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Scoring of leisure activities for older adults according to cognitive, physical, and social components

Rachel K. Wion, PhD, RN,

Pennsylvania State University, College of Nursing, 310A Nursing Sciences Building, University Park, PA 16802

Nikki L. Hill, PhD, RN,

Pennsylvania State University, College of Nursing, 201 Nursing Sciences Building, University Park, PA 16802

Jacqueline Mogle, PhD,

Pennsylvania State University, College of Nursing, 307D Nursing Sciences Building, University Park, PA 16802

Sakshi Bhargava, PhD,

Pennsylvania State University, College of Nursing, 311B Nursing Sciences Building, University Park, PA 16802

Diane Berish, PhD,

Pennsylvania State University, College of Nursing, 302A Nursing Sciences Building, University Park, PA 16802

Ann Kolanowski, PhD, RN, FAAN

Pennsylvania State University, College of Nursing, 304 Nursing Sciences Building, University Park, PA 16802

Abstract

Participation in leisure activities may be cognitively protective for older adults. However, there is no comprehensive scoring system for analyzing data related to the effectiveness of leisure activity engagement on cognitive decline risk. We developed a component scoring system to determine the typical amount of cognitive, physical, and social effort required for participation in common leisure activities. Fifty-nine leisure activities were scored on the three activity effort components in two rounds of expert panel review using a modified Delphi technique. Consensus on the component scores was established. Interrater reliability (IRR) was acceptable across all three components (0.72). IRR was adequate for the cognitive component (0.75) and excellent for the physical (0.94) and social (0.95) components. Component scores can be used to examine how the level of cognitive, physical, or social effort required for engagement in specific leisure activities is associated with risk for cognitive decline and other poor outcomes.

Introduction

Engagement in cognitive, physical, and social leisure activities, especially those requiring higher levels of effort, may prevent cognitive decline and reduce the risk of dementia in older adults (Fallahpour, Borell, Luborsky, & Nygård, 2016). Furthermore, some older adults with cognitive impairment endorse benefits of activity participation through self-initiated engagement in new leisure activities after their diagnosis (Morgan, Garand, & Lingler, 2012). The influence of activity engagement on cognitive outcomes, however, is complicated. A lifestyle that includes engagement in cognitively protective leisure activities encompasses a complex set of interrelated behaviors, but the individual effects of these are difficult to tease apart (Bielak, 2010). The use of a system for data analysis where each leisure activity is scored based on the amount of cognitive, physical, and social effort older adults need for engagement may aid in determining the effectiveness of activity type on cognitive decline risk (Karp et al., 2006). Currently, there are no comprehensive scoring systems that can be applied when analyzing data related to leisure activity engagement in older adults.

Ascertaining the influence of leisure activity participation on cognitive and other outcomes in older adults requires the determination of relative contributions of cognitive, physical, and social effort in leisure activities. Brown and colleagues (2016) found evidence that participation in cognitive activity mediates the association between social activity and cognitive outcomes. It is likely that social activities offer opportunities for both social and cognitive stimulation, such as attendance at a public lecture. In most research, individual activities are usually assigned to one component (i.e., reading a newspaper is cognitive, dancing is physical; Chao, 2016; Foubert-Samier et al., 2012) or only a small number of activities are examined (e.g., 8 – 16 activities; Chen, Chiang, Chen, Tu, & Yu, 2016; Nilsen, Agahi, & Shaw, 2018). Such approaches neglect the complexity of leisure activities and conflate the different levels of effort into a single “score” which means the independent effects of varying levels of effort across cognitive, physical, and social components cannot be determined. In response, Karp and colleagues (2006) created a scoring system to account for this overlap across components in their examination of activity engagement and dementia risk. Component scores for 29 leisure activities (e.g., walking or cooking) were proposed based on scoring the intensity of involvement (i.e., effort required) of each component (i.e., cognitive, physical, social) on a scale of zero to three (0 = none; 3 = high). Subsequent studies have reported using modified versions of the Karp et al. weighted activity component scores (Köhncke et al., 2016; Küster et al., 2016), but do not provide a full list of activities and component scores that could be implemented by other researchers (e.g., Keller et al., 2011; Zhu, Qiu, Zeng, & Li, 2017). Additionally, the different types of activities that have been scored using the component method are limited (e.g., nine total activities; Zhu et al., 2017). No studies have provided information on their directions for scoring the components (i.e., parameters for none vs. low vs. medium vs. high) and only Karp et al. (2006) described the process for reaching consensus.

