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Article Title: Effects of Physical Activity Governmental Programs on Health Status in Independent Older Adults: A Systematic Review

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EFFECTS OF PHYSICAL ACTIVITY GOVERNMENTAL PROGRAMS ON HEALTH STATUS IN INDEPENDENT OLDER ADULTS: A SYSTEMATIC REVIEW

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Abstract

This systematic review analyzes the evidence of the effects of physical activity governmental programs oriented towards the health of independent older adults. Medline, Web of Science, PsycINFO and Psychology and Behavioral Sciences Collection databases were used for data mining and the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) recommendations were followed. Five studies ($n=2,545$ participants) fulfilled the established inclusion criteria. The physical activity programs had beneficial effects on the older adults' quality of life, fall risk, activities of daily living, physical activity levels, nutritional risk, body mass index, arterial pressure, resting heart rate, blood glucose, triglycerides and/or cholesterol, but did not significantly alter their body fat mass percentage. Programs involving diverse physical capacities seem to be more effective for healthy aging. It is recommended that governments start to disseminate the outcomes of these programs within society and the scientific community.

Keywords: Exercise, physical fitness, elderly, aging, organizations.

Introduction

Issues surrounding the elder population raises big challenges and opportunities to societies (He, Goodkind, & Kowal, 2016; World Health Organization, 2012a). Among them, the promotion of active lifestyles has been defined as a key aspect for healthy aging (Chapman, Hampson, & Clarkin, 2014; Guigoz, 2006; He et al., 2016). There is important scientific evidence about health improvement achieved in older adults through the regular practice of physical activity (PA) (Bouaziz et al., 2016; Hughes, McDowell, & Brody, 2008; McPhee et al., 2016; World Health Organization, 2012b). Nonetheless, several studies document the highly sedentary lifestyles adopted by many older adults (He et al., 2016; Taylor et al., 2004). This is discouraging because of the link between sedentary lifestyles, obesity and a higher risk of future mortality (Barry et al., 2014; Hruby & Hu, 2015; World Health Organization, 2000).

Toward countering this sedentary lifestyle, many public and private institutions have actively promoted policies and programs intended to encourage and incorporate PA into older adults' lifestyles (Figueira et al., 2012; He et al., 2016; Hughes et al., 2008; World Health Organization, 2012a). A problem for many programs developed “in the real world” is the difficulty of demonstrating their scientific validity, as well as including strategies that have proved effective in smaller and more controlled research contexts (Reis et al., 2016). Several studies have analyzed the effectiveness of health governmental programs incorporating PA for the older adults, obtaining significant improvements in fall risk prevention (Day, Donaldson, Thompson, & Thomas, 2014), body mass index (BMI), waist circumference, arterial pressure and motor functionality (Hetherington, Borodzicz, & Shing, 2015) or factors related to the quality of life such as social participation, death perceptions and intimacy (Figueira et al., 2012). To sum up, the cited studies

document the positive effects that PA programs can have for the older adults at the physical, motor, psychological and social levels.

There are several reviews examining the effects of PA programs on the physical fitness (Bouaziz et al., 2016; Hruby & Hu, 2015), food habits (Guigoz, 2006), fall prevention (Day et al., 2014), quality of life and wellbeing of older adults (Balogun, Balogun, Philbrick, & Abdel-Rahman, 2017). A review regarding the impact of nutritional education governmental programs and PA for healthy aging in the United States of America has been also carried out (Wunderlich & Gatto, 2016). However, to the best of our knowledge, a work summarizing the effects of PA governmental programs on the health of older adults has not been developed yet. This topic is relevant for at least three reasons: (1) its impact on older adults' health; (2) the large investment on human and economic resources that public and private institutions are making in promoting PA for older adults; and specifically for (3) the responsibility that governments have in developing policies and providing efficient basic services that address older adults' needs and ensures for all of them decent living standards (World Health Organization, 1999).

Taking into account these considerations, the aim of the present systematic review was to analyze the studies focused on PA governmental programs aimed at improving the health of independent older adults, as well as to describe the effects of those programs.

Methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses Protocols (PRISMA-P) guidelines, a 17-item checklist intended to facilitate the development and reporting of a robust protocol for the systematic reviews or meta-analysis (Moher et al., 2015). It was also registered on PROSPERO, an international database of prospectively

registered systematic reviews developed by the Centre for Reviews and Dissemination of the University of York (<https://www.crd.york.ac.uk/prospetro>; code [CRD42016052429](#)).

Search strategy and data sources

The object of this work was to examine studies on PA governmental programs oriented towards the health in independent older adults. Governmental programs were understood as those designed, developed and evaluated under the supervision of national, federal, state, regional, province or local governments (Figueira et al., 2012; He et al., 2016; Hetherington et al., 2015; World Health Organization, 2012a). Independent older adults were those older people capable of performing basic activities of daily living by themselves (Ministerio de Salud, 2013).

The data search was performed during March 2018. Medline, Science Citation Index Expanded (SCI-E), Social Sciences Citation Index (SSCI), Emerging Sources Citation Index (ESCI) and SciELO Citation Index (SciELO CI) databases, all of which were included on the Web of Science (WoS) platform, were consulted, as well as the extensive behavioral and social sciences databases PsycINFO (American Psychological Association) and Psychology and Behavioral Sciences Collection (EBSCO). In order to include the newest studies in the review, we set citations alarms in all these databases.

The data search was performed by using the U.S. National Library of Medicine's *Medical Subject Headings* (MeSH) terms and free language terms related to physical activity, elderly and governmental programs. The search string for all databases was the following: ("Physical Activity" OR "Motor Activity" OR "Exercise" OR "Physical Fitness" OR "Sport*" OR "Physical Endurance" OR "Recreation") AND ("Government*") AND ("Elderly" OR "Older Adult*" OR "Older Subject*" OR "Ageing" OR "Aged"). A total of 1,414 records were found in this initial search.

