**Mikalia Guard**

**Background: Assignment 3**

This program, which I will be calling Women’s Power Exercise for Osteoporosis, will involve group exercise class, education, and screening related to osteoporosis in women. The group exercise program will involve functional movements that are progressed from body weight to percentage of 1RM, jumping with controlled landing, postural stability strengthening with a focus on extension, and components of balance, all in the form of high intensity weight bearing exercise in order to promote gains and protection in bone mineral density, reduce falls, and reduce treatment gaps in care for women with osteoporosis. Muscular strength gains will be monitored through the assessment tool, 30 sec sit to stand. Screening will be done through the FRAX tool. The program will include a small portion of education in the beginning of class focused on the benefits of this type of exercise, answering questions, and discussing other factors related to osteoporosis. Education will be measured through the Osteoporosis Knowledge Assessment Tool. The following information will discuss evidence supporting these decisions. Exercise will be is a beneficial intervention for osteoporosis in women because it is generally low cost, accessible, and has positive effects on bone mineral density, cortical bone area, and reduction in risk of osteoporosis related fractures, specifically high intensity weight bearing exercise.1 According to a study on prevention and rehabilitation of osteoporosis in women, regular bone loading results in positive changes in bone geometry as well as reduction in the risk in fragility fractures.2 There is also evidence to suggest that back extensor strengthening, overall muscle strengthening, and increases in BMD, which will be included as part of the exercise regime of this program, results in decreased incidence and risk of vertebral fractures.2

Previously in literature and in practice, high intensity weight bearing exercise was though to be a risky intervention due to fracture risk in osteoporotic women; however, the LIFTMOR trial’s findings deemed supervised high intensity weight bearing exercise effective at increasing bone mass, increasing cortical bone mass, increasing physical function, all with no adverse events occurring.3 This RCT involved 8 weeks of 2x/week sessions that taught 4 functional movements such as squat, overhead press, deadlift, and chin ups with controlled landing.3 Progression was graded through percentage of 1RM.3 The study recommends supervision for technique and safety, which is why the exercise program would be appropriate to ensure safe body mechanics and a controlled environment to promote increase bone mineral density and reduce risk of osteoporosis related fractures. Another study that was cut short by COVID-19 implemented an exercise program that included dynamic resistance training, HIIT, and, later, a jumping sequence that was compared to the controlled group program that involved aerobic exercise, stretching, isometric floor exercises, and a cool down.4 This also emphasized the importance of exercise progression, beginning with body weight movements to teach form, then adding resistance, repetitions, and eventually weight. 4 Although BMD was not found to increase in the exercise group, it did not decrease as it did in the control group, suggesting that the exercise group acted as a protector of existing bone mineral density.4 Strength and lean body mass also increased in the exercise group.4 Both of these studies demonstrate protection/improvements in bone mineral density in women with osteoporosis and osteopenia after participation in high intensity weightbearing exercise. Multimodal exercise for women with osteoporosis also results in 61% reduction in falls that would result in fractures.3 Balance training will be incorporated to further reduce risk of falls including work on static, dynamic, and reactive balance. A balance training program that also involved strengthening of core stabilizing muscles in osteoporotic women who had sustained at least 1 osteoporosis related fracture that occurred 2x/week over 12 months resulted in improvements in balance measures and decreased rate of falls.5 This evidence indicates the potential positive effect a group exercise class centered on improvements in BMD, physical function, balance, and reduction in risk of falls and subsequent osteoporosis related fractures could have on women with osteoporosis.