Although a comprehensive activity component scoring system has not been established, studies of the relative contributions of cognitive, physical, and social effort across leisure activities demonstrate the importance of having such a system. For example, Karp et al.

(2006) found that dementia risk was lower for older adults with high self-reported scores in two or three of the components, regardless of component type, indicating that activities with higher scores in at least two components may be more cognitively protective than activities with lower components scores or a high score in only one component. Similarly, Küster and colleagues (2016) determined that high scores in two or three components was associated with a lower risk of dementia. Finally, Köhncke et al. (2016), found that change in engagement (i.e., increased engagement) in leisure activities that were predominately social was positively associated with changes in white matter microstructure (i.e., increased fiber density) and change in perceptual speed (i.e., increased speed) in adults over 80 years old. As previous research demonstrates, designating specific activities as belonging to a single component (cognitive, physical, or social) fails to recognize the complexity of leisure activity engagement and the need to evaluate the effort required to engage in individual activities across the three components.

With the growing interest in understanding how leisure activities influence older adults' aging-related outcomes, it is important to have a reliable activity scoring system that considers the cognitive, physical, and social components of different activities. Methodological inconsistency may account for why similar activities are scored differently across existing studies. To address these limitations, we sought to develop an activity component scoring system that reflects the relative degree of cognitive, physical, and social effort that is required for a typical, community-dwelling older adult to participate in a wide range of leisure activities, as scored by a panel of experts in gerontology. A secondary goal was to provide detailed and transparent descriptions of the process for scoring the components (i.e., instructions, coming to consensus). Scores for the effort involved in individual leisure activities can then be applied to investigations of cognitive decline risk in older adults, as well as other outcomes of interest.

Methods

The development of the activity component scoring system consisted of: 1) compiling a list of activities from measures used in multiple longitudinal aging studies, 2) convening an expert panel to provide feedback on the scoring tool and complete the activity scoring, and 3) applying a modified Delphi technique (Waltz, Strickland, & Lenz, 2017) to reach consensus on the activity component scores. Given the extensive number of activity types that are frequently examined in aging science and the inconsistent determination of what constitutes physical, cognitive, and social activities, the Delphi technique was selected to support the systematic collection of expert consultation to build consensus. The Conducting and Reporting of Delphi Studies recommendations guided the process and reporting of the results (Jünger, Payne, Brine, Radbruch, & Brearley, 2017). This project did not meet criteria for human subjects research, per the University's Office of Research Protections.

Selection of Activities

A comprehensive list of activity types was compiled from the measures used in five longitudinal studies of health and aging: Health and Retirement Study (HRS), National Health and Aging Trends Study (NHATS), Einstein Aging Study (EAS), Minority Aging

Research Study (MARS), and Midlife in the United States (MIDUS). Each study – three of which are nationally representative datasets that have been widely used for aging research (HRS, NHATS, MIDUS) – investigates aging-related processes and outcomes with a variety of study designs, including different batteries of activity measures. Across these five studies, a variety of different activities questionnaires were used, therefore a comprehensive activity list was compiled and reviewed for duplications (e.g., multiple studies assessing “walking”) by two authors (NH, JM). Fifty-nine unique activities were identified and included in the final list for component scoring by the expert panel.

Expert Panel & Delphi Procedure

The project leader (NH) identified five experts in aging and activity engagement to participate in the Delphi process based on their extensive clinical and research expertise across multiple settings, as well as their diverse perspectives (see modified Delphi process flow diagram in Figure 1). Including the project leader, all six experts were PhD-prepared gerontological nurses or psychologists (representing experimental psychology, social gerontology, and developmental psychology). All five invited experts agreed to join the panel as evaluators. The Delphi scoring rounds were conducted by email, and an individual not associated with the project entered all data into an Excel spreadsheet to preserve anonymity. No pre-specified number of scoring rounds was set. Rather, an *a priori* decision was made to continue the rounds until both a Shrout-Fleiss reliability score greater than 0.5 was achieved (Koo & Li, 2016) and additional scoring rounds did not improve reliability (i.e., reliability was considered maximized).