Study selection, eligibility criteria and data extraction

The selected references were then filtered according to the following inclusion criteria: a) studies written in English, Spanish or Portuguese, as these are the languages known to the authors; b) published from 1990 onwards, as this would nearly cover the most recent 30 years of research; c) their object of study was the effects of PA governmental programs on the health of independent older adults, considering older adults those with an age of 60 or more years, regardless of their gender; d) original experimental studies (randomized controlled trials and non-randomized) as well as observational, analytical studies (cohort and case-control) and descriptive studies including pre- and post-evaluation (Grimes & Schulz, 2002). On the other hand, exclusion criteria were: a) studies that did not correspond to original research (e.g., editorials, letters, translations, notes, book reviews); b) duplicate papers; c) review papers (e.g., meta-analyses, systematic reviews, narrative reviews); and d) single-subject studies (i.e., studies using only one subject/person).

We first used the databases "refine results" tools for applying inclusion criteria a) and b). The remaining references were then exported to Endnote X6 reference manager software and filtered to delete duplicates. This process resulted on 1,009 references, which were filtered one more time by screening the title, abstract and keywords for each reference. Only for a few cases was it necessary to review the full text publication. The study selection was performed independently by two members of the review team (PVB, CGG), with disagreements resolved by a third researcher (MPG). After this process, the number of potentially eligible studies was 44. However, after checking the full texts of these studies, 39 of them were excluded since twelve were not PA governmental programs (Aoki et al., 2015; Brach, Nieder, Nieder, & Mechling, 2009; Burton, Lewin, Clemson, & Boldy, 2013; Etkin, Prohaska, Harris, Latham, & Jette, 2006; Filiatrault et al., 2008; Nguyen et al., 2007; Gawler et al., 2016; Liang et al., 2017; Matsudo et al.,

2003; Quehenberger, Cichocki, & Krajic, 2014; Robitaille et al., 2012; Zgibor et al., 2016), five included participants younger than 60 years old in their samples (Ablah et al., 2015; Cameron, Chahine, Selig, & Newton, 2008; Hetherington et al., 2015; Martinson et al., 2010; Wilcox, Dowda, Wegley, & Ory, 2009), nine did not respond to the object of study of the present review (Babazono, Kuwabara, Hagiihara, Nagano, & Ishihara, 2011; Cheadle, Egger, LoGerfo, Walwick, & Schwartz, 2010a; Dangour et al., 2007; Filiatrault et al., 2007; Goodman, Davies, Tai, Dinan, & Iliffe, 2007; Griffin et al., 2010; Hayashi, Kondo, Suzuki, Yamada, & Matsumoto, 2014; Kanamori et al., 2012; Stewart et al., 2006), six just collected results from only one assessment (post-evaluation) of the participants (Benedetti, Schwingel, Gomez, & Chodzko-Zajko, 2012; Cheadle, Egger, LoGerfo, Schwartz, & Harris, 2010b; da Fonte et al., 2016; Figueira et al., 2009; Valdés-Badilla et al., 2017; Yokoya, Demura, & Sato, 2008), and seven were reviews (Baker, Francis, Soares, Weightman, & Foster, 2011; Buford, Roberts, & Church, 2013; Carande-Kulis, Stevens, Florence, Beattie, & Arias, 2015; Ciolac, 2013; Day et al., 2014; Meads & Exley, 2018; Minkler, Schauffler, & Clements-Nolle, 2000). A total of five studies (Figueira et al., 2012; Marin et al., 2009; Wellman, Kamp, Kirk-Sanchez, & Johnson, 2007; Wunderlich, McKinnon, Piemonte, & Ahmad, 2009; Yokoya, Demura, & Sato, 2009) met all the inclusion criteria and went on to the next phase of methodological quality assessment, which is explained in the next subsection. Figure 1 depicts the flow diagram of outcomes of the present review.

Methodological quality assessment

This phase was aimed at detecting risk of bias in the individual selected studies, which eventually might lead to the exclusion of some of the previously selected studies. For this purpose we applied Downs and Black's (1998) checklist for the assessment of the methodological quality of studies of health care interventions. This is a reliable and valid tool that has been widely used

in health research. It is composed of 27 items concerning reporting (10 items), external validity (3 items), internal validity-bias (7 items), internal validity-confounding (selection bias) (6 items), and statistical power (1 items), allowing to score an individual study between 0 and 32 points. The full list is usually applied for randomized studies, while for non randomized studies it was reduced to 17 criteria, after the exclusion of items 9, 13, 14, 17, 19, 22, 23, 24, 26 and 27, which are not applicable on non-randomized studies, with a maximum score of 17 points (Freke et al., 2016). In this way, the original non-randomized controlled trials and descriptive studies with pre- and post-evaluation positively evaluated on 60% (10 points or more out of 17) criteria were selected and included in the subsequent analyses, since they presented a low risk of bias (Downs & Black, 1998; Grimes & Schulz, 2002; Freke et al., 2016). This selection process was independently performed by three members of the group (PVB, CGG, MPG), and then collected by a researcher (PVB) who included those works evaluated positively by at least two researchers. All five selected studies met the methodological quality criteria.

Data synthesis

The following data were obtained and analyzed from the selected studies: (a) total score of the methodological quality assessment, (b) aim of the study, (c) type of study, (d) size and mean age of the participants, (e) older adults groups (sample), (f) kind of PA practiced, (g) volume of the PA (total duration, weekly frequency and time per session), (h) intensity of the PA, (i) analyzed variables, (j) instruments applied, and (k) main outcomes.

Results

A total of five studies were selected through this process. Tables 1 and 2 show a summary of the analyzed variables for each of them. Two studies were developed in the United States of

America and were funded by the Agency on Aging (AoA) of the federal government (Wellman et al., 2007) and the Area Agency on Aging, Hudson County, New Jersey (Wunderlich et al., 2009). One in Japan was funded by the local government of Kaga city (Yokoya et al., 2009), and two were done in South America, one by the federal government of Brazil (Figueira et al., 2012) and the other by the Senior Center of the municipality of Berisso, Buenos Aires, Argentina (Marin et al., 2009).

