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Study Protocol

Arnis-based Exercise Program for Balance Control in Community-Dwelling Older Adults: Study Protocol for a Pilot Randomized Controlled Trial

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Abstract

Introduction: Aging causes balance impairments and increases falls in older adults. Martial arts interventions incorporated into exercise programs have been shown to improve balance. Further investigation is needed on the effectiveness of Arnis, a Filipino Martial Art, in improving balance control of older adults.

Objectives: This study primarily aims to determine the effects of an Arnis-based exercise program on balance control systems of healthy community-dwelling older adults. This study also aims to describe its effect on older adults' concerns about falling and lower limb functional strength.

Methods: This will be a single-blind, pilot randomized controlled trial. Participants will be randomly allocated to either the intervention or control group. The intervention group will perform an Arnis-based exercise program for 40-60 minutes per session three times a week for 12 weeks. The control group will continue to do their usual activities for the duration of the study. These daily activities may include home gardening, physical exercises, watching television, reading a newspaper, listening to the radio, and engaging in social activities. Participants will be measured at baseline and 12 weeks after for (1) balance using the Berg Balance Scale and Timed-Up and Go Test; (2) concern for falling through the Falls Efficacy Scale-International Filipino; and (3) lower limb strength through the 30-second Chair Sit-to-stand Test. Data will be analyzed through independent and paired t-tests. A p-value < 0.05 is considered significant.

Expected Results: Significant improvements in the balance scores in the intervention group are expected after 12 weeks of the Arnis-based exercise program, along with its effects on concerns for falling and lower extremity strength. The pilot study will provide data on the effectiveness of Arnis as a reference for future larger experimental studies.

***Keywords*:** older adults, balance control, Arnis, exercise program, protocol

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Introduction

Compromised balance constitutes a health concern among older adults due to the increased risk of falling (Shupert & Horak, 2016). According to Deger et al. (2019), the prevalence of balance disorders among community-dwelling older adults in Aydın, Turkey is 34.3% . Even if older adults have high self-perceived confidence in performing activities of daily living (ADLs), their risk for falling is still high if they have poor postural balance (Pua et al., 2017). Falls are the most common mechanism of injury affecting older adults (Montacar et al., 2020). Globally, falls account for 38 million disability-adjusted life years lost yearly and older adults with fall-related disabilities have high risks for hospitalization and long-term care (WHO, 2021). In the Philippines, 53.6% of older adults experienced falls, and 2.4% sustained fractures caused by the falls (Romli et al., 2017).

Balance control is achieved by integrating visual, vestibular, and somatosensory inputs with central processing and muscular strength (Hsu et al., 2014). Good static and dynamic balance are necessary to perform ADLs and recreational activities (Lipardo, Manlapaz, et al., 2021). Physiologic aging is associated with gradually decreasing muscle strength, mass, and power. It is also associated with compromised visual acuity (Norheim et al., 2017). There is an age-related deterioration of the peripheral vestibular system function by measuring the VOR. There is a decline in the response amplitude and less of a compensatory response phase in the rotational test. Patients may complain of dizziness, vertigo, or unsteadiness (Iwasaki & Yamasoba, 2015; Agrawal et al., 2012). There is also decreased sensitivity of somatosensory inputs, specifically of limb position, due to changes in the muscle spindle function, especially of the lower extremity, and progressive loss of the dendrite system in the motor cortex connected with age (Ferlinc et al., 2019). Incongruences between the sensory cues and decreased musculoskeletal function cause difficulty in balance control in older adults that may lead to decreased functionality (Hsu et al., 2014; Ma et al., 2019; Pluchino et al., 2012; Deger et al., 2019; Lipardo, Manlapaz, et al., 2021). Therefore, rehabilitation interventions are implemented to improve balance (Cameron et al., 2018; Penn et al., 2019; Howe et al., 2011).

A systematic review found that only 22% of rehabilitation interventions could be classified as high quality (Arienti et al., 2019). Interventions such as martial arts and multi-component exercises composed of resistance, endurance, and coordination training are beneficial for improving the balance of older adults (Cameron et al., 2018; Penn et al., 2019; Howe et al., 2011, Halvarsson et al., 2015; Ngamsangiam & Suttanon, 2020; Mittaz et al., 2019). These interventions help enhance the strength, coordination, and mobility of the lower extremities, improve quality of life and fall self-efficacy, and reduce the risk of falling. Martial arts as an intervention has shown promise in addressing physical inactivity in recent years (Arienti et al., 2019). It is practiced for physical fitness, competitive purposes, and motor and emotional development (Origua Rios et al., 2018). Some martial arts emphasize leg techniques, while others focus on throws and armed skills. These techniques may be divided into 'hard,' which uses fast and dynamic movements, and 'soft,' which uses smooth and relaxed movements.

Arnis, the Philippine National Martial Art and Sport is a blend of the 'soft' and 'hard' martial art styles. Also known as Kali or Eskrima, Arnis uses 'swinging and twirling movements along with striking, thrusting, and parrying techniques, done with one or two sticks' (National Commission for Culture and the Arts, 2021). Although scarce literature on Arnis and balance exists, published studies have shown the effectiveness of martial arts such as Judo, Taekwondo, Tai Chi, and Wai Khru in balance improvement among geriatrics (Arkkukangas et al., 2020; Valdez-Badilla et al., 2021; Phanpeng et al., 2020; Pon van Dijk et al., 2013; Chen, 2019; Li et al., 2018; Li, 2014). Tai Chi has been found to improve the stability of older adults along with muscle strength and flexibility (Chen, 2019). A tailored exercise program using Tai Chi has been more effective as a training intervention in fall reduction than conventional approaches (Li et al., 2018). The regimen known as Tai Ji Quan: Moving for Better Balance integrated the cognitive, sensory, and musculoskeletal systems, including weight-bearing and shifting movements which are known in Tai Chi (Li, 2014). Therefore, this protocol explores Arnis, which is similar to Tai Chi, and has the potential to improve balance in older adults through its techniques and movement.