Scoring System

A scoring form was developed to facilitate evaluator feedback. The original implementation of activity component scoring by Karp et al. (2006) used four score options for effort (0 = none; 1 = low; 2 = moderate; 3 = high); and this score range was used in the first scoring round. Additionally, to more precisely operationalize the scoring process, we developed descriptive criteria for each score by component type. Based on evaluator feedback from the first scoring round, revisions were made to improve the clarity of instructions as well as the precision of score assignments in subsequent rounds. The 0/none score option was removed, as evaluators questioned whether engaging in any activity would be without some level of cognitive or physical effort. Also, the descriptive criteria of how to differentiate between scoring options and the scoring instructions were modified for clarity based on evaluator feedback. The final activity scoring criteria are presented in the Appendix.

Analysis and Assessment of Activities

Inter-rater reliability (IRR) was calculated by examining Shrout and Fleiss (1979) intraclass correlation coefficient (ICC) in SAS v. 9.4. Random set mean k scores were used to report ICC because measurement was obtained from multiple scorers who were not randomly selected, and we were ultimately interested in using an aggregate score across raters for each activity rather than the scores of any single rater. Additionally, we were interested in examining consistency but not absolute agreement among the scorers. ICCs were calculated for IRR across all activity items as well as for scoring the three components (i.e., cognitive, physical, social). For a given activity, scoring was considered final if four or more evaluators

provided the same score (e.g., if five evaluators gave a social score of 1 to “reading”, then 1 was considered the final social score). If less than four evaluators provided identical scores on an activity, four evaluators discussed the scores and came to a consensus.

Results

Two rounds of component scoring were completed because reliability for the cognitive component scores in the first round was below the acceptable threshold. The following results reflect the outcomes of the second (i.e., final) round of scoring. IRR for all leisure activities across all components was acceptable at 0.72. The IRR of each component was then examined individually. Table 1 includes the final scores for all activities across the three components.

Physical Effort Ratings

IRR for the ratings of physical effort score was excellent (.94). All scorers agreed on 23 of the 59 activities (39%); most scorers agreed on scores for 27 additional items (46%). Scores for the remaining nine activities were resolved through discussion by project team members to reach consensus. The physical component mean was 1.56 (range 1 – 3); 32 activities scored low, 21 scored moderate, and six scored high. An example of an activity that requires low physical effort is light housework, golf needs moderate physical effort, and tennis requires high physical effort.

Social Effort Ratings

IRR for the ratings of social effort score was excellent (.95). All scorers agreed on 33 of the activities (56%); most scorers agreed on another 19 activities (32%). The remaining seven activities were discussed to achieve consensus. The mean for the social component score was 1.56 (range 1 – 3); 32 activities scored low, 21 scored moderate, and six scored high. Listening to music is an activity that requires low social effort, bowling needs moderate social effort, and participating in a club or group requires high social effort.

Cognitive Effort Ratings

IRR for the ratings of cognitive effort were lower than the other two components but remained in the acceptable range at .75. Consistent with this lower IRR, all six scorers agreed on only 1 of the 59 activities. However, most agreed on scores for another 50 activities (85%). There were eight activities that were discussed to achieve consensus. The mean for the cognitive component scores was 1.85 (range 1 – 3); 12 activities scored low, 44 scored moderate, and three scored high. Bicycling needs low cognitive effort, playing a musical instrument requires moderate cognitive effort, and completing crossword puzzles needs high cognitive effort.