Wellman et al. (2007) focused on the program “Eat Better & Move More” (EBMM), which was developed in 2004 by the National Resource Center on Nutrition, Physical Activity & Aging at Florida International University, Miami, as a part of the AoA *You Can! Steps to Healthier Aging* campaign (Wellman et al., 2004). They initially enrolled 999 participants (M age = 74.3 years, 81% females, 43% racial/ethnic minority groups) from ten local programs developed in a variety urban and rural locations (congregate dining centers, neighborhood recreation centers, and housing complexes in urban inner-city, suburban, and rural locations and a Native American reservation) of ten states. Each of these programs received a grant of \$10,000 and specific training on the EBMM program was provided to the lead person at each site (eight registered dietitians, one registered nurse and one Native American program manager). The retention rate in this study was 62.1% (i.e., 620 of 999 participants completed the program).

Also in the United States of America, Wunderlich et al. (2009) studied the provision of six congregate-site meal and exercise programs for an initial cohort of 573 elderly (no mean age, gender and race/ethnic diversity data on this sample is provided. Neither was there information on the specific funding for these programs). The programs were delivered by registered dietitians and certified exercise trainers and a retention rate of 24.6% in these programs was reported.

In Japan, Yokoya et al. (2009) assessed an exercise program that was developed as part of a local government-sponsored health promotion service for the maintenance of health status, quality of life and social interaction of older adults. It initially involved 206 participants (82% females, without specifying the average age, race/ethnicity, the professionals in charge of the program or the specific funding) and had a retention rate of 74.1%.

Figueira et al. (2012) had a project aimed at improving the quality of life of low-income older adults by means of physical exercise. This project was developed in the context of Brazil's Family Health Program, a community-based approach to providing primary health care for defined populations by interdisciplinary teams (Macinko & Harris, 2015). Thirty-five older adults completed the program (M age = 68.7 years, 74.3% females). Data on race/ethnic diversity and the specific funds for this program are not reported. They were guided by a professional physical educator. This program had no desertions in the experimental/exercise group but three in the control group (global retention rate of 95.7%).

Finally, Marin et al. (2009) assessed in Buenos Aires a cohort of 700 older adults (M age = 70, 67.2% women). Fifty percent received monthly food aid. No race/ethnic diversity data on this sample is provided, nor on the professionals in charge of the program or specific funding. This program had no desertions.

In relation to the type of study, two of the selected studies were randomized controlled trials (Figueira et al., 2012; Marin et al., 2009), and three descriptive (Wellman et al., 2007; Wunderlich et al., 2009; Yokoya et al., 2009). They analyzed the effects of PA programs (Figueira et al., 2012), health and pathology prevention promotion (Marin et al., 2009), nutritional education and PA (Wellman et al., 2007; Wunderlich et al., 2009) and fall risk prevention (Yokoya et al., 2009) regarding the perception of the quality of life (Figueira et al., 2012; Marin et al., 2009),

complications associated with aging (Marin et al., 2009), fall risk (Yokoya et al., 2009), nutritional risk (Marin et al., 2009; Wellman et al., 2007; Wunderlich et al., 2009), physical fitness (Wellman et al., 2007; Yokoya et al., 2009), physical activity levels (Wellman et al., 2007) and general health status (Wunderlich et al., 2009) in different groups of older adults. There was a total of 2,545 participants with a mean age of 71.1 years.

The main activities included in the PA programs were muscle strengthening exercises (Figueira et al., 2012; Marin et al., 2009; Wunderlich et al., 2009; Yokoya et al., 2009), stretching (Figueira et al., 2012; Marin et al., 2009; Wellman et al., 2007; Wunderlich et al., 2009; Yokoya et al., 2009), walking (Figueira et al., 2012; Wellman et al., 2007; Wunderlich et al., 2009; Yokoya et al., 2009), hydrogymnastics (Figueira et al., 2012), healthy dance (Marin et al., 2009), balance exercises (Wunderlich et al., 2009), and recreational sports and rhythm exercises (Yokoya et al., 2009), executed mostly at a moderate intensity (Exercise intensity is only reported in Figueira et al., 2012; Marin et al., 2009; Wunderlich et al., 2009). The duration of the programs (period under evaluation) was diverse, including 12 weeks (Figueira et al., 2012), 12 months (Marin et al., 2009; Wellman et al., 2007), three years (Yokoya et al., 2009) and four years (Wunderlich et al., 2009). PA volume was equally diverse, ranging from two to seven sessions per week, for a total of 90 to 165 minutes per week (Table 1).

The selected studies used different indicators for assessing the effects of PA programs. At the physical level, BMI (Marin et al., 2009; Wunderlich et al., 2009), body fat mass percentage (Wunderlich et al., 2009), mobility and habitual physical activity (Wellman et al., 2007) and the activities of daily living, physical fitness and fall risk (Yokoya et al., 2009) were considered. Regarding physiological aspects, the studies measured resting heart rate, blood glucose, cholesterol, systolic and diastolic arterial pressure (Marin et al., 2009; Wunderlich et al., 2009),

and triglycerides (Marin et al., 2009). Nutritional risk was screened through various instruments based on the Nutrition Screening Initiative – NSI checklist (Posner, Jette, Smith, & Miller, 1993). Marin et al. (2009) used the DETERMINE-nutritional risk survey, Wellman et al. (2007) used a nutritional risk questionnaire adapted from the Congregate Meals Survey, version 3. Wunderlich et al. (2009) applied the Mini Nutritional Assessment – MNA. The perception of the quality of life regarding the health was considered in two studies. Marin et al. (2009) used the Health Survey Short Form (SF-12), version 1, while Figueira et al. (2012) used the World Health Organization Quality of Life Questionary. The quality of life was the only measured variable in the latter study.

Regarding the main results obtained in the analyzed studies, significant improvements were reported at the physical level, specifically in decreasing fall risk and improving activities of daily living (Yokoya et al., 2009), improving mobility and habitual physical activity (Wellman et al., 2007), and in reducing BMI (Marin et al., 2009) in the older adults who completed the programs. However, a decline in physical fitness was shown after three years of participation in PA programs (Yokoya et al., 2009). At the physiological level, beneficial effects of PA on the systolic and diastolic arterial pressure (Marin et al., 2009; Wunderlich et al., 2009), resting heart rate (Wunderlich et al., 2009), blood glucose, triglycerides and total cholesterol (Marin et al., 2009) were observed.