This program will also include an education piece, as it has been suggested that educational programs on osteoporosis related to exercise are more effective if they actually include an exercise component.6 Education will center around the reason for certain choices related to exercise and how it positively effects bone health and progression of osteoporosis in women. Success in community-based osteoporosis education programs, determined by a systematic review of existing community based programs, involve a theoretical change model, BDM testing or screening, attempts to increase calcium intake, and promotion of weight bearing exercise.6 Including an exercise component as part of the program increases adherence and promotes adoption of a health behavior.6 Screening can also help with success of a program and direct referrals more efficiently. In one study in the UK that screened women 70-85 years old using the FRAX tool, the group in the study that received more thorough screening had a reduction in rate of hip fractures, a 25.9% reduction in fracture risk overall, and increased incidence and adherence of anti-osteoporotic medication.7 This information emphasizes the importance of including screening to direct care and help close the osteoporosis treatment gap that currently exists.7

The program will utilize the following outcome measures: the FRAX, Berg Balance Scale, and the Osteoporosis Knowledge Assessment tool. The FRAX was chosen because there are country specific versions, it includes 12 different risk factors, it is accessible, and can indicate risk for osteoporotic fractures in the next 10 years.2 Use of the FRAX was associated with initiation of treatment, increased self-reported medication adherence and increased prescription of anti-osteoporotic medications.8 Use of this tool in women over the age of 58 led to a 28% reduction in hip fractures in the 5 years following.8 Therefore, the FRAX would be an appropriate tool to assess risk and aid in direction of referrals and care for attendees of the program. The Osteoporosis Knowledge Assessment Tool is used to assess knowledge as the name suggests and higher scores are associated with increased preventative behavior.9 It was determined to be of satisfactory of difficulty with the most challenge being with ease of readability and inclusion of the word osteoporosis, which is not always understood as easily as “thin or frail bones”.9 Due to average scores, a study on the validity and reliability determined that it is likely that the assessment tool will be able to capture change in knowledge about osteoporosis.9 The final outcome assessment will be the 30 sec sit to stand which measures LE strength.10 In community dwelling women over the age of 60, which are postmenopausal, the test has adequate validity when compared to hip extensor, hip flexor, knee extensor, knee flexor, ankle plantar flexion isometric testing.10 Therefore, it would be beneficial to use for strength measures before and after an exercise program focused on high intensity weight bearing exercise.10 Increased muscular strength is associated with better balance and increased physical fitness and gait speed.11

The group exercise program will be based on the social ecological model, as programs that are based on behavior models are more effective at behavior change.6 Interventions are also more effective at behavior change if they address multiple levels of the social ecological model versus just addressing one.6,12 This program intervenes at the individual level as well as the community level by providing a group in the community for participants to interact with, and arguably also at the organizational level due to the structure of the program and interaction with the health system. Finally, the social ecological model helps to address which aspects of the health program were most valuable to participants and provides a framework analyze influencing factors at the different levels to evaluate effectiveness of the program later on.12 These interventions, outcome measures, and health behavior model background combined will hopefully create program that is successful at its aim to promote high intensity weight bearing exercise, increased screening, proper referrals, and knowledge of osteoporosis in women with osteoporosis to reduce the treatment gap in care, as well as reduce risk of falls that can lead to osteoporosis related fractures, and promote and protect bone mineral density in this population.

**Written Assignment #4:**

**Program Goals**

1. By the end of the program, participants of the Women’s Power Exercise for Osteoporosis will have improvements in scores of the Osteoporosis Knowledge Assessment Tool in order to demonstrate increased knowledge of osteoporosis.
2. By the end of the program, participants will improve Berg Balance Scale scores in the amount of MDC of at least 6 points to demonstrate improvements in balance to reduce risk of falls and fractures.
3. By the end of the program, participants will increase muscular strength determined by increases of at least 2 repetitions (MDC) for 30 sec sit to stand scores.
4. During the last week of the program, participants will show improvements in Prone Extensor Test times, with 50% of participants being able to hold for 1 minute and 25 sec to demonstrate increased back extensor strength which reduces risk of fracture.
5. By the end of the first session of the program, all participants will have received FRAX screening and follow-up referral recommendations to initiate, continue, or redirect treatment of osteoporosis to reduce risk of osteoporosis related fracture.