Discussion

We sought to develop a leisure activity scoring system that determines the degree of cognitive, physical, and social effort that a typical older adult would require for participation. This project builds on the work of Karp and colleagues (2006) by way of

refining the scoring procedures, evaluating an extensive list of activities typically measured in aging research, and applying transparent methodology to the scoring process. Two rounds of expert panel review using a modified Delphi technique resulted in cognitive, physical, and social component scores with established reliability for 59 different leisure activities. Most of the activity scores had a majority consensus after the second round of review and any that did not were adjudicated by the evaluators to reach a final score. Three activities needed adjudication in two different components which was likely due to the activities being more general rather than specific (e.g., participate in a support group, aerobics or aerobic dance, and play sports or exercise). The IRR for the resulting leisure activity component scores ranged from adequate (cognitive) to excellent (physical, social). This activity scoring system can be used to facilitate data harmonization across the HRS, NHATS, EAS, MARS, and MIDUS datasets, and moreover, can be applied to investigations that seek to better understand how participation in leisure activities influences a variety of aging-related outcomes.

Earlier work on the methodology for scoring activity engagement accounted for the overlap among activity components and provided detailed cognitive, physical, and social component scores (Karp et al., 2006; Köhncke et al., 2016; Küster et al., 2016). However, previous scoring systems were inconsistently applied, had a limited number of activities, and/or did not provide details of how scorers differentiated between the levels of effort (i.e., low vs. moderate vs. high). We improved upon this earlier work to include a much more comprehensive list of activities, implement a rigorous methodology for our expert panel review, and provide detailed instructions on how to differentiate the level of effort when scoring the activities.

Activities that have higher scores (i.e., require more effort) in all components may be more cognitively protective (Rehfeld et al., 2017; Verghese et al., 2003). In the current project, some activities were scored moderate to high in all three components: participating in any team sports, exercises, or physical activities; swimming or water exercise; bowling; handball or racquetball; tennis; golf; dancing; going to parties or other social events; and babysitting. In previous work, Küster et al. (2016) also scored tennis, dancing, and racquetball as moderate to high in all components. One activity that was scored high in all components in previous research but not in our project was traveling. Both Köhncke et al. (2016) and Karp et al. (2006) had high scores for traveling while we had a low score for the social component. In this instance, the social component for traveling may have been scored higher in the Köhncke et al. and Karp et al. studies due to the assumption that the older adult would not be traveling alone and also the activity is broad, there are many different types of traveling. However, our scoring system instructions required score assignment based on the minimum amount of effort required to participate and an assumption that the activity does not involve other people unless the description states otherwise; this resulted in a low score for the social component.

This project does have some limitations. The activities scored were limited to those in the HRS, NHATS, EAS, MARS, and MIDUS datasets. However, the 59 activities are typical of those engaged in by older adults, and our review of the measures used across five longitudinal studies captured a larger number of activities than what has been scored in

previous work (Chen et al., 2016; Karp et al., 2006; Köhncke et al., 2016; Küster et al., 2016; Nilsen et al., 2018; Zhu et al., 2017). Another limitation is that the activity scores were not evaluated by older adult participants and were instead scored by experts in gerontology. Including input from older adults and doing test-retest analysis for reliability and replicability in this population is an important next step. Additionally, because older adult participants are the ones who are engaging in these activities, investigating their responses to component scoring will provide further validity (Karp et al., 2006). Finally, we did revise the scoring tool after the first round of expert panel review due to low IRR for the cognitive component. This revision helped to strengthen our scoring system and our final IRR was adequate. Despite several limitations, our activity component scoring system improves upon previous options, can be used by investigators who measure leisure participation, and can be expanded in the future by applying our scoring methodology to include other activities.

