

Original Article

Relationship between physical activity and quality of life in older adults: A meta-analysis

MEUNGGUK PARK¹, EMEKA ANAZA², HEEJINE SHIN³, SIMON M. PACK⁴, MORGAN CHITIYO⁵

¹Sport Administration Program, School of Human Sciences, Southern Illinois University, USA

²Hart School of Hospitality, Sport, and Recreation Management, James Madison University, USA

³School of Management and Marketing, Southern Illinois University, USA

⁴Collins College of Professional Studies, Division of Sport Management, St. John's University, USA

⁵Department of Specialized Education Services, University of North Carolina Greensboro, USA

Published online: December 30, 2020

(Accepted for publication: December 15, 2020)

DOI:10.7752/jpes.2020.06468

Abstract:

Problem Statement: As the global population over the age of 65 has grown significantly in recent decades, their quality of life is of prime importance in the field of health and medicine. In the literature, physical activity is positively related to quality of life of older adults. However, the association between physical activity and quality of life among this population needs to be examined further. The lack of meta-analytical research using correlation coefficients in measuring the average effect size of the relationship is apparent. **Purpose:** This study was designed to conduct a meta-analysis of the correlation between physical activity and quality of life among older adults. **Methods:** A systematic search of Academic Search Complete, PubMed, and Google Scholar yielded 12 studies that met the criteria for a meta-analysis (total participants = 2,819). Comprehensive Meta-Analysis Version 3 software was used to compute weighted average effect size. **Results:** The main finding of this study indicated that the effect size across the 12 studies was .263 (Fisher's $Z = 5.298, p < .001$), indicating that participation in physical activity had a significant positive effect on quality of life. In addition, this study analyzed heterogeneity that represents the variability among the studies, the Q-value ($Q = 75.142, p < .001$), and the I-squared value (85.361), which demonstrated that the studies were heterogeneous. To assess publication bias, the researchers produced the symmetrical funnel plot, indicating a possible absence of publication bias. **Conclusions:** This study provided evidence of a strong relationship between physical activity and quality of life among older adults. This research adds to the existing literature, while also contributing to practice. Most importantly, this study has meaningful implications for health care professionals serving seniors who have limited access to physical activity as a result of the COVID-19 pandemic.

Key Words: Older population, Overall well-being, Physical education, Health care professionals

Introduction

There were 703 million people age 65 years and over in the world in 2019, and a sixth (i.e., 17% or roughly 1.6 billion people) of the world's population will be over the age of 65 years by 2050 (He, Goodkind, & Kowal, 2016; United Nations, 2019). According to the United States Census Bureau (2017), the number of older adults in the United States is 47.8 million, accounting for almost 15% of the total population. While Baernholdt, Hinton, Yan, Rose, and Mattos (2012) found that the quality of life worsened in the U.S. population from 1993-2001, Richard J. Hodes (Director of the National Institute on Aging) pointed out, "People are living longer, but that does not necessarily mean that they are living healthier." (Cire, 2016, para. 3). Quality of life (QOL) is a broad and multi-dimensional concept that includes physical and mental health, social functioning, and emotional well-being (World Health Organization, 1993). Due to the need to improve quality of life for the elderly, several studies have been conducted to examine factors affecting QOL among older adults. Extant research has yielded several key factors including, demographic factors (e.g., advanced age, marital status, employment, higher education, etc.; Thadathil, Jose, & Varghese, 2015), family relationship and social support (e.g., Kang, Park, & Wallace, 2018; LaRocca & Scogin, 2015), religious affiliation (e.g., Gallardo-Peralta, 2017), and depression (e.g., Sivertsen, Bjørkløf, Engedal, Selbæk, & Helvik, 2015). More importantly, physical activity (PA), including sport participation, has consistently been positively associated with QOL in older adults (Elavsky et al., 2005; McAuley et al., 2006; Phillips, Wójcicki, & McAuley, 2013).