**Methods**

The Women’s Power Exercise for Osteoporosis group program meant to promote high intensity weight bearing exercise, balance interventions, and screening in women with osteoporosis will begin recruitment by placing flyers at local senior centers, churches, and primary care offices. These flyers will be advertising an interest meeting for the program. The meeting will discuss the importance and logistics of the program, while collecting information from interested women like what days of the week or time of day work best for them. Interested women will provide contact information and be contacted 2 weeks before the start of the program to gauge interest one last time, and again 1 week before the program to serve as a reminder. New flyers would be posted at the same places the initial flyers were placed with information regarding program specific information. I would also reach out to local news stations, radio stations, and the newspaper to spread for advertisement. The program will be held 2x/week for 1 hour, for 8 weeks in length and held at a local community center that also functions as a senior center. The frequency and length were based on the LIFTMOR trial.3 It has 2 gyms and a large gathering room with a TV, as well as workout equipment efficient for the needs of this program. The workout equipment available includes dumbbells, small barbells, mats, and palates steps which can be rented from the center.

The program will be led by my friend who is a personal trainer and interested in this population and myself. Her role will revolve mainly around planning of exercises and exercise progression with my guidance, along with leading the exercise classes. My role will include planning of exercises and progressions, as well as researching and leading the education portion of the class, outcome measure data collection, and managing logistical needs of the program. I also plan to include a local physician who is well-versed and treats many women with osteoporosis in the education portion by having them discuss medications and other treatments outside of the PT scope of practice and be available to answer questions for participants.

The first meeting will involve a process of collecting demographic information, an introduction, initial education on goals and aims of the program, quick overview of definitions related to osteoporosis, and the outcome measure data collection process. Participants will undergo FRAX screening, and perform the Berg Balance Scale, 30 sec sit to stand test, prone extensor test, 1RM (squat & overhead press), and the Osteoporosis Knowledge Assessment tool. The outcome measure data collection will span over the 2 sessions during the first week and be performed by the personal trainer and myself. Exercise intensity will be monitored throughout sessions using heart rate (HR) monitors, so ideal range of HR range for high intensity will be determined based on age during the first week, supported by ACSM recommendations of 50-85% of heart rate max for moderate-vigorous intensity.13

At the end of the second session, there will be a quick review of the movements for next week. The second week will be focused on technique and form of body weight exercises. The general set up for a class will include: 5-10 min of education, 5 minute warm up, 4 main exercises performed for 1 minute each for 3 rounds, 30 second break in between exercises, and 1 minute break in between rounds. The next portion of the session will involve balance exercises and core stabilization. The general set up of this will be 2 static balance exercises, 2 dynamic balance exercises, and 2 core stabilization exercises with a focus on extension. Each exercise will be performed for 1 minute, with a 30 second break in between reps, and 1 minute break in between round. The exercises will be done for 2 rounds. The session will end with a 5-minute cool down. This equals about 53.5 minutes of total time, leaving room for demonstrations, extra breaks if needed, and questions at the end. Reference Table 1 for a more detailed chart demonstrating specific exercises that will be used throughout the program.

The table depicts common exercises that will be used throughout the program. Exercise will increase in weight based on percentage of 1RM starting with 0% the half of the program and ≥50% by week 6. These recommendations are based on the LIFTMOR trial where the first month included mostly bodyweight exercises, then weight at high intensities was added during the second month.3 Modifications will also be provided as necessary for different levels of strength and ability. The specific exercise chosen are based on what movements were included in research studies that were found to be safe and effective for women with osteoporosis.2–5 The balance is included to help reduce falls, and further fractures, supported by evidence in a study suggesting that increased muscle strength, proprioception, and more postural control are main factors to improvements in balance in women with osteoporosis.5 Also, core stabilization with a focus on extension (and avoidance of trunk flexion) is protective against vertebral compression fractures, common to this population.2 Education each week will change topics and questions will be addressed as appropriate.

