of policies related to PA, the health or other effects of PA, and the factors influencing participation in a PA program.

### Authors' Contributions

All the authors have contributed to the study design, data collection, data analysis, and manuscript editing.

### Ethical Considerations

The ethics committee of Tehran University of Medical Sciences approved the study, which is part of a PhD thesis, with the ethics code IR.TUMS.SPH.REC.1400.310.

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### Conflict of Interests

The authors declare that they have no competing interests.

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