Results of nutritional risk were contradictory since they showed a significant reduction on the moderate and high risk for an older adults group compared to the control group (Marin et al., 2009), but they also depicted no significant changes in the distribution of the nutritional risk in older adults participating in a PA program during four years (Wunderlich et al., 2009). Another study showed significant improvements in the consumption of fruits, vegetables, fiber, calcium and water in the participants who completed the program after one year (Wellman et al., 2007).

Finally, the perception of the quality of life showed improvements in the sensorial function, social participation, death perception, intimacy (Figueira et al., 2012) and health perception, together with reduced limitations and problems while performing activities of daily living (Marin et al., 2009).

Discussion

The aim of the present review was to analyze the current literature on the effects of physical activity governmental programs on health status in independent older adults. After exhaustive data mining, it should be highlighted that only five studies fulfilling all the inclusion criteria were found. This is paradoxical, since it is obvious that governments in many countries and at multiple levels (national, regional, local, etc.) are promoting PA programs for older adults as these are "very low-cost prevention measures that can reduce medical spending by delaying the development of chronic disease" (Wunderlich et al., 2009, p. 266). This fact has been already reported by the literature, which claims the necessity of these programs to be elaborated, developed and assessed from solid technical and scientific principles (Bouaziz et al., 2017; Ogawa, You, & Leveille, 2016; World Health Organization, 2012b). Among the main problems cited for the development of these kind of studies include the difficulty for having a control group since these initiatives set among their purposes the inclusion, dissemination and mass application of the PA among the older adults (Robitaille et al., 2012), thereby limiting the randomization of the participants. The economic resources are limited for carrying out studies on the PA area, and the lack of coordination among health professionals (Goodman et al., 2007) are other difficulties that could hinder the increase of studies in real practice contexts. Moreover, it seems that the governments' aims are more related with the implementation of PA programs than the monitoring, evaluation and spreading of their results within the scientific field. In fact, many of the assessments applied on these programs were

not registered nor informed by means of the main scientific communication media, and the validity of these kinds of assessments has been discussed because they are not reviewed by the scientific community (Reis et al., 2016). Arguably, improvements in these areas require additional personnel, economic and organizational resources, and this may be why governments deliver but do not rigorously assess the outcomes of these programs.

In any case, beneficial effects were observed in some of the health indicators in older adults participating in the PA governmental programs. However, some studies did not report much improvement in the physical fitness or activities of daily living (Yokoya et al., 2009), nor in the BMI or nutritional risk (Wunderlich et al., 2009) of the older adults, especially after three to four years of participation in these programs. This does not mean that the effects of these programs were not beneficial in these indicators, since their maintenance for three and four years could be considered positive. In this regard, it is important to point out that the aforementioned studies were descriptive and did not have a control/comparator group against which to assess the real effects of the PA programs.

These results also could be related to the planning and type of PA practiced, as the analyzed studies did not provide complete information in this regard. Only two studies stated the number of repetitions for the exercises of muscular strengthening (Yokoya et al., 2009; and Wellman et al., 2007, by referring Wellman et al.'s, 2004, *Eat better & Move More* guidebook). Few pointed out the time or intensity of the walk (Figueira et al., 2012; Wunderlich et al., 2009; Yokoya et al., 2009), hydrogymnastics (Figueira et al., 2012), healthy dance (Marin et al., 2009), or recreational sports and rhythm exercises (Yokoya et al., 2009). Only three studies (Figueira et al., 2012; Wellman et al., 2007; Wunderlich et al., 2009) performed more than two supervised PA sessions per week, while just two studies indicated the gradual increase in intensity of the exercises during

the program (Wellman et al., 2007; Wunderlich et al., 2009). These elements are considered of relevance in PA planning for healthy older adults without physical limitations (Izquierdo et al., 2017; Kraemer et al., 2002), and are also aligned with the World Health Organization’s (2012b, p. 11) recommendation that “Scientifically-informed recommendations, with a global scope, on the benefits, type, amount, frequency, intensity, duration and total amount of the physical activity necessary for health benefits are key information for policy-makers wanting to address physical activity at population level and who are involved in the development of guidelines and policies at regional and national levels on prevention and control of NCDs. [Non-communicable Diseases]”

It should be also highlighted that only three of the studies clearly indicated that the PA was programmed and supervised by professionals of this area (Figueira et al., 2012; Wellman et al., 2007; Wunderlich et al., 2009). The inclusion of PA professionals has been classified as a key element for the success of these programs (Kraemer et al., 2002). Some discrepancies still exists regarding which professionals should be responsible for promoting PA in the health sector (Goodman et al., 2007). Nevertheless, all studies carried out the older adults’ medical assessment and authorization followed the recommendations for any older adults intervention (Izquierdo et al., 2017), so they could start the PA (Figueira et al., 2012; Marin et al., 2009; Wellman et al., 2007; Wunderlich et al., 2009; Yokoya et al., 2009).

One aspect that caught our attention was the high drop-out rates reported in the descriptive studies (Wellman et al., 2007; Wunderlich et al., 2009; Yokoya et al., 2009). This was about 50% on average at the final assessment and the reason was not investigated. This is in line with other studies which reported attrition rates ranging from 22% to 76% (Jancey et al., 2007). Current research shows that adherence to PA programs for older adults was higher when programs were supervised, and also that personal factors (demographic, health-related, physical and

psychological) played an important role (Picorelli, Pereira, Pereira, Felício, & Sherrington, 2014). Therefore, as stated by these authors, research on specific strategies that enhance “the recruitment, adherence and retention of people from diverse cultures and ethnic backgrounds” (p. 155) is needed.

In general, all the analyzed articles in this review presented PA programs incorporating different physical capacities in their planning, such as endurance, strength, flexibility, balance and agility; which are key factors for health maintenance and improvement in older adults (Izquierdo et al., 2017; Kraemer et al., 2002). Some works have already focused their attention not only on strength exercises for older adults. Witard, McGlory, Hamilton and Phillips’s (2016) recent review indicated that aerobic endurance is an essential component not only of the cardiovascular and metabolic health, but also a promoting element for muscular strengthening and a protector against sarcopenia in the older adults. Therefore, the PA programs aimed at older adults should include activities involving different physical capacities, that is, multicomponent training (Izquierdo et al., 2017; Witard et al., 2016).