The primary objective of this study is to determine the effects of a 12-week Arnis-based exercise program on static and dynamic balance control among healthy community-dwelling older adults. The secondary objective is to determine the effects of the Arnis-based exercise program on the older adults' concern for falling and lower limb strength. This study will add an Arnis-based exercise program as an alternative intervention in improving balance in the geriatric population for physical therapists (PT) and other health professionals. The administration of a culturally specific exercise program may increase the engagement and interest of older adults.

Methods

Study Design

A pilot randomized controlled study design will be utilized as the study aims to assess the effectiveness of a novel Arnis-based exercise program on the balance control of healthy community-dwelling older adults. This method is used when participants are introduced to a new intervention to check whether the treatment improves their condition. Ethical approval has been granted by the University of Santo Tomas, College of Rehabilitation Sciences Ethical Review Committee (SI-2021-023-R2). The study protocol has been registered on Health Research and Development

Information Network (HERDIN) with the registry ID PHRR220211-004334. The study will adhere to the Philippine National Ethical Guidelines for Health and Health-related Research (2017) along with the Data Privacy Act of 2012. The study will also be kept ethically sound by national standards. In addition, the study will abide by the Declaration of Helsinki (2013). Since the participants are a population considered vulnerable, only those with a consent form voluntarily signed by the participant and co-signed by a legally authorized representative will be allowed to participate in this study. The individual will be informed that they have the right to refuse participation and withdraw at any given moment of the study.

Eligibility Criteria

Healthy Filipino community-dwelling older adults aged 60 years or above from a partner community of the University of Santo Tomas (UST) will be included in the study. They will be selected based on the following inclusion criteria:

1. Lives with at least one adult companion to provide standby assistance and ensure safety, and prevent falls (Gopinath et al., 2013).
2. Has a mobile phone, laptop, or desktop that can access the internet
3. Stands without assistance (Mustafa et al., 2022)
4. Ambulates independently without an assistive device (Lip et al., 2015)
5. Cleared by a healthcare practitioner to engage in physical activity, as proven by a written letter with the practitioner's signature
6. With or without a history of falls in the past 12 months (Li et al., 2018).
7. Have no medical conditions based on the Modified PAR-Q Questionnaire (Lipardo et al., 2019).
8. Having a score of > 25/30 in the Mini-Mental State Examination in Filipino ensures comprehension (Duncan et al., 2016; Nguyen & Kruse, 2012).

The inclusion criteria were set to recruit only healthy older adults who are physically capable of engaging in an exercise program. Older adults will be excluded from the study if they present with the following criteria:

1. Symptomatic cardiovascular disease at a moderate exertion level as defined by the modified PAR-Q and poorly controlled blood pressure (Li et al., 2018).
2. History of neurologic disease, metastatic cancer, or acute orthopedic problems that affect ambulation and with dizziness or vertigo or taking benzodiazepines or antiepileptic medications (Katrancha et al., 2015).
3. Lives alone
4. Engages in muscle strength and endurance activities, moderate and strenuous sports, or recreational activities as defined by the Physical Activity Scale for the Elderly in Filipino (Lip et al., 2015; Lipardo et al., 2019).

Sample Size Computation

Considering a 90% power, two-sided 5% significance, and an allocation ratio of 1 for the main clinical trial, the recommended sample size for this pilot trial is 20. Ten older adults should be allocated per treatment arm for a standardized large effect size of 0.8 (Whitehead et al., 2016).

Sampling Methodology

Participant recruitment will be done within 1 month using simple random sampling based on the list of older adults from city hall records. A total of twenty (20) participants will be randomly chosen through a third party who is uninvolved in the study and will be asked to generate the names to maintain neutrality. Should a participant fail to meet the recruitment criteria, another participant would be randomly selected through the computer-generated program by a third party composed of statisticians not involved in the study. Retention of participants will be promoted throughout the program with constant communication and reminders through the coordinators of the partner community. Moreover, incentives will be given to participants after the program. In addition, research goals, recruitment information, forms and risk details are to be made available in both English and Filipino for ease of comprehension and understanding to increase voluntary participation. The sampling process can be visualized in Figure 1.

Setting

Due to the imposed restrictions brought about by the COVID-19 pandemic, the study will be conducted online method via Zoom or Google Meet. A participant's companion may assist the participant in setting up the Zoom or Google meet. Strict adherence to established protocols will be followed. The study will be in partnership with the community of Binangonan, Rizal. The program will be delivered through telerehabilitation.

Instrument

The study was designed with primary and secondary outcome measures wherein the primary will be the main outcome that we target dovetailed to the main objective of the study. The secondary outcomes are likewise aligned with the secondary aims of the study. (Vetter & Mascha, 2017) The primary outcome measure tools for this study are the Berg Balance Scale (BBS) and Timed-Up and Go Test (TUG), while the secondary outcome measures are the Falls Efficacy Scale - International Filipino (FES-I) and 30-Second Chair Sit-to-stand Test (30CST).