Future research examining leisure activity participation among older adults should also consider the inclusion of objective measures of effort. Objective quantification of physical activity is commonly achieved using devices such as accelerometers and pedometers (Sylvia, Bernstein, Hubbard, Keating, & Anderson, 2014). Pedometers monitor the number of steps (but not amount of effort) taken, while accelerometers measure the frequency, duration, and intensity of physical activity. Accelerometers have been recommended over pedometers for measuring activity effort in older adults due to their accuracy in measuring a slower or uneven gait; however, high cost may be a drawback of using this type of device (Sylvia et al., 2014). Objective measures of cognitive effort are less straightforward, as the cognitive effort required to perform an activity represents a subjective construct (Westbrook & Braver, 2015). Investigators have attempted to objectively measure cognitive effort using functional magnetic resonance imaging (fMRI; Lozano, 2018) by examining the areas of the brain activated during a cognitive task (Vassena et al., 2014). One specific area of the brain, the amygdala, is only activated when a higher than average amount of cognitive effort is needed to complete a task (Lozano, 2018; Vassena et al., 2014). Therefore, fMRI may be useful in measuring the amount of cognitive effort needed for certain high-demand activities but is not able to differentiate between mild and moderate effort and can only be used to measure effort in activities that do not require physical movement. Social activity effort can be measured using a special clip-on microphone device that does not record the actual content of the conversation but rather paralinguistic aspects of speech (i.e., speaking rate, turn duration, turn frequency; Berke, Choudhury, Ali, & Rabbi, 2011). The data can then be analyzed to determine the amount of time spent engaged in a conversation with at least one other person (Berke et al., 2011). In all cases of objective measures of effort, comparisons can be made between participants' subjective ratings for further examination.

Engagement in leisure activities may be linked to a lower risk of dementia (Kuiper et al., 2015), but it is unclear whether different types of activities confer greater cognitive protection due to the unique combinations of cognitive, physical, and social effort required. Projections are that dementia will continue to take a toll on the health and well-being of older adults across the globe (World Health Organization, 2015). The key to reducing dementia incidence is likely rooted in lifestyle choices made early in life (Wajman, Mansur, & Yassuda, 2018). Activity engagement has shown promise in reducing the risk of cognitive

decline, and future investigations can employ our component scoring system to better understand which activities or which components of activities provide the most benefit.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

- Berke EM, Choudhury T, Ali S, & Rabbi M (2011). Objective measurement of sociability and activity: Mobile sensing in the community. *Annals of Family Medicine*, 9(4), 344–350. 10.1370/afm.1266 [PubMed: 21747106]
- Bielak AAM (2010). How can we not 'lose it' if we still don't understand how to 'use it'? Unanswered questions about the influence of activity participation on cognitive performance in older age – A mini-review. *Gerontology*, 56(5), 507–519. 10.1159/000264918 [PubMed: 19996570]
- Brown CL, Robitaille A, Zelinski EM, Dixon RA, Hofer SM, & Piccinin AM (2016). Cognitive activity mediates the association between social activity and cognitive performance: A longitudinal study. *Psychology and Aging*, 31(8), 831–846. 10.1037/pag0000134 [PubMed: 27929339]
- Chao S-F (2016). Changes in leisure activities and dimensions of depressive symptoms in later life: A 12-year follow-up. *The Gerontologist*, 56(3), 397–407. 10.1093/geront/gnu052 [PubMed: 24986219]
- Chen Y-M, Chiang T-L, Chen D-R, Tu Y-K, & Yu H-W (2016). Trajectories of older adults' leisure time activity and functional disability: a 12-year follow-up. *International Journal of Behavioral Medicine*, 23(6), 697–706. 10.1007/s12529-016-9554-y [PubMed: 26944752]
- Fallahpour M, Borell L, Luborsky M, & Nygård L (2016). Leisure-activity participation to prevent later-life cognitive decline: A systematic review. *Scandinavian Journal of Occupational Therapy*, 23(3), 162–197. 10.3109/11038128.2015.1102320 [PubMed: 26586025]
- Foubert-Samier A, Catheline G, Amieva H, Dilharreguy B, Helmer C, Allard M, & Dartigues J-F (2012). Education, occupation, leisure activities, and brain reserve: a population-based study. *Neurobiology of Aging*, 33(2), 423.e15–25. 10.1016/j.neurobiolaging.2010.09.023
- Jünger S, Payne SA, Brine J, Radbruch L, & Brearley SG (2017). Guidance on Conducting and REporting DELphi Studies (CREDES) in palliative care: Recommendations based on a methodological systematic review. *Palliative Medicine*, 31(8), 684–706. 10.1177/0269216317690685 [PubMed: 28190381]
- Karp A, Paillard-Borg S, Wang H-X, Silverstein M, Winblad B, & Fratiglioni L (2006). Mental, physical and social components in leisure activities equally contribute to decrease dementia risk. *Dementia and Geriatric Cognitive Disorders*, 21(2), 65–73. 10.1159/000089919 [PubMed: 16319455]
- Keller L, Xu W, Wang H-X, Winblad B, Fratiglioni L, & Graff C (2011). The obesity related gene, FTO, interacts with APOE, and is associated with Alzheimer's disease risk: a prospective cohort study. *Journal of Alzheimer's Disease: JAD*, 23(3), 461–469. 10.3233/JAD-2010-101068 [PubMed: 21098976]
- Köhncke Y, Laukka EJ, Brehmer Y, Kalpouzos G, Li T-Q, Fratiglioni L, ... Lövdén M (2016). Three-year changes in leisure activities are associated with concurrent changes in white matter microstructure and perceptual speed in individuals aged 80 years and older. *Neurobiology of Aging*, 41, 173–186. 10.1016/j.neurobiolaging.2016.02.013 [PubMed: 27103530]
- Koo TK, & Li MY (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, 15(2), 155–163. 10.1016/j.jcm.2016.02.012 [PubMed: 27330520]