The main strengths of this review were: (a) the methods used for the selection and assessment of the studies, following the recommendations of the PRISMA-P and PROSPERO protocols; and (b) the inclusion of several generic and specific databases for information retrieval, increasing the precision and reducing the potential bias on the obtained results (Moher et al., 1996). Among the limitations: (a) only studies written in English, Spanish or Portuguese were considered; and (b) the variety of instruments and variables observed made it difficult to synthesize all the information provided in the selected studies. This fact shows PA in the elder population is an emerging field which needs further support and research. The present systematic review is the first work assessing the scientific articles focused on the effects of PA governmental programs on the

health of independent older adults. Future studies should explore different local databases (e.g., Russian Science Citation Index, Korean Journal Database, Chinese Biomedical Literature database), and include other publication languages for improving data mining.

Conclusion

It is necessary that governments developing PA programs for older adults become involved in the evaluation of these programs and in the dissemination of their results within the scientific community. The PA governmental programs analyzed in this review showed beneficial effects on the quality of life, fall risk, activities of daily living, physical activity levels, nutritional risk, BMI, arterial pressure, resting heart rate, blood glucose, triglycerides and/or cholesterol in the older adults, although there were no changes in the body fat mass percentage. Multicomponent training seems to be the most effective PA program design for the maintenance and improvement of health in the older adults.

References

- Brach, M., Nieder, F., Nieder, U., & Mechling, H. (2009). Implementation of preventive strength training in residential geriatric care: a multi-centre study protocol with one year of interventions on multiple levels. *BMC geriatrics*, 9, 51. doi: 10.1186/1471-2318-9-51

- Day, L., Donaldson, A., Thompson, C., & Thomas, M. (2014). Integrating proven falls prevention interventions into government programs. *Australian and New Zealand journal of public health*, 38(2), 122-127. doi: 10.1111/1753-6405.12140

- Griffin, S., Wilcox, S., Ory, M., Lattimore, D., Leviton, L., Castro, C., . . . Rheaume, C. (2010). Results from the Active for Life process evaluation: program delivery fidelity and adaptations. *Health education research*, 25(2), 325-342. doi: 10.1093/her/cyp017

- Grimes, D. A., & Schulz, K. F. (2002). An overview of clinical research: the lay of the land. *The Lancet*, 359(9300), 57-61. doi: [https://doi.org/10.1016/S0140-6736\(02\)07283-5](https://doi.org/10.1016/S0140-6736(02)07283-5)
- Guigoz, Y. (2006). The Mini Nutritional Assessment (MNA (R)) review of the literature - What does it tell us? *Journal of nutrition health & aging*, 10(6), 466-485.
- Hayashi, T., Kondo, K., Suzuki, K., Yamada, M., & Matsumoto, D. (2014). Factors associated with falls in community-dwelling older people with focus on participation in sport organizations: the Japan Gerontological Evaluation Study Project. *BioMed research international*, 2014, 537614. doi: 10.1155/2014/537614
- He, W., Goodkind, D., & Kowal, P. (2016). *U.S. Census Bureau, International Population Reports, P95/16-1, An Aging World: 2015* Washington, DC,. Retrieved from: <https://www.census.gov/content/dam/Census/library/publications/2016/demo/p95-16-1.pdf>
- Hetherington, S., Borodzicz, J., & Shing, C. (2015). Assessing the real world effectiveness of the Healthy Eating Activity and Lifestyle (HEAL) program. *Health promotion journal of Australia* 26(2), 93-98. doi: 10.1071/he14031
- Hruby, A., & Hu, F. (2015). The Epidemiology of Obesity: A Big Picture. *Pharmacoeconomics*, 33(7), 673-689. doi: 10.1007/s40273-014-0243-x
- Hughes, J., McDowell, M., & Brody, D. (2008). Leisure-time physical activity among US adults 60 or more years of age: results from NHANES 1999-2004. *Journal of physical activity & health*, 5(3), 347-358. doi: <https://doi.org/10.1123/jpah.5.3.347>
- Izquierdo, M. , Casas-Herrero, A., Zambom-Ferraresi, F. , Martínez-Velilla, N. , Alonso-Bouzáon, C. , Rodríguez-Mañas, L., & VIVIFRAIL. (2017). *Programa de ejercicio físico multicomponente. VIVIFRAIL. Guía práctica para la prescripción de un programa de entrenamiento físico multicomponente para la prevención de la fragilidad y caídas en mayores de 70 años*. s.l.: Erasmus+ Programme of the European Union.
- Jancey, J., Lee, A., Howat, P., Clarke, A., Wang, K., & Shilton, T. (2007). Reducing Attrition in Physical Activity Programs for Older Adults. *Journal of Aging and Physical Activity*, 15(2), 152-165. doi: 10.1123/japa.15.2.152
- Kanamori, S., Kai, Y., Kondo, K., Hirai, H., Ichida, Y., Suzuki, K., & Kawachi, I. (2012). Participation in sports organizations and the prevention of functional disability in older Japanese: the AGES Cohort Study. *PloS one*, 7(11), e51061. doi: 10.1371/journal.pone.0051061
- Kraemer, W., Adams, K., Cafarelli, E., Dudley, G., Dooly, C., Feigenbaum, M., . . . Hoffman, J. (2002). American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. *Medicine and science in sports and exercise*, 34(2), 364-380. doi: 10.1097/00005768-200202000-00027