The last week of the program will exist to perform final assessments which include data collection of outcome measures, completion of a survey, and final reminders for participants to make appointments with their primary care providers to address osteoporosis management needs. The survey will include questions on thoughts of the program, if participants plan to follow up with their doctors, whether they found the education helpful, and changes they’d recommend for future implementation of the program. I would also provide them with a list of community resources related to osteoporosis and hopefully a supportive group of women that they can turn to for support.

Influence of the social ecological model is seen through the group exercise that addresses the interpersonal level. The education being provided addresses the intrapersonal level. It also affects the community level by being held at a community center where other community resources exist, involves a local physician as well as locally based staff operating the program, and utilizes places in the community advertise and recruit. According to a study on educational programs for osteoporosis, interventions and programs that address multiple levels of the model are more effective and more likely to produce change.6

Table 1.

|  |  |  |  |
| --- | --- | --- | --- |
| Week: | Exercise: | Balance and Core: | Education: |
| Week 1:  Outcome measure data collection | Outcome measures: 30 second sit to stand, Prone Extensor test, 1RM squat and overhead press.  Demonstration of squat, overhead press, lunge, jumping+ controlled landing, sit-stand, push-up variations | Berg balance scale  Demonstration of tandem stance, Romberg stance, hip abduction, hip extension, back extension, planks, dead bugs, prone superwoman holds, birddogs | * Importance/benefits of high intensity weight bearing exercise * Influence of balance and core stabilization exercises * Definitions related to Osteoporosis |
| Week 2:  Warm-up: marching, side stepping, arm circles, overhead reaching, and butt kickers  cool-down: standing back extension, overhead reaching, and stretching of the arms and legs in standing and sitting. | 1. Squats 2. Overhead press 3. Step ups with high knees 4. Wall push ups | Static:   1. Romberg stance 2. Semi-tandem stance   Dynamic:   1. Side stepping + Single leg stance 2. 3-point star excursion   Core:   1. Wall plank 2. Dead bugs | Importance of regular primary care visit and screening |
| Week 3:  Warm-up and cool-down | 1. Squats 2. Wall push-up 3. Lunges 4. Side shuffling | Static:   1. Romberg stance 2. Semi-tandem stance   Dynamic:   1. Side stepping + Single leg stance 2. 3-point star excursion   Core:   1. Wall plank 2. Dead bugs | Local Physician visit to discuss medical management of osteoporosis. |
| Week 4:  Warm-up and cool-down | 1. Squats with weight 2. Overhead press 3. Weighted step ups 4. Wall push up with increased angle | Static:   1. Semi-tandem stance 2. Tandem stance   Dynamic:   1. Single leg stance on foam pad 2. Forward and backward walking   Core:   1. Modified floor plank 2. Supine heel slide with transverse abdominus contraction | Progression of osteoporosis and risk of fractures  Redo outcome measures to check progress! |
| Week 5 | 1. Squats with weight 2. Overhead press 3. Weighted step ups 4. Wall push up with increased angle | Static:   1. Semi-tandem stance 2. Tandem stance   Dynamic:   1. Single leg stance on foam pad 2. Forward and backward walking   Core:   1. Modified floor plank 2. Prone Extension | Calcium intake |
| Week 6 | 1. Weighted lunges 2. Modified floor push ups 3. Side shuffles 4. Controlled landing from pilates step | Static:   1. Tandem stance 2. Romberg stance eyes closed   Dynamic:   1. Star excursion on foam pad 2. Four square stepping   Core:   1. Modified floor plank 2. Bird dogs | How to perform functional activities safely. (lifting, getting in and out of bed with neutral spine, etc.) |
| Week 7 | 1. Weighted lunges 2. Modified floor push ups 3. Weighted squats 4. Controlled landing from pilates step | Static:   1. Tandem stance 2. Romberg stance eyes closed   Dynamic:   1. Star excursion on foam pad 2. Tandem walking   Core:   1. Modified floor plank 2. Bird dogs | Strategies for incorporating exercise into daily routine. Recommendations for making appointments with primary care physicians. |
| Week 8 | Final Assessment outcome measures | Final Assessment outcome measures | Summary of learned information. Connecting the dots. |