PA was found to have both short and long-term positive effects on QOL among older adults (Elavsky et al., 2005). In addition, PA interventions are very effective in reducing the risks of age-related diseases and enhancing cognitive abilities in older adults (Centers for Disease Control and Prevention, 2020). Several studies found that the link between PA and QOL was mediated by several psychological variables including self-efficacy, self-esteem, and positive affect (Elavsky et al., 2005; White, Wójcicki, & McAuley, 2009).

3472-----

Given the amount of empirical studies that have been carried out to examine the relationship between PA and QOL among the elderly, there is a need to systematically review existing empirical studies related to this relationship. Unfortunately, there have been relatively few meta-analyses investigating the association between the two variables in recent years (e.g., Kelley, Kelley, Hootman, & Jones, 2009; Raafs et al., 2020). Among these few studies, there is a lack of meta-analysis research using correlation coefficients in measuring the average effect size of the relationship between PA and QOL.

A meta-analysis is a statistical method that enables researchers to combine data from multiple quantitative studies (Akobeng, 2005; Haidich, 2010). There are several benefits for using meta-analysis over individual studies.

First, while individual studies may yield conflicting results, meta-analysis allows scholars to identify trends and patterns among study results by contrasting results from different studies (Greenland & O'Rourke, 2008).

Second, because a meta-analysis is a statistical procedure that combines the effect sizes from a set of empirical studies, this statistical procedure provides a powerful and precise estimate of the mean effect size across studies, leading to enhanced generalizability of results (Haidich, 2010).

Third, as opposed to qualitative reviews, a meta-analysis allows researchers to minimize bias in the review process, which leads to improved reliability and accuracy (Akobeng, 2005). Given these benefits of meta-analyses and the lack of such studies in relation to PA and QOL among the elderly, it is necessary to explore this further.

Therefore, the purpose of this current meta-analysis was to examine the relationship between PA and QOL among older adults. Specifically, the researchers wanted to answer the following research questions:

1. *What is the relationship between PA and QOL among elderly?*
2. *Is there difference in the effect sizes (the correlation between PA and QOL) between studies conducted before 2010 (2001-2010) and those that were conducted after 2010 (2011-2018)?*

It is anticipated that this knowledge can have meaningful implications for both researchers and practitioners in the health care and physical education sectors.

Methods

Search Strategy and Literature Search

The authors identified related journal articles through a database search. To find and retrieve related, published studies on the link between PA and QOL, the authors used six search-engine databases including EBSCO, Academic Search Complete, Business Source Complete, PsycINFO, SPORTDiscus, and Google Scholar. The key words used were “physical activity”, “quality of life” and “seniors or older adults.”

Eligibility Criteria

The authors established five eligibility criteria to select the relevant articles for data analysis. First, only articles published from 2001 to 2018 were included in this study. Second, the studies must have investigated physical activity and quality of life among the elderly. Third, the empirical studies examined should have demonstrated and reported a correlation between PA and QOL. Fourth, the study statistics could be transformed into an effect size and fifth, the studies should have been available and accessible as full-text articles.

Sample

In the process of identifying relevant articles, the authors manually reviewed each of the identified articles (titles and abstracts) and removed those that did not meet the five criteria. In addition, duplicates were removed during this process. As a result of the literature search and selection processes, only 12 articles were selected as meeting the eligibility criteria for this meta-analysis ($N = 12$; total participants = 2,819). A list of the 12 articles used to conduct the meta-analysis in this study is presented in Table 1.