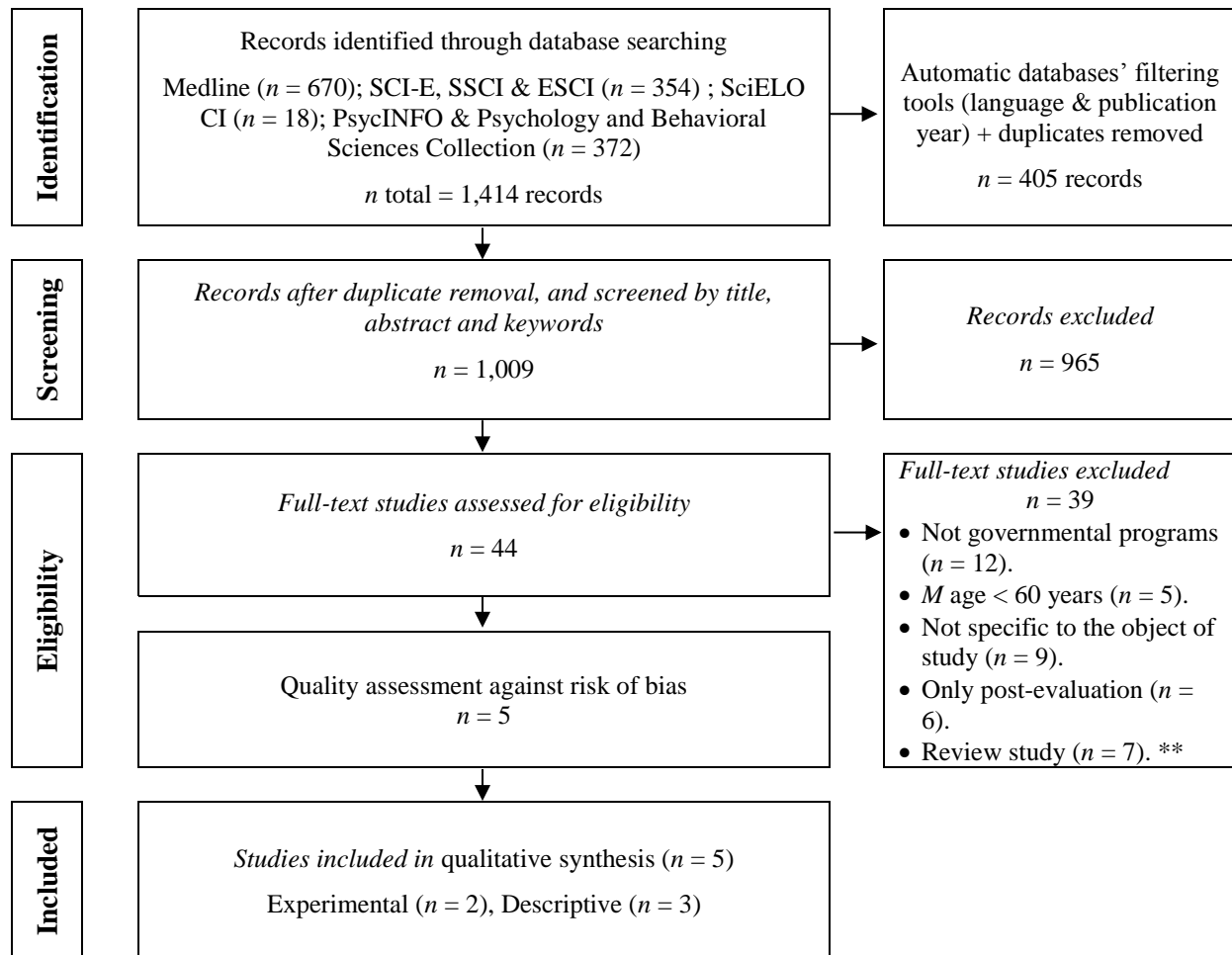
- Liang, C.-C., Change, Q.-X., Hung, Y.-C., Chen, C.-C., Lin, C.-H., Wei, Y.-C., et al. (2017). Effects of a Community Care Station Program With Structured Exercise Intervention on Physical Performance and Balance in Community-Dwelling Older Adults: A Prospective 2-Year Observational Study. *Journal of aging and physical activity*, 25(4), 596-603. doi: 10.1123/japa.2015-0326
- Macinko, J., & Harris, M. J. (2015). Brazil's Family Health Strategy — Delivering Community-Based Primary Care in a Universal Health System. *New England Journal of Medicine*, 372(23), 2177-2181. doi: 10.1056/NEJMp1501140
- Marin, G., Homar, C., Niedfeld, G., Matcovick, G., Mamonde, M., & Grupo Interdisciplinario para la Salud. (2009). Evaluation of the state intervention project to improve quality of life and reduce the complications associated with aging: "Add health to your years". [Evaluacion del proyecto estatal de intervencion para la mejora de la calidad de vida y la reduccion de complicaciones asociadas al envejecimiento: <<Agrega salud a tus años>> .]. *Gaceta sanitaria / S.E.S.P.A.S*, 23(4), 272-277. doi: 10.1016/j.gaceta.2009.02.010
- Martinson, B., Sherwood, N., Crain, A., Hayes, M., King, A., Pronk, N., & O'Connor, P. (2010). Maintaining physical activity among older adults: 24-month outcomes of the Keep Active Minnesota randomized controlled trial. *Preventive medicine*, 51(1), 37-44. doi: 10.1016/j.ypmed.2010.04.002
- Matsudo, S. M., Matsudo, V. R., Araujo, T. L., Andrade, D. R., Andrade, E. L., Oliveira, L. C. d., et al. (2003). The Agita São Paulo Program as a model for using physical activity to promote health. *Revista Panamericana de Salud Pública*, 14(4), 265-272. doi: 10.1590/s1020-49892003000900007
- McPhee, J., French, D., Jackson, D., Nazroo, J., Pendleton, N., & Degens, H. (2016). Physical activity in older age: perspectives for healthy ageing and frailty. *Biogerontology*, 17(3), 567-580. doi: 10.1007/s10522-016-9641-0
- Meads, C., & Exley, J. (2018). A systematic review of group walking in physically healthy people to promote physical activity. *International Journal of Technology Assessment in Health Care*, 34(1), 27-37. doi: 10.1017/s0266462317001088
- Ministerio de Salud. (2013). *Manual de Aplicación del Examen de Medicina Preventiva del Adulto Mayor*. (www.minsal.cl). Retrieved from: <http://web.minsal.cl/portal/url/item/ab1f81f43ef0c2a6e04001011e011907.pdf>.
- Minkler, M., Schauffler, H., & Clements-Nolle, K. (2000). Health promotion for older Americans in the 21st century. *American Journal of Health Promotion*, 14(6), 371-379. doi: 10.4278/0890-1171-14.6.371
- Moher, D., Fortin, P, Jadad, A, Jüni, P, Klassen, T, Le Lorier, J, . . . Linde, K. (1996). Completeness of reporting of trials published in languages other than English: implications for conduct and reporting of systematic reviews. *The Lancet*, 347(8998), 363-366. doi: [https://doi.org/10.1016/S0140-6736\(96\)90538-3](https://doi.org/10.1016/S0140-6736(96)90538-3)