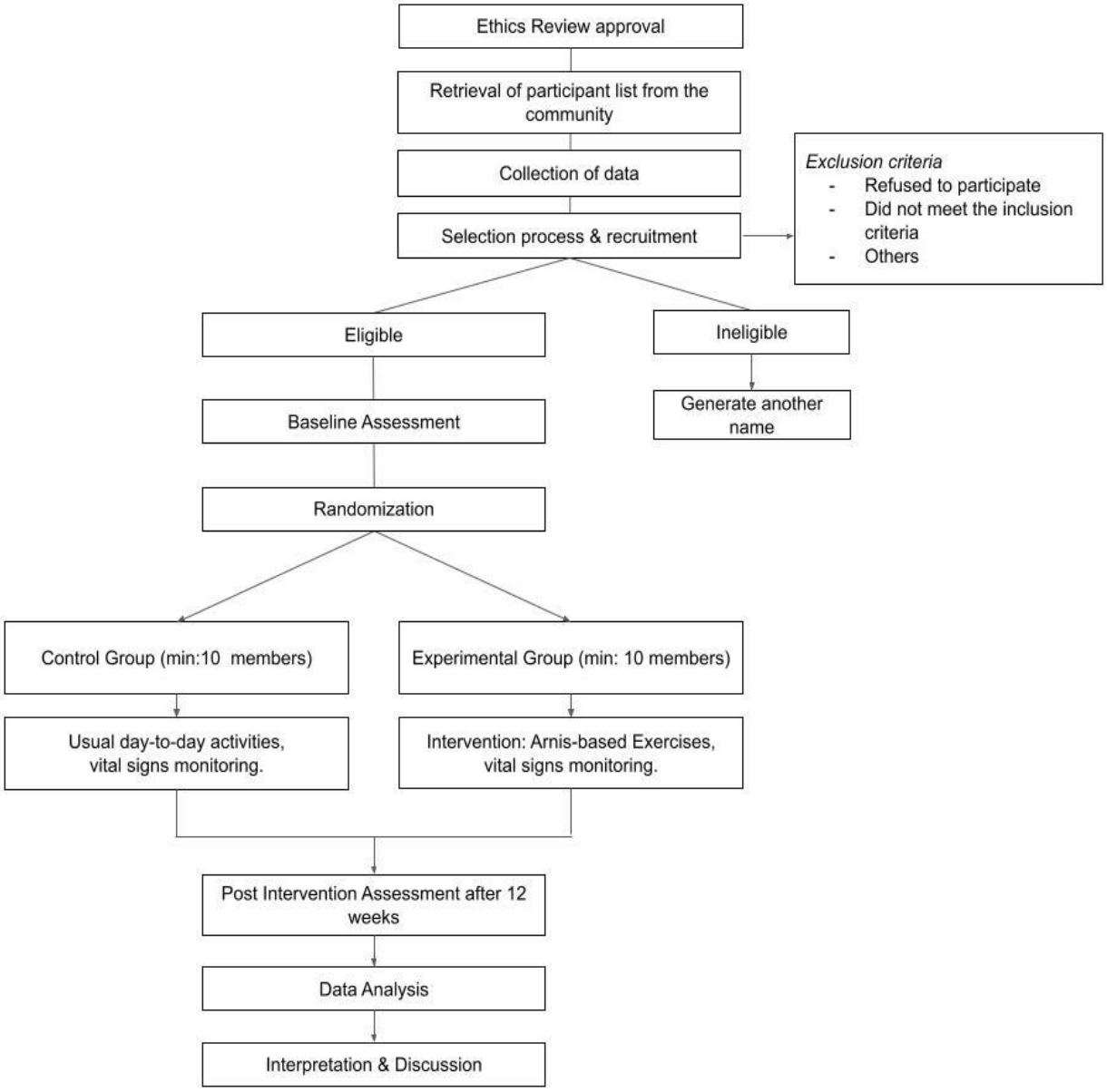

Figure 1. Sampling Process

Berg Balance Scale

The BBS is a 14-item objective measure that assesses static balance and the risk of falling in adults through direct observation. The items of the questionnaire include static and dynamic activities of varying difficulty. According to Wang et al., (2006), BBS has good interrater reliability (ICC = 0.87) observed among community-dwelling elderly Taiwanese, and moderate to high reliability has been established for the BBS within various settings and diagnoses. Construct validity was examined in community-dwelling Taiwanese concerning the BBS (r = -0.53, p =0.1). It is a well-established valid outcome measurement tool for fall risk prediction in different populations (Muir-Hunter et al., 2015). Item-level scores range from 0, indicating the inability to complete the task, to 4, indicating independent completion. A total score of 41- 56 on the scale is determined as good balance or low fall risk, a score of 21-40 indicates medium fall risk while a total score of 0-20 suggest a high risk for falls (Neuls et al., 2011).

Timed Up and Go Test

The Timed-Up and Go Test (TUG) is a widely used tool that examines functional performance and the risk of falling. The TUG test has excellent test-retest reliability (ICC =0.97) among community-dwelling older adults (Steffen et al., 2002). The results depend on the individual's total time to complete the timed trial, composed of sit-to-stand and a 3-meter walk. According to Podsiadlo & Richardson (1991), criterion validity for this test in correlation with BBS is excellent (r = -0.81) and an excellent correlation with gait speed equivalent to r = -0.61 Podsiadlo & Richardson, 1991. The standard cut-off time for risk of falls is 13.5 seconds among community-dwelling elderly adults.