Data Analysis and Effect Size Calculation

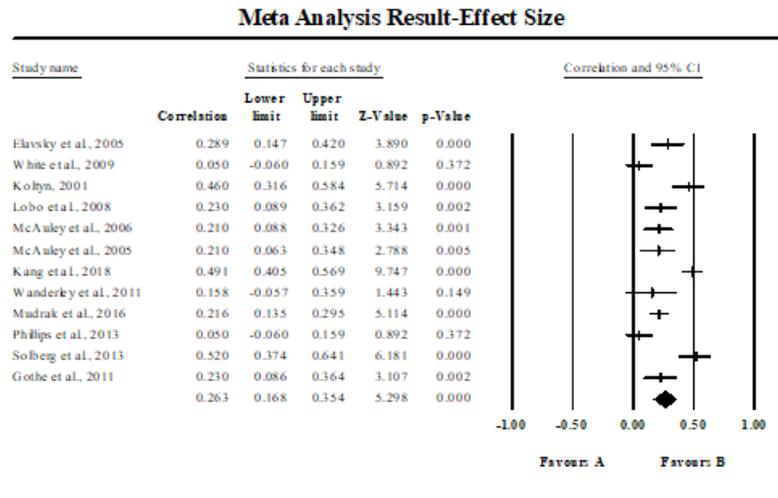
The meta-analysis for this study was conducted using Comprehensive Meta-Analysis Software Version 3, which is one of the most widely used programs. Comprehensive Meta-Analysis (CMA) is considered as the most user-friendly software program with one of its main benefits being the ability to enable a conversion between different indices of effect size (Bax, Yu, Ikeda, & Moons, 2007). In addition, CMA allows for measuring of heterogeneity and publication bias. These authors used a random-effect model to measure the overall effect size (Borenstein, Hedges, Higgins, & Rothstein, 2009). The correlation coefficient r was used as the effect size.

Results

Effect Size for Relationship between PA and QOL

The CMA software program performed the analysis and the results showed the correlation and sample size of each of the 12 studies. The effect size across all 12 studies was .263 (Lower limit = .168, Upper limit = .354, Fisher's $Z = 5.298$, $p < .001$). The correlation of each study was converted to the Fisher's z scale (this transformation is used in meta-analysis for stabilizing the variance). This result suggests that participation in PA had a significant, positive effect on QOL for older adults. The effect size results are shown in Table 1.

Table 1. Effect Sizes of the 12 Studies and the Overall Mean Effect Size



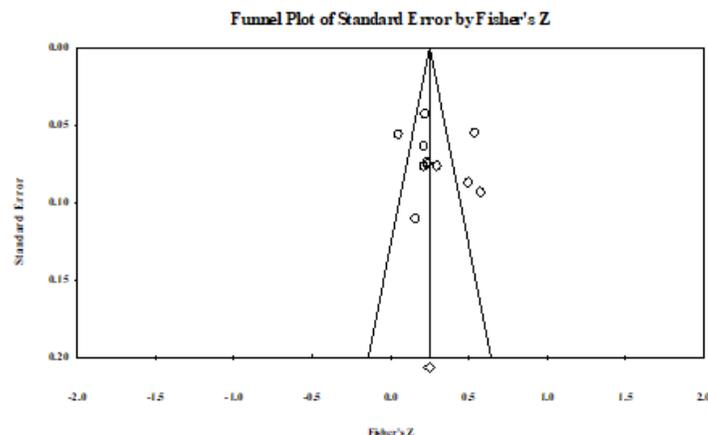
Meta Analysis

Additionally, a subgroup analysis was conducted to see if the effect sizes were different between the studies conducted before 2010 (2001-2010) and studies conducted after 2010 (2011-2018). The effect size for each of the two groups was significant. For studies conducted from 2001-2010 ($n = 6$), the effect size was .238 (Lower limit = .127, Upper limit = .343, Fisher’s $Z = 4.133$, $p < .001$), and for studies conducted between 2011-2018 ($n = 6$), the average effect size was .287 (Lower limit = .125, Upper limit = .433, Fisher’s $Z = 3.421$, $p < .001$). However, a comparison of the effect sizes between the studies conducted before 2010 (2001-2010) and those that were conducted after 2010 (2011-2018) (Q -value = 2.494, $p = .114$) did not indicate any statistically significant difference.