- Valdés-Badilla, P., Godoy-Cumillaf, A., Ortega-Spuler, J., Herrera-Valenzuela, T., Durán-Agüero, S., Zapata-Bastias, J., et al. (2017). Asociación entre índices antropométricos de salud y condición física en mujeres mayores físicamente activas. *Salud pública de Mexico*, 59(6), 682-690. doi: 10.21149/8580

- Wellman, N., Friedberg, B., Weddle, D., Cuervo, L., Sanchez, N. K., Rosenzweig, L., et al. (2004). Eat Better & Move More: A Guidebook for Community Programs. Miami, Fla: National Resource Center on Nutrition, Physical Activity and Aging. Retrieved from http://nutrition.fiu.edu/You_Can/07.2YouCanGuidebook.pdf
- Wellman, N. S., Kamp, B., Kirk-Sanchez, N. J., & Johnson, P. M. (2007). Eat Better & Move More: A Community-Based Program Designed to Improve Diets and Increase Physical Activity Among Older Americans. [Article]. *American Journal of Public Health*, 97(4), 710-717. doi: 10.2105/ajph.2006.090522
- Wilcox, S., Dowda, M., Wegley, S., & Ory, M. (2009). Maintenance of change in the Active-for-Life initiative. *American journal of preventive medicine*, 37(6), 501-504. doi: 10.1016/j.amepre.2009.07.016
- Witard, O., McGlory, C., Hamilton, D., & Phillips, S. (2016). Growing older with health and vitality: a nexus of physical activity, exercise and nutrition. *Biogerontology*, 17(3), 529-546. doi: <https://doi.org/10.1007/s10522-016-9637-9>
- World Health Organization. (1999). *Ageing: Exploding the myths*. Retrieved from: http://apps.who.int/iris/bitstream/handle/10665/66330/WHO_HSC_AHE_99.1.pdf?sequence=1
- World Health Organization. (2000). Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. Geneva: World Health Organization. *WHO technical report series*, 894. Retrieved from: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/
- World Health Organization. (2012a). *Good health adds life to years: Global brief for World Health Day 2012*. Retrieved from: http://www.who.int/ageing/publications/whd2012_global_brief/en/
- World Health Organization. (2012b). *Global Recommendations on Physical Activity for Health*. Geneva: World Health Organization. Retrieved from <http://www.who.int/dietphysicalactivity/publications/9789241599979/en/>
- Wunderlich, S., & Gatto, K. (2016). Impact of government-sponsored nutrition education and physical activity programs on healthy aging in the United States. *Healthy aging research*, 5, 1-6. doi: 10.1097/01.HXR.0000491109.90858.d5
- Wunderlich, S., McKinnon, C., Piemonte, J., & Ahmad, Z. (2009). Measuring the impact of nutrition education and physical activity on older adults participating in government sponsored programs. *Journal of nutrition for the elderly*, 28(3), 255-271. doi: 10.1080/01639360903140189
- Yokoya, T., Demura, S., & Sato, S. (2008). Fall risk characteristics of the elderly in an exercise class. *Journal of physiological anthropology*, 27(1), 25-32. doi: 10.2114/jpa2.27.25

- Yokoya, T., Demura, S., & Sato, S. (2009). Three-year follow-up of the fall risk and physical function characteristics of the elderly participating in a community exercise class. *Journal of physiological anthropology*, 28(2), 55-62. doi: <http://doi.org/10.2114/jpa2.28.55>
- Zgibor, J., Schlenk, E., Vater, L., Kola, S., Vander Bilt, J., Woody, S., . . . Newman, A. (2016). Partnership Building and Implementation of an Integrated Healthy-Aging Program. *Progress in community health partnerships : research, education, and action*, 10(1), 123-132. doi: 10.1353/cpr.2016.0001

Figure 1: Flow chart of the review process*



* Based on PRISMA-P recommendations (Moher et al., 2015). SCI-E: Science Citation Index Expanded; SSCI: Social Sciences Citation Index; ESCI: Emerging Sources Citation Index; SciELO CI: SciELO Citation Index. ** Not governmental programs: the studies were nor designed, developed and evaluated under the supervision of government institutions; M age < 60 years: the mean age of the sample was older than 60 years; Not specific to the object of study: the study was not focused on health outcomes in independent older adults; Only post-evaluation: only one evaluation (post-evaluation) was performed. Review study: the study was not an original research paper but a review.

Table 1: Characteristics of studies examining the effects of physical activity governmental programs on health status in independent older adults.

Study Country (study score)*	Study Aim	Study Type	Size (n) and participants' mean age (SD)	Older adults groups (sample)	Kind of PA practiced	PA Volume			PA intensity
						Total Duration (monthly)	Frequency (weekly)	Time per Session (min)	
Figueira et al., 2012 Brazil (22/32)	To verify the effect of PA on the quality of life of the older adults attended by a health program.	Experimental	n=67 69.2 (7.0) years.	PCP=35	Walking, hydro-gymnastics, muscular strengthening and stretching.	3	2	50	Moderate. 60-70% of the HR max.
				EG=35 (26 W and 9 M). CG=32 (20 W and 12 M)	They were asked not to do PA.	3	N/A	N/A	N/A
Marin et al., 2009 Argentina (20/32)	To evaluate the effectiveness of a program based on health promotion and pathologies prevention, in order to avoid complications associated with illnesses and improve the quality of life in older adults.	Experimental	n=700 70.0 (8.3) years.	PCP=350	Muscular strengthening (quadriceps, psoas, spinals, biceps and triceps).	12	2	60	Moderate.
				EG=350 (67.2% W and 32.8% M).	Healthy Dance	12	1	45	N/A
				CG=350 (65.8% W and 30.4% M).	Continued with their usual daily activities	12	N/A	N/A	N/A