Falls Efficacy Scale - International in Filipino

The Falls Efficacy Scale - International (FES-I) is a questionnaire that assesses the patients' concerns about falling while performing a range of essential ADLs through a 4-item scale (Yardley et al., 2005; Delbaere et al., 2010). The FES-I in Filipino (FES-I F) is a validated local version to assess the concern of falling for Filipino community-dwelling older adults (Lipardo, Leung, et al., 2020). The psychometric properties of the FES-I F are at par with the original FES-I (Visschedijk et al, 2015; Morgan et al, 2013; Halvarsson et al., 2013; Helbostad et al., 2010; Lipardo, Leung, et al., 2020), with good test-retest reliability (ICC = 0.86) and internal consistency reliability ($\alpha = 0.91$) and confirmed construct validity on physical aspects related to fear of falling. The total FES-I F score is calculated by adding the scores from each of the 16 items that range from 16, which indicates no concern of falling, to a total of 64, which indicates severe concern of falling (Yardley et al., 2005; Delbaere et al., 2016). The cut-off score to separate those with fear of falling from those without fear of falling is 22.

30-Second Chair Sit-to-Stand Test

The 30-Second Chair Sit-to-stand Test (30CST) measures the older adult's functional lower extremity strength (Rikli & Jones, 1999). The participant is instructed to complete as many full stands as possible within 30 seconds and fully sit between each stand. The tester observes and records a count of the number of correctly performed sit-to-stand repetitions while omitting those performed incorrectly. This measure has a good test-retest reliability ($0.84 < r < 0.92$), with r values as high or higher than those obtained from previously published protocols and excellent interrater reliability of r = 0.95 (95% CI = 0.84-0.97), which provides a reasonably valid indication of lower body strength in generally active, community-dwelling older adults. A mean of 13.7 Chair Stands for men and 12.7 for women are the normative scores for community-dwelling elderly adults (Jones & Rikli, 1999).

Assessment Procedures

Eligible participants will be assessed through the BBS, TUG, FES-I F, and 30CST at baseline and within a week after the last treatment session. Measurements will be taken at the participant's home by a blinded assessor. The assessor is a licensed PT with at least one year of experience, is fully vaccinated with at least one booster, and who resides near or in the area (Lipardo, Añonuevo, et al., 2022). Participants must also have a companion at home during the assessments. Blinding of the participants and of the clinicians will not be possible given the nature of the intervention.

Intervention

After baseline assessments, eligible older adults will be randomly allocated in a 1:1 ratio into either the Arnis intervention group or the control group study using the "True Random Number Generator" of Random.org. An independent research assistant who is not involved in the recruitment and assessment will perform the allocation of participants and will also contact the participants to inform them of their group assignment.

Arnis Intervention Group

The intervention group will participate in an Arnis-based exercise program in addition to their usual daily activities. They will engage in a 12-week non-combative Arnis-based exercise regimen evaluated and approved by a panel of experts and adapted from the exploratory study of Lipardo, Añonuevo et al. (2022). The exercise program consists of three phases that will gradually progress in intensity. Phase 1 (Weeks 1-4) focuses on familiarization and mastery of basic Arnis techniques with a low-intensity exercise. Phase 2 (Weeks 5-8) incorporates progression in the exercise routines with low-to-moderate level of intensity. Phase 3 (Weeks 9-12) includes movements that challenge static and dynamic balance control with moderate-intensity exercise. The program will be delivered through telerehabilitation three times a week, and assessment for progression will be done weekly using the Rating of Perceived Exertion (RPE) Scale and Talk test. The Talk test is a subjective method for monitoring exercise intensity based on the ability of the subject to hold a conversation while exercising. Each Arnis movement pattern will be performed for 2-5 sets. Every session will start with a warm-up period (5-10 minutes), followed by the main Arnis-based exercises (30-40 minutes) and a cool-down period (5 minutes). The participants will follow a video recording of the exercises to learn the basic forms and stances virtually. They will join video calls with a licensed PT and researchers. The licensed PT with at least a year of experience will have a different task from the PT assessors who will obtain the baseline and 12-week measurements. The PT will facilitate and oversee the exercise session by providing feedback to ensure the participants' accuracy of movement execution and safety. The researchers will assist the PT in monitoring the participants every exercise session. Adherence to the program will be monitored through check-ins and recorded in a weekly calendar journal that will indicate the schedule and duration of

their participation. All equipment and necessities such as the arnis sticks, mobile load, and refreshments will be provided.

Control Group

Participants in the control group will carry out their usual daily activities for the study duration. Daily activities performed by Filipino older adults may include home gardening, physical exercises, watching television, reading a newspaper, listening to the radio, and engaging in social activities (Ogena, 2019). Added measures of having weekly check-ins will be implemented to ensure that the participants will not do any physical activity stated in the exclusion criteria.

Plan for Data Analyses

Data will be encoded to MS Excel and analyzed through IBM SPSS version 28. Demographic characteristics will be summarized through descriptive statistics. Inferential statistics through a paired t-test will be conducted to compare the baseline and the 12-week assessments of the control and intervention groups. An independent t-test will be conducted between baseline and the 12-week assessment for between-group analysis. If the assumptions of the parametric tests are not met, alternatives such as the Wilcoxon Signed Rank Test and the Mann-Whitney U test will be utilized. A p-value of < 0.05 would be considered statistically significant.