**Program Evaluation**

The program outcome measures will be performed during the first week, at week 4, and finally at week 8. Scores at week 4 will be used to assess if improvements are occurring. If they are not, adjustments can be made in areas where we would like to see more improvements. If scores are not increasing for the Berg Balance Scale, more time can be spent on balance interventions, and/or balance interventions changed.5 Improvements in strength may need a longer time period to show improvements, but we could adjust time under tension, amount of weight, or amount of repetitions and sets. However, frequency would not be manipulated, because of evidence to suggest no change in muscle strength when comparing high frequency training to low frequency.14 If improvements are not being seen in knowledge, more time could be allotted to education, and, more importantly, a conversation could be had with participants to determine their preferred learning style to perhaps present the information in a different way.15 This closely relates to discussions in unit 3 about considering area demographics so that programs are applicable and relatable to the patient population. Therefore, an open conversation with participants about what they like and dislike in a program will be helpful to the success of the program. The final outcome measure scores will be compared to the initial scores, and percentage of improvement determined. Participants should achieve minimum detectable change addressed in the program goals by final evaluation. If participants do not achieve measurable improvements, the program should re-evaluate structure and implementation for the future. A survey will also be given to participants at week 8 to determine satisfaction, suggestions, and highlight best and worst features.

The CDC’s framework for program evaluation discusses evaluating implementation, effectiveness, efficiency, cost-effectiveness, and attribution.16 We can evaluate implementation and effectiveness by collecting demographic, attendance, and outcome measure score data to determine the effect of treatment. Efficiency can be determined to see if time and costs were spent in meaningful ways. This relates closely to cost-effectiveness. By tracking outcome measures which are part of the goals of this program, attribution can be determined by the improvements in scores from initial to final assessment. The midway assessment can also help to adjust aspects mid-program. This information combined could aid in adjusting the program to better fit this population in the future, and to produce effective and efficient outcomes that promote increase bone mineral density, reduce risk of falls and subsequent fractures, and decrease the osteoporosis treatment gap.

**Conclusion**

The Women’s Power Exercise for Osteoporosis group exercise program will implement screening, education, and exercise involving high intensity weight bearing movements, balance, and core stabilization to address an existing osteoporosis treatment gap. The treatment gap exists because many women once diagnosed with osteoporosis do not receive proper treatment or make necessary lifestyle changes to manage the disease and subsequently may suffer from osteoporosis related fractures, which are costly to both the body and the wallet.7 Annually, these fractures can cost ~$17.9 billion in the U.S and risk of death increases following one osteoporosis related fracture.7 These patients are also at risk for arthrosis, arthritis, chronic low back pain, depression, and heart failure, which are costly and often disabling issues.7 This demonstrates how imperative it is to reduce the risk of falls and fractures by increasing bone mineral density, participating in screening, and promoting education and regular primary care visits. High intensity weight bearing exercise, the main intervention of this program, has been shown to increase bone mineral density as well as muscular strength in this population.3,4 Participating in balance interventions reduces risk of falls and promotes postural stability.5 Educational interventions promote knowledge and awareness for patients.6 Screening identifies risk factors and can help direct referrals and recommended physician follow-ups.17 These factors combined with a group exercise setting and inclusion of the Social Ecological Model operate to promote community/social support, while promoting behavior change.6 Therefore, this program will operate to increase bone mineral density, reduce risks of falls and fractures related to osteoporosis, and reduce the osteoporosis treatment gap for women.