- Kuiper JS, Zuidersma M, Oude Voshaar RC, Zuidema SU, van den Heuvel ER, Stolk RP, & Smidt N (2015). Social relationships and risk of dementia: A systematic review and meta-analysis of longitudinal cohort studies. *Ageing Research Reviews*, 22, 39–57. 10.1016/j.arr.2015.04.006 [PubMed: 25956016]
- Küster OC, Fissler P, Laptinskaya D, Thurm F, Scharpf A, Woll A, ... Kolassa I-T (2016). Cognitive change is more positively associated with an active lifestyle than with training interventions in older adults at risk of dementia: A controlled interventional clinical trial. *BMC Psychiatry*, 16(1), 315 10.1186/s12888-016-1018-z [PubMed: 27608620]
- Lozano JCV (2018). Brain activation for effort in human learning: A critical and systematic review of fMRI studies. *International Journal of Psychology and Psychological Therapy*, 18(3), 257–271.
- Morgan GH, Garand LI, & Lingler JH (2012). Self-initiated health behaviors following a diagnosis of mild cognitive impairment. *Research in Gerontological Nursing*, 5(2), 94–100. 10.3928/19404921-20110831-02 [PubMed: 21928756]
- Nilsen C, Agahi N, & Shaw BA (2018). Does the association between leisure activities and survival in old age differ by living arrangement? *Journal of Epidemiology and Community Health*, 72(1), 1–6. 10.1136/jech-2017-209614 [PubMed: 29079586]
- Rehfeld K, Müller P, Aye N, Schmicker M, Dordevic M, Kaufmann J, ... Müller NG (2017). Dancing or Fitness Sport? The Effects of Two Training Programs on Hippocampal Plasticity and Balance Abilities in Healthy Seniors. *Frontiers in Human Neuroscience*, 11, 305 10.3389/fnhum.2017.00305 [PubMed: 28674488]
- Shrout PE, & Fleiss JL (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin*, 86(2), 420–428. [PubMed: 18839484]
- Sylvia LG, Bernstein EE, Hubbard JL, Keating L, & Anderson EJ (2014). Practical guide to measuring physical activity. *Journal of the Academy of Nutrition and Dietetics*, 114(2), 199–208. 10.1016/j.jand.2013.09.018 [PubMed: 24290836]
- Vassena E, Silvetti M, Boehler CN, Achten E, Fias W, & Verguts T (2014). Overlapping neural systems represent cognitive effort and reward anticipation. *PLoS ONE*, 9(3). 10.1371/journal.pone.0091008
- Verghese J, Lipton RB, Katz MJ, Hall CB, Derby CA, Kuslansky G, ... Buschke H (2003). Leisure activities and the risk of dementia in the elderly. *The New England Journal of Medicine*, 348(25), 2508–2516. 10.1056/NEJMoa022252 [PubMed: 12815136]
- Wajman JR, Mansur LL, & Yassuda MS (2018). Lifestyle patterns as a modifiable risk factor for late-life cognitive decline: A narrative review regarding dementia prevention. *Current Aging Science*. 10.2174/1874609811666181003160225
- Waltz CF, Strickland OL, & Lenz ER (2017). *Measurement in nursing and health research* (5th ed.). New York, NY: Springer.
- Westbrook A, & Braver TS (2015). Cognitive effort: A neuroeconomic approach. *Cognitive, Affective & Behavioral Neuroscience*, 15(2), 395–415. 10.3758/s13415-015-0334-y
- World Health Organization. (2015). The epidemiology and impact of dementia: Current state and future trends. Retrieved from https://www.who.int/mental_health/neurology/dementia/dementia_thematicbrief_epidemiology.pdf
- Zhu X, Qiu C, Zeng Y, & Li J (2017). Leisure activities, education, and cognitive impairment in Chinese older adults: A population-based longitudinal study. *International Psychogeriatrics*, 29(5), 727–739. 10.1017/S1041610216001769 [PubMed: 28067190]