Ethical Considerations

The study will adhere to the Philippine National Ethical Guidelines for Health and Health-related Research (2017) along with the Data Privacy Act of 2012. The study will also be kept ethically sound by national standards. In addition, the study will abide by the Declaration of Helsinki (2013). Ethical approval will be sought from the UST-CRS Ethics Review Committee. Since the participants are a population considered vulnerable, only those with a consent form voluntarily signed by the participant and co-signed by a legally authorized representative will be allowed to participate in this study. The individual will be informed that they have the right to refuse participation and withdraw at any given moment of the study. If any participant opt to withdraw from the program, their data and personal information will be kept confidential. Pertinent protocol modification will also be disseminated among relevant parties promptly. The safety of the participants is of utmost importance, with the recruitment criteria playing an integral role in ensuring that the participants are healthy individuals. There will be a close one-on-one monitoring during the exercise to address physical risks and the researchers will ensure that the participants have stable vital signs before, during, and after exercising. Participants will also have an allotted 1-minute break as indicated in the adapted protocol or as needed. For both the control and intervention group, A list of contact numbers of the nearest hospitals will be given. Prior coordination will also be made to the two nearest hospitals to ensure transport accommodations as well as arrangements with the barangay. In situations wherein anticipated risks occur, the exercise program will be terminated. The participant will then rest and be monitored by the companion and the PT present in the Zoom or Google Meet for 5 minutes. If no improvement is seen, the participant will be taken to the nearest hospital. Inter-Agency Task Force for the Management of Emerging Infectious Diseases and Local Government Unit guidelines will be strictly adhered to.

All data collected will be kept confidential through de-identification codes and will only be used for this study. Access to data extracted from the participants is limited to the research team and journal databases, if necessary. Collected data from the participants will be stored in a Google Drive only accessible by the research team and faculty co-authors. Individual documents will be encrypted to prevent data breaches. To prevent data loss, copies of the data will also be protected. The devices that the researchers will use will be password-protected. Public access to protocol and data set will be granted. However, released data will not be indicative of the patient's identity and demographics, nor will it create risks or harm to the participant. After the data analysis and research presentation, the results will be initially disseminated to the participants. All collected data will be transferred for safe-keeping in the Center of Health Research and Movement Science (CHRMS) for five years. All copies of collected data will be disposed of manually. Data processed as hardcopies will be shredded and data saved as electronic files will be manually deleted.

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Expected Results

This pilot study will provide preliminary data on the effectiveness of the Arnis-based exercise program on balance control in older adults, which could serve as a reference for future, more extensive experimental studies.

Conflict of interest statement

Two of the authors, Donald S. Lipardo and Donald G. Manlapaz, are members of the Editorial Board of the Philippine Journal of Physical Therapy. All other authors declare no competing interests.

References

Agrawal, Y., Zuniga, M. G., Davalos-Bichara, M., Schubert, M. C., Walston, J. D., Hughes, J., & Carey, J. P. (2012). Decline in semicircular canal and otolith function with age. Otology & Neurotology, 33(5), 832-839. https://doi.org/10.1097/MAO.0b013e3182545061

Arienti, C., Lazzarini, S. G., Pollock, A., & Negrini, S. (2019). Rehabilitation interventions for improving balance following stroke: An overview of systematic reviews. PLoS One, 14(7), Article e0219781. https://doi.org/10.1371/journal.pone.0219781

Arkkukangas, M., Stromqvist Baathe, K., Ekholm, A., & Tonkonogi, M. (2020). Health promotion and prevention: The impact of specifically adapted judo-inspired training program on risk factors for falls among adults. Preventive Medicine Reports, 19, Article 101126. https://doi.org/10.1016/j.pmedr.2020.101126

Borges, V. S., Silva, N. S., Malta, A. C., Xavier, N. C., & Bernardes, L. E. S. (2017). Falls, muscle strength, and functional abilities in community-dwelling elderly women. Fisioterapia em Movimento, 30, 357–366. https://doi.org/10.1590/1980-5918.030.002.ao16

Cadore, E. L., Rodriguez-Manas, L., Sinclair, A., & Izquierdo, M. (2013). Effects of different exercise interventions on risk of falls, gait ability, and balance in physically frail older adults: A systematic review. Rejuvenation Research, 16(2), 105–114. https://doi.org/10.1089/rej.2012.1397

Cameron, I. D., Dyer, S. M., Panagoda, C. E., Murray, G. R., Hill, K. D., Cumming, R. G., & Kerse, N. (2018). Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database of Systematic Reviews, 9, CD005465. https://doi.org/10.1002/14651858.CD005465.pub4

Chen, S. (2019). Effect of Tai Chi Exercises on the Balance, Functional Gait, and Flexibility of Elderly Filipino Males. Atlantis Press, 268, 147–153. https://doi.org/10.2991/sohe-19.2019.25

ClinicalTrials.gov. (2020). Protocol Registration Data Element Definition for Interventional and Observational Studies. https://prsinfo.clinicaltrials.gov/definitions.html

Deger, T. B., Sarac, Z. F., Savas, E. S., & Akcicek, S. F. (2019). The Relationship of Balance Disorders with Falling, the Effect of Health Problems, and Social Life on Postural Balance in the Elderly Living in a District in Turkey. Geriatrics (Basel), 4(2), 37. https://doi.org/10.3390/geriatrics4020037