Analysis of Study Heterogeneity Heterogeneity in meta-analysis represents the variability among the studies in the meta-analysis (Higgins, Thompson, Deeks, & Altman, 2003). This current study analyzed heterogeneity, based on the I-squared value. There are three main levels in I-squared values to determine the variability among the studies (Higgins et al., 2003): (1) I-squared values of 20% and below means that there are low levels of heterogeneity, (2) I-squared value of 50% means there are either average or medium levels of heterogeneity, and (3) I-squared value of 75% and above means there are high levels of heterogeneity. In this study, the I-squared value was 85.361, a number that indicates a high level of heterogeneity.

Analysis for Publication Bias-Funnel Plot It is important to measure publication bias in a meta-analysis research study. Publication bias is defined as “a bias against negative findings on the part of those involved in deciding whether to publish a study” (Soeken & Sripusanapan, 2003, p. 57). Publication bias occurs when empirical studies reporting positive findings tend to be published more than those with negative findings (Stanley, 2008). Therefore, meta-analysis research is more likely to include such studies; thus, researchers may prefer to submit research manuscripts showing the statistical significance of their study results (Homberg, McCarthy, & Tabvuma, 2015). One of the widely used assessments for publication bias is to use funnel plots, which visually assess the amount of variation among the results of the studies (Homberg et al., 2015). The symmetrical plot indicates that the literature is unbiased, while asymmetrical plot shows there is a bias in the related published literature. In this current study, the CMA analysis showed the symmetrical funnel plot, indicating a possible absence of publication bias. The funnel plot is presented in Figure 1.

Figure 1. Funnel Plot of the Meta-Analysis of the 12 Studies



Discussions

Older adults benefit greatly from PA, and some of these benefits include the ability to live independently, reduced risk of coronary heart disease, high blood pressure, colon cancer, diabetes, limit anxiety and depression, and maintain healthy bones (Centers for Disease Control and Prevention, 2020). This current study provided evidence of a strong relationship between PA and QOL among seniors. We found a strong support for the idea that when older adults actively participate in PA, they are likely to have improved quality of life. The result from the subgroup analysis showed that there were no significant differences in the effect size between the studies conducted before 2010 (2001-2010) and after 2010 (2011-2018) with the average effect size ($r = .287$, Fisher's $Z = 3.421$, $p < .001$). For the studies conducted after 2010, stronger effect sizes ($r = .238$, Fisher's $Z = 4.133$, $p < .001$) were found relative to studies conducted from 2001-2010. While statistically insignificant (Q-value = 2.494, $p = .114$, 95 % confidence interval), the authors carefully assumed that this result shows a trend. For example, a variety of health campaigns on the importance of PA for seniors seems to be effective, and PA programs for this population developed in recent years seems to be effective in enhancing their QOL.

Few studies have performed a meta-analytic review on the relationship between PA and QOL for older adults. Those studies used odds ratio and mean differences to assess the average effect size (e.g., Kelley et al., 2009; Raafs et al., 2020; Zhang et al., 2020). This current study extends the existing body of knowledge on the topic by using a correlation method in computing the effect size. Odd ratio and mean differences methods are the measures frequently used to report findings of meta-analysis in the medical field whereas researchers in the social sciences tend to mostly rely on use of the correlation coefficient r (Krasnikov & Jayachandran, 2008). In addition, meta-analyses using correlation coefficients can enable researchers to have a deeper understanding of the meta-analytic findings (Diener, Hilsenroth, & Weinberger, 2009).

During this COVID-19 pandemic, many older adults have had limited access to PA, and a majority of them are experiencing loneliness and depression (Armitage & Nellums, 2020; Banerjee, 2020; Damiot, Pinto, Turner, & Gualano, 2020). This study has meaningful implications for health care professionals and administrators in physical education who provide health care services to seniors. Health care professionals should seek to promote physical activity among their elderly clients since it helps to maintain PA among this population to improve their overall well-being (Damiot et al., 2020). The World Health Organization (2020) recently launched the Be Active campaign designed to promote PA at home during the COVID-19 pandemic. One of the recommendations of the campaign was to have individuals participate in online exercise classes. Thus, health care professionals serving seniors may develop virtual PA programs for their senior clients. In addition, there should be continued education and research on the importance of aging adults incorporating PA into their lives and community activities (Centers for Disease Control and Prevention, 2020).