Figure 1.
Flow diagram of the modified Delphi process.

Table 1**Leisure Activities and Effort Scores**

Activity	Cognitive	Physical	Social
Reading - including newspapers, magazines, books, etc.	2	1	1
Visit a library	2	1	1
Visit museums	2	2	1
Handicrafts - including knitting, crochet, sewing, etc.	2	1	1
Board games	3 ^a	1	2
Card games	2	1	2 ^a
Crossword puzzles	3	1	1
Computer games	2	1	1
Use a computer for email	2	1	2
Use a computer, other than for games or email	2	1	1 ^a
Writing - including letters, stories, journals, etc.	2	1	1
Play a musical instrument	2	1	1
Listen to music	1	1	1
Singing, such as with a choir or similar group	2	1	3 ^a
Watch TV or movies	1	1	1
Shopping	1	2	1
Attend educational programs – including lectures, courses, trainings	3	1	2
Travel – including day and overnight trips	2 ^a	2	1
Participate in a support group	2 ^a	1	3 ^a
Volunteering	2	1 ^a	2
Participate in any team sports, exercises, or physical activities	2	3 ^a	2
Vigorous physical activity (e.g., running, lifting heavy objects)	2	3	1
Moderate physical activity (e.g., bowling, mowing the lawn)	2	2	1
Light physical activity (e.g., laundry, home repairs)	1	2	1
Babysitting	2	2	2
Dancing	2	2	2
Walking	1	2	1
Jogging or running	1	3	1
Bicycling	1	2 ^a	1
Yoga, Tai Chi, or stretching	1	2	1
Aerobics or aerobic dance	2 ^a	3 ^a	1
Play sports or exercise	2	2 ^a	1 ^a
Weight training	2	2	1
Swimming or water exercise	2	2	1
Bowling	2	2	2 ^a

Activity	Cognitive	Physical	Social
Hiking	2 ^a	2	1
Horseback riding	2	2 ^a	1
Handball or racquetball	2	3 ^a	2
Tennis	2	3 ^a	2
Golf	2	2	2 ^a
Light housework	1	1	1
Heavy housework	2	2	1
Cooking or baking	2 ^a	1	1
Gardening or yard work	2 ^a	2	1
Do home or car maintenance	2	2	1
Praying or meditating	1	1	1
Get together socially with friends/neighbors	2	1	3
Talk with friends/neighbors on the telephone	2	1	2
Communicate with friends on social media	2	1	2
Communicate with friends on email	2	1	2
Get together with family	2	1	3
Talk with family on the telephone	2	1	2
Communicate with family on social media	2	1	2
Communicate with family on email	2	1	2
Participate in a club or group	2	1	3
Go out for enjoyment, other than participating in club or group activities - including going out to dinner, movies, concerts, gambling	2	1	2
Go to parties or other social events (e.g., senior dances, nightclubs)	2	2 ^a	3
Go to senior citizen center services	1 ^a	1	2
Attend church or religious services	1	1	2

Note. Scoring system: 1 = mild effort, 2 = moderate effort, 3 = substantial effort.

^aConsensus on score reached after group discussion.