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						Total Duration (monthly)	Frequency (weekly)	Time per Session (min)	
Wellman et al., 2007 United States of America (10/17)	Assess outcomes of an integrated nutrition and exercise program designed for Older Americans Act Nutrition Program participants as part of the Administration on Aging’s You Can! Campaign.	Descriptive	n= 999. 74.6 (7.5) years.	PCP= 620 (82% W and 18% M). PNCP= 379 (77% W and 23% M).	Participants were taught exercises for flexibility and walking inside and outside the home, both individually and in groups.	12	7	N/A	It was based on the <i>Eat Better & Move More</i> program guidelines (Wellman et al., 2004).
Wunderlich et al, 2009 United States of America (11/17)	To examine the health status of the older adults participating in nutritional education and PA programs sponsored by the Department of Health and Human Services, Aging area agency.	Descriptive	n=573. 70.9 (5.4) years.	PCP=139 (71% W). Cohorts: 2004 n=18 2005 n=29 2006 n=38 2007 n=54	Balance, muscle strengthening, relaxation and stretching exercises. The subjects were encouraged to walk.	48 48	3 7	30-45 20-30	Moderate with progressive load. N/A
Yokoya et al., 2009	This study was aimed at the older	Descriptive	n=206.	PCP=197	Walking on tatami.	36	1	10	N/A

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Japan (11/17)	adults participating on community exercise classes implemented by the government and followed their fall risk and function during three years. This study compared the changes between low and high fall risk		71.0 (6.2) years.	LFRG=168	Stretching.	36	1	10	N/A
				HFRG=29 (34 M and 163 W).	Strength training (abdominals, bent knee push ups and squats)	36	1	10	N/A
					Recreational sports and rhythm exercises.	36	1	60	N/A

n: participants number; SD: standard deviation; PA: physical activity; M: men; W: women; EG: experimental group; CG: control group; PCP: participants who completed the program; PNCP: participants who did not completed the program; LFRG: low fall risk group; HFRG: high fall risk group; min: minutes; HR: resting heart rate; N/A: no answer. * Score adapted from Downs and Black’s (1998) checklist, 17 items were selected for a maximum score of 17 points (descriptive studies) and 27 items for a score of 32 points (experimental studies).

Table 2: Effects reported by physical activity governmental programs on health status in independent older adults.

Study	Analyzed Variables	Instruments applied	Main outcomes
Figueira et al., 2012	Quality of life, distribute in six facets: 1) Sensorial functioning; 2) Autonomy; 3) Past, present, and future activities; 4) Social participation; 5) Perceptions of death and dying; and 6) Intimacy.	WHOQOL-old questionnaire developed by the WHO.	The EG showed better results on sensorial functionality ($\Delta\% = 0,022\%$, $p = 0.0001$), social participation ($\Delta\% = 0,012\%$, $p = 0,013$), death and dying perceptions ($\Delta\% = 0.04\%$, $p = 0,009$), intimacy ($\Delta\% = 0,059\%$, $p = 0.05$) and total score ($\Delta\% = 0,001$, $p = 0,000$) regarding the CG on the post test.
Marin et al., 2009	Physical Area: Anthropometric measurements Nutritional Risk Physiological aspects: Blood glucose, total cholesterol, triglycerides, HR, BP. Quality of life, distributed in four facets: 1) daily chores; 2) autonomy loss; 3) emotional state; 4) pain presence or absence	Scale and stadiometer. DETERMINE-risk nutritional questionnaire. Through oxidase glucose lab methods. Through precision aneroid sphygmomanometer. Short form (SF)-12v1 Health Survey.	The EG showed a significant reduction ($p < 0.05$) in the BP, triglycerides and cholesterol values and reduced the cardiovascular events on a 31% regarding the CG. Also the post-intervention quality of life increased 38.7% the favourable responses regarding the basal register and 33.4% regarding the CG.
Wellman et al., 2007	Physical Area: Physical activity indicator Physical fitness Assessment Nutritional Risk	Steps walked, blocks walked, flights of stairs climbed and days walked per week. Timed Up and Go. Questionnaire was adapted from the Performance Outcomes Measures Project Congregate Meals Survey.	The PCP made a significant advance of one or more nutrition and physical activity stages of change; 24% reported improved health status. Daily intake of fruits increased one or more servings among 31% of PCP; vegetables, 37%; and fiber, 33%. Daily steps increased 35%; blocks walked, 45%; and stairs climbed, 24%.

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Study	Analyzed Variables	Instruments applied	Main outcomes
Wunderlich et al, 2009	Physical Area: Anthropometric measurements and body fat percentage Physiological aspects: Blood glucose, serum cholesterol, triglycerides, HR, BP. Nutritional Risk	MHCUP MHCUP Mini nutritional assessment.	The average BP, both systolic and diastolic improved on women ($p < 0.05$); 141(19.0) / 79.3 (9.7) (2004) vs 127.8 (10.9) / 73.8 (10.2) mm Hg (2007). There were also improvements on both men and women ($p < 0.05$) on the HR between 2004 y 2007.
Yokoya et al., 2009	Physical Area: The activities of daily living assessment. Physical fitness Assessment Fall Risk	The activities of daily living (ADL) capability were evaluated by a questionnaire consisting of 12 items: walking ability, changing and maintaining posture, balance, muscular strength and dexterity (manual activity). Battery of 6 tests (approved in Japan): grip strength, sit up, sit and reach, one leg balance with eyes open, 10m obstacle walk and a 6-minute walk. Fall Assessment chart of Suzuki.	The LFRG showed significant changes ($p < 0.05$) in the fall risk walking 1 km, by medication, using sandals or sneakers and the anxiety of falling. Meanwhile the HFRG showed significant improvements ($p < 0.05$) on the fall risk using sandals and sneakers. The physical fitness just improved on the 6 min walking ($p < 0.0000$) and total score ($p < 0.0000$) in both groups (LFRG and HFRG). However, after three years a decreasing development of the physical fitness appeared.

WHOQOL-old: World Health Organization Quality of Life Questionnaire; WHO: World Health Organization; EG: experimental group; CG: control group; HR: resting heart rate; BP: blood pressure; PCP: participants who completed the program; MHCUP: measured on health centres or universities by professionals of the sector; LFRG: low fall risk group; HFRG: high fall risk group.