A main limitation of this study is that only 12 studies met the criteria for inclusion. It is possible some studies that met the criteria might have been missed during the search process. However, despite these limitations, results from this study are still informative given the total number of participants (2,8193).

There is a need for additional meta-analytic research exploring mediating factors between PA and QOL among seniors. Several variables could mediate the relationship between PA and QOL. McAuley et al. (2006) found that self-efficacy can play a primary role in the relationship between PA and QOL. Physical self-worth/self-esteem (McAuley et al., 2005) was also found to be an important factor influencing the relationship. In addition, it is worthwhile to examine the average effect size by different subgroups (e.g., gender, geography, type of PA intervention, etc.). Finally, there is a strong research need for examining PA and QOL among seniors in low-and-middle income countries, as there is limited research on ageing in those countries (e.g., Daskalopoulou et al., 2017).

Conclusions

This meta-analytic review supported the evidence that higher levels of PA are related to greater QOL among older adults. **This meta-analysis showed substantial evidence of heterogeneity among the 12 studies.** The main finding extends the existing literature on the topic by using the meta-analysis of correlation coefficients. For practitioners, this study has meaningful implications particularly for health care professionals serving the elderly-it highlights the significance of providing quality PA programs to the population.

References:

- * denotes studies included in the meta-analysis
- Akobeng A. K. (2005). Understanding systematic reviews and meta-analysis. *Archives of Disease in Childhood*, 90(8), 845–848. doi:10.1136/adc.2004.058230
- Armitage, R., & Nellums, L. B. (2020). COVID-19 and the consequences of isolating the elderly. *Lancet Public health*, 5(5), e256. doi:10.1016/S2468-2667(20)30061-X
- Baernholdt, M., Hinton, I., Yan, G., Rose, K., & Mattos, M. (2012). Factors associated with quality of life in older adults in the United States. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 21(3), 527–534. doi:10.1007/s11136-011-9954-z