Delbaere, K., Close, J. C., Mikolaizak, A. S., Sachdev, P. S., Brodaty, H., & Lord, S. R. (2010). The Falls Efficacy Scale International (FES-I): A comprehensive longitudinal validation study. Age and Ageing, 39(2), 210–216. https://doi.org/10.1093/ageing/afp225

Duncan, M. J., Rosenkranz, R. R., Vandelanotte, C., Caperchione, C. M., Rebar, A. L., Maeder, A. J., Tague, R., Savage, T. N., van Itallie, A., Mummery, W. K., & Kolt, G. S. (2016). What is the impact of obtaining medical clearance to participate in a randomised controlled trial examining a physical activity intervention on the socio-demographic and risk factor profiles of included participants? Trials, 17(1), 580. https://doi.org/10.1186/s13063-016-1715-4

Ferlinc, A., Fabiani, E., Velnar, T., & Gradisnik, L. (2019). The importance and role of proprioception in the elderly: A short review. Materia Sociomedica, 31(3), 219–221. https://doi.org/10.5455/msm.2019.31.219-221

Gopinath, B., Rochtchina, E., Anstey, K. J., & Mitchell, P. (2013). Living alone and risk of mortality in older, community-dwelling adults. JAMA Internal Medicine, 173(4), 320–321. https://doi.org/10.1001/jamainternmed.2013.1597

Halvarsson, A., Dohrn, I. M., & Stahle, A. (2015). Taking balance training for older adults one step further: The rationale for and a description of a proven balance training programme. Clinical Rehabilitation, 29(5), 417–425. https://doi.org/10.1177/0269215514546770

Halvarsson, A., Franzen, E., & Stahle, A. (2013). Assessing the relative and absolute reliability of the Falls Efficacy Scale-International questionnaire in elderly individuals with increased fall risk and the questionnaire's convergent validity in elderly women with osteoporosis. Osteoporosis International, 24(6), 1853–1858. https://doi.org/10.1007/s00198-012-2197-1

Helbostad, J. L., Taraldsen, K., Granbo, R., Yardley, L., Todd, C. J., & Sletvold, O. (2010). Validation of the Falls Efficacy Scale-International in fall-prone older persons. Age and Ageing, 39(2), 259. https://doi.org/10.1093/ageing/afp224

Howe, T. E., Rochester, L., Neil, F., Skelton, D. A., & Ballinger, C. (2011). Exercise for improving balance in older people. The Cochrane Database of Systematic Reviews (11), CD004963. https://doi.org/10.1002/14651858.CD004963.pub3

Hsu, W. L., Chen, C. Y., Tsauo, J. Y., & Yang, R. S. (2014). Balance control in elderly people with osteoporosis. Journal of the Formosan Medical Association, 113(6), 334–339. https://doi.org/10.1016/j.jfma.2014.02.006

Iwasaki, S., & Yamasoba, T. (2015). Dizziness and imbalance in the elderly: Age-related decline in the vestibular system. Aging and Disease, 6(1), 38–47. https://doi.org/10.14336/AD.2014.0128

Jones, C. J., Rikli, R. E., & Beam, W. C. (1999). A 30-s chair-stand test as a measure of lower body strength in community-residing older adults. Research Quarterly for Exercise and Sport, 70(2), 113–119. https://doi.org/10.1080/02701367.1999.10608028

Katrancha, E. D., Hoffman, L. A., Zullo, T. G., Tuite, P. K., & Garand, L. (2015). Effects of a video guided T'ai Chi group

intervention on center of balance and falls efficacy: A pilot study. Geriatric Nursing, 36(1), 9–14. https://doi.org/10.1016/j.gerinurse.2014.08.015

Li, F. (2014). Transforming traditional Tai Ji Quan techniques into integrative movement therapy-Tai Ji Quan: Moving for Better Balance. Journal of Sport and Health Science, 3(1), 9–15. https://doi.org/10.1016/j.jshs.2013.11.002

Li, F., Harmer, P., Fitzgerald, K., Eckstrom, E., Akers, L., Chou, L. S., Pidgeon, D., Voit, J., & Winters-Stone, K. (2018). Effectiveness of a therapeutic Tai Ji Quan intervention vs a multimodal exercise intervention to prevent falls among older adults at high risk of falling: A randomized clinical trial. JAMA Internal Medicine, 178(10), 1301–1310. https://doi.org/10.1001/jamainternmed.2018.3915

Lip, R. W., Fong, S. S., Ng, S. S., Liu, K. P., & Guo, X. (2015). Effects of Ving Tsun Chinese martial art training on musculoskeletal health, balance performance, and self-efficacy in community-dwelling older adults. The Journal of Physical Therapy Science, 27(3), 667–672. https://doi.org/10.1589/jpts.27.667

Lipardo, D., Añonuevo, D., Barlis, Jason, Chang, E., Ferrer, S., Lama, J., Rivera, D., Saludo, K., Turiano, T., Porto, J., & Laxa, R. (2022). Evaluation of an Arnis-based exercise program for community-dwelling older adults in the philippines: An exploratory study. Philippine Journal of Physical Therapy, 5(2), 23–29. https://doi.org/10.46409/002.FISO7698

Lipardo, D., Lopez, J., Santiago, S., Tubig, M., Enriquez, G., Cañares, C. G., Pagaduan, M., & Devora, K. (2019). Translation and validation of the Physical Activity Scale for the Elderly in Filipino community-dwelling older adult fallers and non-fallers. Philippine Journal of Allied Health Sciences, 3, 1–8. https://doi.org/10.36413/pjahs.0301.009