Bibliography

1. Troy KL, Mancuso ME, Butler TA, Johnson JE. Exercise early and often: effects of physical activity and exercise on women’s bone health. *Int J Environ Res Public Health*. 2018;15(5). doi:10.3390/ijerph15050878

2. Kerschan-Schindl K. Prevention and rehabilitation of osteoporosis. *Wien Med Wochenschr*. 2016;166(1-2):22-27. doi:10.1007/s10354-015-0417-y

3. Watson SL, Weeks BK, Weis LJ, Harding AT, Horan SA, Beck BR. High-Intensity Resistance and Impact Training Improves Bone Mineral Density and Physical Function in Postmenopausal Women With Osteopenia and Osteoporosis: The LIFTMOR Randomized Controlled Trial. *J Bone Miner Res*. 2018;33(2):211-220. doi:10.1002/jbmr.3284

4. Hettchen M, von Stengel S, Kohl M, et al. Changes in Menopausal Risk Factors in Early Postmenopausal Osteopenic Women After 13 Months of High-Intensity Exercise: The Randomized Controlled ACTLIFE-RCT. *Clin Interv Aging*. 2021;16:83-96. doi:10.2147/CIA.S283177

5. Mikó I, Szerb I, Szerb A, Poor G. Effectiveness of balance training programme in reducing the frequency of falling in established osteoporotic women: a randomized controlled trial. *Clin Rehabil*. 2017;31(2):217-224. doi:10.1177/0269215516628616

6. Nguyen VH. Osteoporosis prevention and osteoporosis exercise in community-based public health programs. *Osteoporos Sarcopenia*. 2017;3(1):18-31. doi:10.1016/j.afos.2016.11.004

7. Clynes MA, Harvey NC, Curtis EM, Fuggle NR, Dennison EM, Cooper C. The epidemiology of osteoporosis. *Br Med Bull*. 2020;133(1):105-117. doi:10.1093/bmb/ldaa005

8. Parsons CM, Harvey N, Shepstone L, et al. Systematic screening using FRAX® leads to increased use of, and adherence to, anti-osteoporosis medications: an analysis of the UK SCOOP trial. *Osteoporos Int*. October 2019. doi:10.1007/s00198-019-05142-z

9. Winzenberg TM, Oldenburg B, Frendin S, Jones G. The design of a valid and reliable questionnaire to measure osteoporosis knowledge in women: the Osteoporosis Knowledge Assessment Tool (OKAT). *BMC Musculoskelet Disord*. 2003;4:17. doi:10.1186/1471-2474-4-17

10. McCarthy EK, Horvat MA, Holtsberg PA, Wisenbaker JM. Repeated chair stands as a measure of lower limb strength in sexagenarian women. *J Gerontol A, Biol Sci Med Sci*. 2004;59(11):1207-1212. doi:10.1093/gerona/59.11.1207

11. Bemben D, Stark C, Taiar R, Bernardo-Filho M. Relevance of Whole-Body Vibration Exercises on Muscle Strength/Power and Bone of Elderly Individuals. *Dose Response*. 2018;16(4):1559325818813066. doi:10.1177/1559325818813066

12. McLeroy KR, Bibeau D, Steckler A, Glanz K. An Ecological Perspective on Health Promotion Programs. *Health Education & Behavior*. 1988;15(4):351-377. doi:10.1177/109019818801500401

13. Riebe D, Ehrman JK, Liguori G, Magal M. *American College of Sports Medicine: Guidelines for Exercise Testing and Prescription*. 10th ed. (Wolters Kluwer, ed.). Philedelphia; 2018.

14. Ralston GW, Kilgore L, Wyatt FB, Buchan D, Baker JS. Weekly Training Frequency Effects on Strength Gain: A Meta-Analysis. *Sports Med Open*. 2018;4(1):36. doi:10.1186/s40798-018-0149-9

15. Inott T, Kennedy BB. Assessing learning styles: practical tips for patient education. *Nurs Clin North Am*. 2011;46(3):313-20, vi. doi:10.1016/j.cnur.2011.05.006

16. Office of Strategy and Innovation. US Department of Health and Human Services Centers for Disease Control and Prevention. Program Evaluation for Public Health Programs: A Self-Study Guide. 2011.

17. Alswat K, Adler SM. Gender differences in osteoporosis screening: retrospective analysis. *Arch Osteoporos*. 2012;7:311-313. doi:10.1007/s11657-012-0113-0