- Banerjee, D. (2020). The impact of Covid-19 pandemic on elderly mental health. *International Journal Geriatric Psychiatry*, 1–2. doi:10.1002/gps.5320
- Bax, L., Yu, L. M., Ikeda, N., & Moons, K. G. (2007). A systematic comparison of software dedicated to meta-analysis of causal studies. *BMC Medical Research Methodology*, 7, 40. doi:10.1186/1471-2288-7-40
- Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Chichester: John Wiley & Sons, Ltd.
- Centers for Disease Control and Prevention. (2020). *Benefits of physical activity*. Retrieved from <https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>
- Cire, B. (2016, March 28). *World's older population grows dramatically*. National Institute of Aging. Retrieved from <https://www.nia.nih.gov/news/worlds-older-population-grows-dramatically>
- Damiot, A., Pinto, A. J., Turner, J. E., & Gualano, B. (2020). Immunological implications of physical inactivity among older adults during the COVID-19 pandemic. *Gerontology*, 66, 431–438. doi:10.1159/000509216
- Daskalopoulou, C., Stubbs, B., Kralj, C., Koukounari, A., Prince, M., & Prina, A. M. (2017). Physical activity and healthy ageing: A systematic review and meta-analysis of longitudinal cohort studies. *Ageing Research Reviews*, 38, 6–17. doi:10.1016/j.arr.2017.06.003
- Diener, M. J., Hilsenroth, M. J., & Weinberger, J. (2009). A primer on meta-analysis of correlation coefficients: The relationship between patient-reported therapeutic alliance and adult attachment style as an illustration. *Psychotherapy Research Methods*, 19(4-5), 519-526.
- *Elavsky, S., McAuley, E., Motl, R. W., Konopack, J. F., Marquez, D. X., Hu, L.,...Diener, E. (2005). Physical activity enhances long-term quality of life in older adults: efficacy, esteem, and affective influences. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, 30(2), 138–145. doi:10.1207/s15324796abm3002_6
- Gallardo-Peralta, L. P. (2017). The relationship between religiosity/spirituality, social support, and quality of life among elderly Chilean people. *International Social Work*, 60(6), 1498–1511. doi:10.1177/0020872817702433
- *Gothe, N. P., Mullen, S. P., Wójcicki, T. R., Mailey, E. L., White, S. M., Olson, E. A.,... McAuley, E. (2011). Trajectories of change in self-esteem in older adults: exercise intervention effects. *Journal of Behavioral Medicine*, 34(4), 298–306. doi:10.1007/s10865-010-9312-6
- Greenland S, O'Rourke K. (2008). Meta-analysis. In K. J. Rothman, S. Greenland, & T. L. Lash (Eds.), *Modern Epidemiology* (pp. 652–682). 3rd ed. Philadelphia: Lippincott Williams.
- Haidich A. B. (2010). Meta-analysis in medical research. *Hippokratia*, 14(Suppl 1), 29–37.
- He, W., Goodkind, D., & Kowal, P. (2016). *An Aging World: 2015: International Population Reports*. Report for the United States Census Bureau. Retrieved from <https://www.census.gov/content/dam/Census/library/publications/2016/demo/p95-16-1.pdf>
- Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ: British Medical Journal*, 327(7414), 557–560. doi:10.1136/bmj.327.7414.557
- Homberg, F., McCarthy, D., & Tabvuma, V. (2015). A meta-analysis of the relationship between public service motivation and job satisfaction. *Public Administration Review*, 75(5), 711-722.
- *Kang, H., Park, M., & Wallace, J. (2018). The impact of perceived social support, loneliness, and physical activity on quality of life in South Korean older adults. *Journal of Sport and Health Science*, 7(2), 237-244. doi:10.1016/j.jshs.2016.05.003
- Kelley, G. A., Kelley, K. S., Hootman, J. M., Jones, D. L. (2009). Exercise and health-related quality of life in older community-dwelling adults: A meta-analysis of randomized controlled trials. *Journal of Applied Gerontology*, 28(3), 369-394.
- *Koltyn, K. F. (2001). The association between physical activity and quality of life in Older Women. *Women's Health Issues*. 11(6), 471-80. doi:10.1016/S1049-3867(01)00128-1
- Krasnikov, A., & Jayachandran, S. (2008). The relative impact of marketing, research and development, and operations capabilities on firm performance. *Journal of Marketing*, 72(4), 1-11.
- LaRocca, M. A., & Scogin, F. R. (2015). The effect of social support on quality of life in older adults receiving cognitive behavioral therapy. *Clinical Gerontologist*, 38(2), 131–148. doi:10.1080/07317115.2014.990598
- *Lobo, A., Santos, P., Carvalho, J., & Mota, J. (2008). Relationship between intensity of physical activity and health-related quality of life in Portuguese institutionalized elderly. *Geriatrics & Gerontology International*, 8(4), 284–290. doi:10.1111/j.1447-0594.2008.00478.x
- *McAuley, E., Elavsky, S., Motl, R. W., Konopack, J. F., Hu, L., & Marquez, D. X. (2005). Physical activity, self-efficacy, and self-esteem: longitudinal relationships in older adults. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 60(5), P268–P275. doi:10.1093/geronb/60.5.p268
- *McAuley, E., Konopack, J. F., Motl, R. W., Morris, K. S., Doerksen, S. E., & Rosengren, K. R. (2006). Physical activity and quality of life in older adults: influence of health status and self-efficacy. *Annals*