Lipardo, D., Manlapaz, D., Orpilla, V., Regino, J., & Pagarigan, S. (2021). Improving balance control in older persons through martial arts: A scoping review protocol. Philippine Journal of Allied Health Sciences, 5, 7–13. https://doi.org/10.36413/pjahs.0501.002

Lipardo, D. S., Leung, A. Y. M., Gabuyo, C. M. A., Escuadra, C. J. T., Leung, P. A., Aseron, A. M. C., Hernandez, K. A. V., Diaz, J. B., & Tsang, W. W. N. (2020). Cross-cultural adaptation and psychometric properties of the Falls Efficacy Scale - International in Filipino community-dwelling older adults. Disability and Rehabilitation, 42(9), 1292–1298. https://doi.org/10.1080/09638288.2018.1519045

Ma, A. W. W., Wang, H. K., Chen, D. R., Chen, Y. M., Chak, Y. T. C., Chan, J. W. Y., Yam, T. T. T., Cheng, Y. T. Y., Ganesan, B., & Fong, S. S. M. (2019). Chinese Martial Art Training Failed to Improve Balance or Inhibit Falls in Older Adults. Perceptual and Motor Skills, 126(3), 389–409. https://doi.org/10.1177/0031512518824945

Mittaz Hager, A. G., Mathieu, N., Lenoble-Hoskovec, C., Swanenburg, J., de Bie, R., & Hilfiker, R. (2019). Effects of three home-based exercise programmes regarding falls, quality of life and exercise-adherence in older adults at risk of falling: Protocol for a randomized controlled trial. BMC Geriatrics, 19(1), 13. https://doi.org/10.1186/s12877-018-1021-y

Moncatar, T. J. R., Nakamura, K., Siongco, K. L., Rahman, M., & Seino, K. (2020). Prevalence and determinants of self-reported injuries among community-dwelling older adults in the philippines: A 10-year pooled analysis. International Journal of Environmental Research and Public Health, 17(12), 4372. https://doi.org/10.3390/ijerph17124372

Morgan, M. T., Friscia, L. A., Whitney, S. L., Furman, J. M., & Sparto, P. J. (2013). Reliability and validity of the Falls Efficacy Scale-International (FES-I) in individuals with dizziness and imbalance. Otology & Neurotology, 34(6), 1104–1108. https://doi.org/10.1097/MAO.0b013e318281df5d

Muir-Hunter, S. W., Graham, L., & Montero Odasso, M. (2015). Reliability of the berg balance scale as a clinical measure of balance in community-dwelling older adults with mild to moderate alzheimer disease: A pilot study. Physiotherapy Canada, 67(3), 255–262. https://doi.org/10.3138/ptc.2014-32

Mustafa, H., Harrison, A., Sun, Y., Pearcey, G. E. P., Follmer, B., Nazaroff, B. M., Rhodes, R. E., & Zehr, E. P. (2022). Five weeks of Yuishinkai karate training improves balance and neuromuscular function in older adults: A preliminary study. BMC Sports Science, Medicine and Rehabilitation, 14(1), 65. https://doi.org/10.1186/s13102-022-00458-6

National Commission for Culture and the Arts. (2017, November 6). National Sport: Arnis. https://ncca.gov.ph/about-culture-and-arts/culture-profile/philippine-fast-facts/national-sport-arnis/

Neuls, P. D., Clark, T. L., Van Heuklon, N. C., Proctor, J. E., Kilker, B. J., Bieber, M. E., Donlan, A. V., Carr-Jules, S. A., Neidel, W. H., & Newton, R. A. (2011). Usefulness of the Berg Balance Scale to predict falls in the elderly. Journal of Geriatric Physical Therapy, 34(1), 3–10. https://journals.lww.com/jgpt/fulltext/2011/01000/Usefulness_of_the_Berg_Balance_Scale_to_Predict.2.aspx

Norheim, K. L., Hjort Bonlokke, J., Samani, A., Omland, O., & Madeleine, P. (2017). The effect of aging on physical performance among elderly manual workers: Protocol of a cross-sectional study. JMIR Research Protocols, 6(11), Article e226. https://doi.org/10.2196/resprot.8196

Ngamsangiam, P., & Suttanon, P. (2020). Risk factors for falls among community-dwelling elderly people in Asia: a systematic review. Science & Technology Asia, 105–126. https://doi.org/10.14456/scitechasia.2020.40

Nguyen, M. H., & Kruse, A. (2012). A randomized controlled trial of Tai chi for balance, sleep quality and cognitive performance in elderly Vietnamese. Clinical Interventions in Aging, 7, 185–190. https://doi.org/10.2147/CIA.S32600

Ogena, N. B. (2019). Activities, social isolation, and information technology. Ageing and health in the Philippines, Jakarta, Indonesia: Economic research institute for ASEAN and East Asia, 129–148.