- of *Behavioral medicine: A Publication of the Society of Behavioral Medicine*, 31(1), 99–103. doi:10.1207/s15324796abm3101_14
- *Mudrak, J., Stochl, J., Slepicka, P., & Elavsky, S. (2015). Physical activity, self-efficacy, and quality of life in older Czech adults. *European Journal of Ageing*, 13(1), 5–14. doi:10.1007/s10433-015-0352-1
- *Phillips, S. M., Wójcicki, T. R., & McAuley, E. (2013). Physical activity and quality of life in older adults: An 18-month panel analysis. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 22(7), 1647–1654. doi:10.1007/s11136-012-0319-z
- Raafs, B. M., Karssemeijer, E., Van der Horst, L., Aaronson, J. A., Olde Rikkert, M., & Kessels, R. (2020). Physical exercise training improves quality of life in healthy older adults: A meta-Analysis. *Journal of Aging and Physical Activity*, 28(1), 81–93. doi:10.1123/japa.2018-0436
- Sivertsen H, Bjørkløf, G. H., Engedal, K., Selbæk, G., & Helvik, A. S. (2015). Depression and quality of life in older persons: A review. *Dementia and Geriatric Cognitive Disorders*, 40(5-6), 311-339. doi:10.1159/000437299
- Soeken, K. L., & Sripusanapan, A. (2003). Assessing publication bias in meta-analysis. *Nursing Research*, 52(1), 57–60. doi:10.1097/00006199-200301000-00009
- *Solberg, P. A., Halvari, H., & Ommundsen, Y. (2013). Linking exercise and causality orientations to change in well-being among older adults: does change in motivational variables play a role? *Journal of Applied Social Psychology*, 43(6), 1259-1272. doi:10.1111/jasp.12088
- Stanley, T. D. (2008). Meta-regression methods for detecting and estimating empirical effect in the presence of publication selection. *Oxford Bulletin of Economics and Statistics*, 70, 103-127.
- Thadathil, S., Jose, R., & Varghese, S. (2015). Assessment of domain wise quality of life among elderly population using WHO-BREF Scale and its determinants in a rural setting of Kerala. *International Journal of Current Medical and Applied Sciences*, 7(1), 43-46.
- United Nations, Department of Economic and Social Affairs, Population Division (2019). *World Population Ageing 2019: Highlights* (ST/ESA/SER.A/430). Retrieved from <https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Highlights.pdf>
- U.S. Census Bureau. (2017). *Older Americans Month: May 2017*. Retrieved from <https://www.census.gov/content/dam/Census/newsroom/facts-for-features/2017/cb17-ff08.pdf>
- U.S. Department of Health and Human Services' Center for Disease Control and Prevention. (2020). *About physical activity*. Retrieved from <https://www.cdc.gov/physicalactivity/about-physical-activity/index.html>
- *Wanderley, F. A., Silva, G., Marques, E., Oliveira, J., Mota, J., & Carvalho, J. (2011). Associations between objectively assessed physical activity levels and fitness and self-reported health-related quality of life in community-dwelling older adults. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 20(9), 1371–1378. doi:10.1007/s11136-011-9875-x
- *White, S. M., Wójcicki, T. R., & McAuley, E. (2009). Physical activity and quality of life in community dwelling older adults. *Health and Quality of Life Outcomes*, 7(10), 1-7. doi:10.1186/1477-7525-7-10
- World Health Organization. (2020). *Be active at home during #COVID 19 outbreak*. Retrieved from <https://www.who.int/news-room/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome---physical-activity>
- Zhang, Y., Zhang, Y., Du, S., Wang, Q., Xia, H., & Sun, R. (2020). Exercise interventions for improving physical function, daily living activities and quality of life in community-dwelling frail older adults: A systematic review and meta-analysis of randomized controlled trials. *Geriatric nursing (New York, N.Y.)*, 41(3), 261–273. doi:10.1016/j.gerinurse.2019.10.006