Origua Rios, S., Marks, J., Estevan, I., & Barnett, L. M. (2018). Health benefits of hard martial arts in adults: A systematic review. Journal of Sports Sciences, 36(14), 1614–1622. https://doi.org/10.1080/02640414.2017.1406297

Penn, I. W., Sung, W. H., Lin, C. H., Chuang, E., Chuang, T. Y., & Lin, P. H. (2019). Effects of individualized Tai-Chi on balance and lower-limb strength in older adults. BMC Geriatrics, 19(1), 235. https://doi.org/10.1186/s12877-019-1250-8

Phanpheng, Y., Larha, W., & Hirantrakul, A. (2020). Effects of Wai Khru Muaythai training to balance ability in the elderly. Sport Scientific & Practical Aspects, 17(1), 53–59

Pluchino, A., Lee, S. Y., Asfour, S., Roos, B. A., & Signorile, J. F. (2012). Pilot study comparing changes in postural control after training using a video game balance board program and 2 standard activity-based balance intervention programs. Arch Phys Med Rehabil, 93(7), 1138–1146. https://doi.org/10.1016/j.apmr.2012.01.023

Podsiadlo, D., & Richardson, S. (1991). The Timed "Up & Go": A test of basic functional mobility for frail elderly persons. Journal of the American Geriatrics Society, 39(2), 142–148. https://doi.org/10.1111/j.1532-5415.1991.tb01616.x

Pons van Dijk, G., Lenssen, A. F., Leffers, P., Kingma, H., & Lodder, J. (2013). Taekwondo training improves balance in volunteers over 40. Frontiers in Aging Neuroscience, 5, 10. https://doi.org/10.3389/fnagi.2013.00010

Pua, Y. H., Ong, P. H., Clark, R. A., Matcher, D. B., & Lim, E. C. (2017). Falls efficacy, postural balance, and risk for falls in older adults with falls-related emergency department visits: Prospective cohort study. BMC Geriatrics, 17(1), 291. https://doi.org/10.1186/s12877-017-0682-2

Rikli, R. E., & Jones, C. J. (1999). Functional fitness normative scores for community-residing older adults, ages 60-94. Journal of Aging and Physical Activity, 7(2), 162–181. https://doi.org/10.1123/japa.7.2.162

Romli, M. H., Tan, M. P., Mackenzie, L., Lovarini, M., Suttanon, P., & Clemson, L. (2017). Falls amongst older people in Southeast Asia: A scoping review. Public Health, 145, 96–112. https://doi.org/10.1016/j.puhe.2016.12.035

Shupert, C., & Horak, F. (2016). Balance and falls in the older adult. Portland: Vestibular Disorders Association, 1–3. https://vestibular.org/sites/default/files/page_files/Documents/Balance%20and%20Falls_88.pdf

Steffen, T. M., Hacker, T. A., & Mollinger, L. (2002). Age- and gender-related test performance in community-dwelling elderly people: Six-Minute Walk Test, Berg Balance Scale, Timed Up & Go Test, and gait speeds. Physical Therapy, 82(2), 128–137. https://doi.org/10.1093/ptj/82.2.128

Valdes-Badilla, P., Herrera-Valenzuela, T., Ramirez-Campillo, R., Aedo-Munoz, E., Baez-San Martin, E., Ojeda-Aravena, A., & Branco, B. H. M. (2021). Effects of olympic combat sports on older adults' health status: A systematic review. International Journal of Environmental Research and Public Health, 18(14), 7381. https://doi.org/10.3390/ijerph18147381

Vetter TR, Mascha EJ. Defining the primary outcomes and justifying secondary outcomes of a study: Usually, the fewer, the better. Anesth Analg. 2017 Aug;125(2):678-681. https://doi.org/10.1213/ANE.0000000000002224

Visschedijk, J. H., Terwee, C. B., Caljouw, M. A., Spruit-van Eijk, M., van Balen, R., & Achterberg, W. P. (2015). Reliability and validity of the Falls Efficacy Scale-International after hip fracture in patients aged >/= 65 years. Disability and Rehabilitation, 37(23), 2225–2232. https://doi.org/10.3109/09638288.2014.1002573

Wang, C.-Y., Hsieh, C.-L., Olson, S. L., Wang, C.-H., Sheu, C.-F., & Liang, C.-C. (2006). Psychometric properties of the Berg Balance Scale in a community-dwelling elderly resident population in Taiwan. Journal of the Formosan Medical Association, 105(12), 992–1000. https://doi.org/10.1016/s0929-6646(09)60283-7

Whitehead, A. L., Julious, S. A., Cooper, C. L., & Campbell, M. J. (2016). Estimating the sample size for a pilot randomised trial to minimise the overall trial sample size for the external pilot and main trial for a continuous outcome variable. Statistical Methods in Medical Research, 25(3), 1057–1073. https://doi.org/10.1177/0962280215588241

World Health Organization (2021). Falls. Geneva: World Health Organization https://www.who.int/news-room/fact-sheets/detail/falls

Yardley, L., Beyer, N., Hauer, K., Kempen, G., Piot-Ziegler, C., & Todd, C. (2005). Development and initial validation of the Falls Efficacy Scale-International (FES-I). Age and Ageing, 34(6), 614–619. https://doi.org/10.1093/ageing/afi196

Appendix A

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Protocol Amendment Number: 03

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Revision Chronology

2022-Feb 28	Initial Version
2022-April 19	Amendment 01.: Primary reason for amendment: Revised Proposal with Appendices Revised Form 2D: Informed Consent Assessment Form Completed Form 2E: Response Sheet
2022-May 18	Amendment 02.: Primary reason for amendment: Revised Proposal with Appendices Revised PIS-ICF Revised Form 2D: Informed Consent Assessment Form Completed Form 2E: Response Sheet
2022-August 28	Amendment 03.: Primary reason for amendment: Major revisions; changes based on PHJPT reviewers
2022-September 29	Amendment 04: Primary reason for amendment: Minor revisions; changes based on PHJPT reviewers